

CHAPTER THREE

Study One: An exploratory study in the conceptualisation of the executive functions in ADHD

Methodology and Results

This chapter describes the methodology and results of Study One, the purpose of which was to establish a conceptual framework within which the subsequent phase of the research (Study Two) could proceed. Thus, Study One served to define the parameters in the search for the central executive impairments exhibited by children with ADHD. This process comprised a number of distinct, yet inter-related, phases. Initially, a comprehensive and critical review of the theoretical and research literature was undertaken (presented in Chapter Two). This was followed by a series of exploratory semi-structured interviews with leading international researchers in the fields of education, psychology, psychiatry, and paediatrics. The data obtained from these semi-structured interviews are reported here and discussed in further detail in the following chapter.

Participants

Participants in the semi-structured interviews which comprised Study One included six influential and highly regarded scholars within the field of ADHD research. Participants were purposefully chosen to ensure that they had extensive clinical and research experience of children with ADHD and included senior academics and paediatricians, many of whom have published extensively. The professionals interviewed in Study One were:

Russell Barkley, PhD

Dr Barkley is Professor of Neurology and Psychiatry and Director of Psychology at the University of Massachusetts Medical Center. Professor Barkley is a much sought-after keynote speaker at international conferences and an internationally-recognised authority on ADHD, with over 100 publications to his credit, including several books. He has published in many leading international journals including the Journals of: Abnormal Child Psychology, Child Psychology and Psychiatry, Developmental and Behavioral Pediatrics, Learning Disabilities, and the American Academy of Child and Adolescent Psychiatry. Professor Barkley has won numerous grants from many external sources including the National Institute of Mental Health (NIMH) and is a past president of the International Society for Research in Child and Adolescent Psychopathology (ISRCAP).

Rosemary Tannock, PhD

Dr Tannock is an Associate Professor at the University of Toronto and The Hospital for Sick Children, Toronto. In addition to her membership of ISRCAP, Associate Professor Tannock has also served on the review board of the NIMH, and is a sought-after keynote speaker at international conferences. She has in excess of 50 publications to her credit, including several book chapters and articles in leading international journals including the Journal of Abnormal Child Psychology, the Journal of Child Psychology, the Journal of the American Academy of Child and Adolescent Psychiatry, the Journal of Clinical Child Psychology, and Clinical Psychology Review.

Thomas Brown, PhD

Dr Brown is Associate Director of the Yale Clinic for Attention and Related Disorders at the Yale University School of Medicine. Dr Brown has presented papers, workshops and symposia at national meetings of the American Psychological Association, American Psychiatric Association, American Academy of Child and Adolescent Psychiatry, and the International Neuropsychological Society. Dr Brown has also published articles in a number of professional journals and is author of the Brown Attention Deficit Disorder Scales published by The Psychological Corporation. Dr Brown's research interests include the assessment and treatment of ADHD (especially the Predominantly Inattentive Type) and executive function and memory impairments in ADHD.

Annemaree Carroll, PhD

Dr Annemaree Carroll is a Senior Lecturer and Registered Psychologist at the Schonell Special Education Research Centre, University of Queensland, Brisbane, Australia. She has published articles in a number of leading international journals including the Journal of Child Psychology and Psychiatry, the Journal of Educational Psychology, and Clinical Psychology Review. Dr Carroll has won early career research awards and been a recipient of grants totalling over \$1 million. In addition, Dr Carroll is a member of the professional advisory boards of the Queensland ADHD and Tourette's Syndrome support groups.

Dr Christopher Green

Dr Green is a consultant paediatrician based in Sydney, Australia, who has extensive clinical experience of children with ADHD and developmental

disorders. Dr Green is the author of a number of influential books including "Toddler Taming" and "Understanding ADHD" and has been instrumental in raising public awareness about ADHD worldwide through numerous radio and television appearances. Dr Green has also been the keynote speaker at a number of international conferences. Until recently, Dr Green was a Clinical Lecturer at the University of Sydney and Head of the Child Development Unit at the Royal Alexandra Hospital for Children, before having to step down due to illness.

Dr Trevor Parry

Dr Parry is a consultant paediatrician with extensive clinical experience of children with ADHD. Dr Parry is also Director of Community Paediatrics for Princess Margaret Hospital, Perth, Western Australia. In addition, Dr Parry is Director of the State Child Development Centre, where he is responsible for the assessment and diagnosis of children with ADHD and other developmental disorders. Dr Parry's own particular speciality is the ADHD Predominantly Inattentive Type. Furthermore, Dr Parry has been a member of various state and federal committees pertaining to ADHD.

Settings

The location for the interviews was arranged by prior agreement with participants. Individuals were interviewed at the New York Hilton and Towers, the venue of the Tenth Annual Children and Adults with Attention Deficit Disorders (CHADD) Conference in New York City, 15-17 October, 1998, with the following exceptions. Dr Trevor Parry was interviewed at the State Child Development Centre, located in Perth, Western Australia, and Associate Professor Rosemary Tannock and Dr Annemaree Carroll were interviewed at

the Centre for Attention and Related Disorders, The Graduate School of Education, The University of Western Australia. During the interviews, the interviewer sat on the opposite side of a small table to the participant, with a portable audio cassette recorder placed on the table between them to record the interview.

Instrumentation

Semi-structured interviews were utilised in the present study which sought to elicit new information that has not been reported in the available literature to date. The use of open-ended interview questions allows participants to formulate their own answers, and to disclose their own opinions and feelings, thus reducing the potential for interviewer bias. The semi-structured interview questions systematically addressed those pertinent issues which arose from the initial review of literature. A copy of the semi-structured interview questions is included as Appendix A.

Participants were first asked to describe how they conceptualised ADHD. Their views were then sought pertaining to the nature and composition of the ADHD subtypes, with particular regard to the differential characteristics of these subtypes and the nature of any associated attentional problems. Participants were also asked to respond to suggestions that only two subtypes of ADHD may exist in practice (due to the virtual absence of the ADHD-HI diagnosis in clinical settings), and that the ADHD-PI and ADHD-CT subtypes may in fact represent two inherently different disorders (Barkley, 1997a). Subsequent questions examined participants' understandings of ADHD, inquiring as to whether they viewed attentional impairment as central to the disorder, and the mechanism by which such an impairment interacts with the executive functions (EFs). Feedback was also sought regarding Barkley's (1997a) prediction that a

deficit in response inhibition represents a central impairment in ADHD, which in turn affects the effective deployment of specific EFs.

The tendency of ADHD children to perseverate, despite the presence of corrective feedback (Houghton et al., 1999), was discussed with a view to eliciting examples of situations in which such behaviour is likely to occur. Impairments in working memory were also advanced for discussion and participants were asked to comment on this and the way(s) in which working memory might be impaired or otherwise manifest in ADHD children. Feedback was also sought pertaining to Barkley et al.'s (1997) prediction that a deficiency in non-verbal working memory might also manifest as an impaired concept of time in ADHD children, with particular regard to the cross-temporal organisation of behaviour. Attention was drawn to ADHD children's supposed use of past knowledge and experiences (hindsight) in novel contexts (forethought), the integration of time and space, and dual task performance.

In line with Barkley's (1997a) predictions of impairments in verbal working memory, delayed internalisation of speech, and thus rule-governed behaviour, participants were asked to describe what they perceived as the role of language in children with ADHD. Finally, participants were asked whether they viewed the current terminology (ADHD) as an appropriate diagnostic label, and whether its placement amongst the Disruptive Behaviour Disorders category of DSM-IV is warranted. At the conclusion of the interview, participants were given the opportunity to comment, qualify their statements, or provide additional information.

Procedure

Participants were initially contacted via e-mail (international and national) or by telephone (local) and informed of the purpose of the present research, and then e-mailed (or telephoned) to arrange mutually acceptable times and locations for the interviews. At the commencement of each interview, it was reiterated to the participant that the interview would be recorded, subject to their approval. None of the participants had any objections to the recordings being made.

During the course of the interviews, every effort was made to ensure the homogeneity of the interviews by following a written standardised administration format. However, the open-ended nature of the questions afforded participants considerable latitude in their responses. If particular topics of interest were raised during the interview, the researcher probed with further questions in order to elicit as much relevant information as possible. The moderator subsequently guided the participant back to the pre-designed format of the questions. In some cases, participants' responses pre-empted subsequent interview questions. In these instances, the moderator allowed the participant to finish speaking before asking the next question, thereby allowing participants to elaborate on their previous response should they wish, but emphasising that the participant may have already answered the question.

Data analysis

The transcripts obtained from the recorded interviews were analysed using procedures similar to those used by Zemke and Kramlinger (1985). This involves generating a list of key ideas, words, phrases, and verbatim quotes; using these ideas to formulate categories and placing ideas and quotes in

appropriate categories; examining the contents of each category for subtopics; and selecting the most frequent and most useful illustrations for the various categories.

Results

The data presented here are discussed in further detail in the following chapter, where they also serve to inform the selection of instrumentation to be used in the subsequent phase of the research (Study Two). Participants' responses were arranged into five sections comprising: (1) The nature of ADHD and its subtypes; (2) The characteristic impairments of ADHD children; (3) The role of response inhibition and the executive functions (EFs); (4) Verbal and non-verbal working memory; and (5) Further comments and unresolved issues. For the purposes of analysis, each of these broad categories (or themes) was divided into a number of sub-categories or questions. (Copies of the interview transcripts have been reproduced as Appendices B through G.)

(1) The nature of ADHD and its subtypes

Moderator (M): Briefly, how would you describe your conceptualisation of ADHD?

Whilst this question received a range of individual responses, the prevailing consensus among all six participants appeared to be that ADHD represents a problem of self-regulation, which manifests as impairments in the executive functions (i.e., those organisational processes mediated by the frontal lobe). Some of the responses were as follows:

"I think the problem is largely one of the development of self-regulation... I suggested I think there were four major forms of behaviour that start out as

public, are then turned on ourselves as a means of controlling us, and then gradually are made private. Specifically, the four things are: the ability to sense privately to ourselves, primarily including visual imagery - but other senses also being capable of private use without others seeing us. This allows us to simulate information mentally without actually having to test it out in the real world first. The second one is language - that's a very Vygotskian view of language - turned on the self, made private. The third is emotional behaviour that is then made private - the individual uses emotions to themselves. And then lastly is this concept of reconstitution, which I think is probably most akin to play - a child who takes apart and rebuilds blocks and designs and manipulates the environment - and then gradually is able to do this not only with symbols and language but then can do it internally as well" (Professor Russell Barkley).

"I would differentiate my point of view from that of Russ Barkley on the grounds that I think of his model as a very good one in terms of describing executive function except when he gives primacy to the specific function of behavioural inhibition... with that modification I would pretty much join him in thinking of this as Attention Deficit Disorder as being essentially developmentally impaired executive function" (Dr Thomas Brown).

"ADHD appears to be a disorder of response inhibition. Whilst it was once thought that attention was the key element of the disorder, it is now more likely that response inhibition is the key element with other features being hyperactivity, impulsivity, inattention plus problems with self-regulation" (Dr Annemaree Carroll).

"ADHD is a frontal lobe problem. A problem of self-monitoring, self-monitoring behaviour, self-monitoring learning, causes children to be out of

step in their behaviour and out of step in their learning” (Dr Christopher Green).

“I would see ADHD, by DSM-IV criteria, as a developmental, genetic, neurobiochemical disorder of organisational processes” (Dr Trevor Parry).

“It’s most likely I think... a neurodevelopmental problem, so although we still define it behaviourally, I believe that’s just the observable consequences if you like, of some underlying problems in dealing with information processing... I think it really is a manifestation of a complex system of cognitive impairments - difficulty processing information - that in turn give rise to some of these observable behavioural symptoms that we see like inattention, disorganisation, the so-called behavioural impulsiveness et cetera” (Associate Professor Rosemary Tannock).

M: Please describe your view of the ADHD subtypes.

Although it was clear that participants had differing views about the ADHD subtypes, it seemed that the majority of them viewed inattention as a characteristic that is pervasive across the ADHD subtypes. Participants described the inattentive symptoms as a central characteristic of both the Predominantly Inattentive Type and the Combined Type. Responses were as follows:

“I think that the Combined Type is an output disorder, meaning that there is no problem with how information is being perceived and processed but that the problems come in when behaviour must be organised and executed, or when strategies must be applied to the information coming in to organise it better... In the inattentive children, I think it is an input problem. I think it does have to do with the initial perceptual, selective, and processing aspects – the front end

of an information processing model. And so I think it's a different attentional mechanism - I would say that they are focused or selective attention problems and the other is an executive/behaviour control problem. That's how I would conjecture that they differ" (Professor Russell Barkley).

"The first thing I think it's important to note is the division of the two symptom clusters... I think this has been a useful advance in conceptualisation in the field... And what becomes difficult now is when you say theoretically these two clusters may give rise to three subtypes - and that is where I think you run into problems. And why is that? Because essentially how it's operationalised in DSM is that you've got to have at least six of the inattentive and fewer than six of the hyperactive-impulsive to be called the Predominantly Inattentive Type. But in reality, you're going to get kids who have six of the inattentive and five of the hyperactive-impulsive. It also depends which informant you're going to base that on" (Associate Professor Rosemary Tannock).

"The way I see it is that the PI type symptoms are present in those that we would diagnose as Predominantly Inattentive Type but they also are present in virtually all of the people who have the Combined Type. And really the Predominantly Hyperactive-Impulsive Type is essentially a category for talking about preschoolers who aren't expected to be able to attend very much anyhow" (Dr Thomas Brown).

"I would recognise the Combined - where you've certainly had an early history of some kind of kinesis or Barkley's inhibitory/impulsivity and that is no longer current in the primary school child as he gets older, and inattentive disorganisation is. So you would see that. But none of that allows for more widespread developmental disorganisation which is frequently in partnership with just those learning and attentional aspects that Barkley speaks about. So I

guess that though the Barkley theory fits well for classical hyperkinetic disorder which is not necessarily associated with these other areas of disorganisation, that's fine, but it doesn't allow for what I think actually in our experience is probably a much larger group of kids who have the ADHD part without hyperkinesis as a component" (Dr Trevor Parry).

"All ADHD - there are very few pure one or others - most are a mix and most of the mixes are different to other mixes - so it is a very varied thing. I see the majority are a mix of behaviour and learning but the balance of whether it is more behaviour or more learning varies dramatically from child to child. And I see that there are very, very, very few pure ADHD inattention only... There is probably a very great number of those who've got a predominantly learning problem - the ADHD Predominantly Inattentive - but they've nearly all got a little bit of impulsivity and 'stupid' behaviour with it" (Dr Christopher Green).

M: What are your views on the suggestion that only two subtypes of ADHD may exist (i.e., the ADHD-CT, which subsumes the ADHD-HI, and the ADHD-PI)?

While the majority of participants appeared to agree with the delineation of the ADHD-PI and ADHD-CT subtypes, there was little support for the suggestion that only two subtypes of ADHD may exist, as the following responses illustrate:

"In examining the most recent research in this area it would seem that the Predominantly Hyperactive and Combined Type children are on the same continuum or display similar features compared with the Predominantly Inattentive Type children" (Dr Annemaree Carroll).

“The Predominantly Hyperactive-Impulsive Type is essentially a category for talking about preschoolers who aren’t expected to be able to attend very much anyhow” (Dr Thomas Brown).

“I suspect there are probably four or five subgroups... You know kids where there is no evidence clinically at all at any time of there having being a hyperkinetic component... certainly there is a group of - I believe of - what might be called if not have to be called Inattentive ADHD that are not just a burned out Combined” (Dr Trevor Parry).

“I actually think that - we certainly see kids with hyperactive-impulsive only. Even when we take into account information from parents and teachers. They are relatively few sure, and they’re not always the young kids. So it’s not that they’re just up to six and seven year olds, we also see some of the nine, ten and eleven year olds like this too” (Associate Professor Rosemary Tannock).

M: How would you respond to the suggestion that the ADHD Predominantly Inattentive and the ADHD Combined Type might represent separate disorders?

The range of responses provided by participants revealed that further research is necessary to clarify the nature of the ADHD subtypes and their characteristics. All but one of the participants were inclined to agree that the ADHD-PI and ADHD-CT represent two qualitatively different disorders. Responses were as follows:

“I would certainly hold that view, at least that view that you know kids where there is no evidence clinically - at all - at any time of there having been a hyperkinetic component... certainly there is a group of... inattentive ADHD that are not just a burned out Combined. And I think that the nearest that you

get to that... [is] Gillberg's concept of what he calls DAMP, by which he means disorders of attention, motor control, and perception" (Dr Trevor Parry).

"Given that the features of the Predominantly Inattentive children are so different in many aspects (e.g., daydreamers) from the Hyperactive and Combined, then yes, this could well be a likely view" (Dr Annemaree Carroll).

"If the Predominantly Inattentive type is being conceptualised as not having problems with inhibition, which is how we conceptualise it, and my model places inhibition at a key point in the development of these other functions, then there's no way that my model could speak to the Inattentive type" (Professor Russell Barkley).

"I think there are some intriguing genetic findings - or findings from twin studies - that do suggest that there may be something important to take into account that these clusters of symptoms may differentiate... It brings to mind a recent study by Willcutt and Pennington... they showed that... individuals who have extreme levels of inattention, show high heritability, irrespective of what their level of hyperactivity-impulsivity is. On the other hand, in that sample, individuals who showed extreme levels of hyperactivity-impulsivity, that was not highly heritable if it did not occur with a lot of inattention, which suggested that hyperactive-impulsivity alone may be something completely etiologically distinct from the hyperactivity-impulsivity that occurs with inattention" (Associate Professor Rosemary Tannock).

"I disagree sharply with Russ Barkley when he talks about how those Predominantly Inattentive Type are a whole different thing - I think that's something which is central to both subtypes" (Dr Thomas Brown).

(2) The characteristic impairments of ADHD children

M: What are the key features of ADHD?

The majority of participants described impairments with cognitive functioning. In particular, participants frequently cited difficulties with organisation and executive functioning. The comments received from participants included:

“I think probably it’s most useful to begin by saying I think of the cognitive impairments associated with ADHD as the central impairments... the main things are problems with being able to get organised and get started, problems with being able to stay tuned and screen out distractions, problems with being able to sustain alertness and effort, processing speed to complete tasks in a reasonable time, being able to manage affect so that it doesn’t interfere too much, and problems with short term working memory. And I see these as a cluster of functions that I think of as important in executive function” (Dr Thomas Brown).

“Whether or not I think it’s any specific one deficit, no is the answer. I don’t think we can really narrow it down and adopt this reductionist position that it can be a single, fundamental deficit. That’s too simple. I think that we’re going to have a group of them - in my head right now I would say I could think of about four or five difficulties with processing information” (Associate Professor Rosemary Tannock).

“I think the key one is the issue of difficulty with organisational processing... of course the classical difficulties are with concentration, impulsivity, and distractibility... But I suppose the kinds of things that we are much more aware/alert to these days is the issue of underachievement compared to known ability for no other identifiable reason... there is in other words an amalgam, an

interplay, of disorganisational, developmental delay, of which attentional deficiency, and to use Barkley's concept of executive decision or function, is the key" (Dr Trevor Parry).

"The main problem with ADHD is that it varies dramatically from child to child and the key features, if you're looking at behavioural presentation in the school age child, are impulsivity - why does such a clever child do such stupid things? - and insatiability - demand - the mosquito that buzzes you and doesn't give you space. Those would be the key things that are not present in other conditions. And the learning ones are a circling brain which is self-distraction, a problem of getting the focus on the right thing, a problem of moving focus from one thing to another, a problem of an over-focus, a problem of short term memory, and a problem of organisation" (Dr Christopher Green).

M: Do you think attentional impairment is central to ADHD?

Participants provided a range of responses to this question. Whilst some rejected the notion of attentional impairment as central to ADHD, others were inclined to accept a more broader definition of "attentional impairment" as characteristic of ADHD. The responses obtained from participants were as follows:

"No, no I don't. I think disorganisation is" (Dr Trevor Parry).

"No. I would see that behavioural inhibition is the central component of ADHD" (Dr Annemaree Carroll).

"I think that attention is a bad word - like hyperactivity. I think it is the self-monitoring, which means it is the control of the attention (that is, the coming in and out of attention, moving focus from one thing to another, regrouping after

a distraction) - it is the moving of attention - it isn't inattention. It isn't that they don't concentrate, it's that they find it hard to select - home in on - and keep homing in on the right thing - that's where it's all at" (Dr Christopher Green).

"Yes. But I also would say that it's attentional impairment broadly defined. If you take a look at the cluster of symptoms under attention what you see is that there is a wide range of cognitive impairments associated with them. It's not just paying attention in the sense of listening to a speaker, but it involves - you know - being able to get organised, being able to activate - that certain energetic, affective component to it, and modulating that affect, and there's a problem with short term memory that's a crucial element of it" (Dr Thomas Brown).

"Yes, absolutely... these symptoms of the inattention - if we look at the actual symptoms, they incorporate many critical cognitive - or suggest or reflect critical cognitive processing. And we know that they persist into adolescence and adulthood, whereas the kinds of fidgety/restless behaviours typically decline... And if we look at the comorbidity, that may also be informative. The comorbidity that's associated with the hyperactive-impulsive only type and the combined type is typically Oppositional Defiant Disorder and Conduct Disorder. By contrast learning disabilities typically go across the board" (Associate Professor Rosemary Tannock).

M: In particular, how would you distinguish the nature of any attentional problems between the subtypes?

This question also received a range of responses from participants who conceptualised the attentional impairments associated with the ADHD-PI and ADHD-CT subtypes in a number of different ways. For example:

“The Predominantly Inattentive children appear as daydreamers, with high levels of inattention, and in particular poor sustained attention. In contrast, the Combined Type have problems with withholding responses, and are often hyperactive, clumsy, with problem solving difficulties, inattention, problems with sequencing and time concepts, and distractibility... Where the Combined type may rapidly flit from one task to the other (i.e., selective attention difficulties) and may have problems screening out unnecessary information and are easily distractible, the Inattentive’s have more difficulties with sustained attention” (Dr Annemaree Carroll).

“I think that the Combined Type is an output disorder, meaning that there is no problem with how information is being perceived and processed... the problems come in when behaviour must be organised and executed, or when strategies must be applied to the information coming in to organise it better... the attentional problems there are: one, resistance to distraction, which is the interference control/inhibition problem; and an inability to guide behaviour by internal information, which is the sustained attention/sustained effort problem... So I think that their sustained attention and distractibility problems are due to the working memory deficits and the inhibitory deficits. In the inattentive children, I think it is an input problem... And so I think it’s a different attentional mechanism - I would say that they are focused or selective attention problems. I think it does have to do with the initial perceptual, selective, and processing aspects - the front end of an information processing model” (Professor Russell Barkley).

“Not clearly. We’ve actually tried this by looking at just what I call the behavioural phenomenology. In other studies, where we were looking at an objective measure of activity - so we were using actigraphs. We didn’t find on this measure, any difference between the Predominantly Inattentive Type and

the Combined Type. And it's puzzling because you'd assume if everybody's describing that the Combined Type are the fidgety/restless ones, that should be picked up on an actigraph, which measures movement... But we also looked... at the sustained type of attention and the selective, focussed attention - and in terms of just the symptom count and what's been endorsed, we really didn't see any difference there. But I think that's because we're just looking at these surface behaviours. So I think the next step is we clearly need to be looking at more of the cognitive processes, and this is where I think we're beginning to get some evidence of some separation. As soon as we go to the cognitive processing, then I think we might be seeing some differences for example in working memory" (Associate Professor Rosemary Tannock).

(3) The role of response inhibition and the executive functions (EFs)

Participants were invited to share their views on Barkley's (1997a) recent Unifying Theory of ADHD, which has response inhibition as the core deficiency in ADHD, which in turn leads to secondary impairments in four specific EFs. In particular, Barkley refers to four EFs that are gradually internalised over the course of normal human development. Specifically, these four EFs are: the ability to sense privately to ourselves (primarily visual imagery), the internalisation of language (i.e., the development of private speech), emotional behaviour that is then made private, and reconstitution (i.e., the analysis and synthesis of behavioural sequences). When interviewed, Professor Barkley himself outlined his theory in some detail, clarifying the role he hypothesises that response inhibition plays in the development of self-control. It is Barkley's (1997a) contention that the normal development and deployment of these executive functions is contingent upon response inhibition, which effectively provides the delay needed for these executive functions to develop.

Furthermore, Barkley predicts that an impairment in response inhibition in children with ADHD compromises the normal development (i.e., internalisation) of these executive functions, thus affording these children considerably lower levels of self-control.

“I think that over development those four behaviours slowly become private and as they do they take over the guidance of public behaviour, so that public behaviour is being guided by private information... this means that over the course of child development there is a shift between external control to internal control, of control by the temporal moment to control by the conjectured future... and from public observed self-control to private self-control that’s no longer observable” (Professor Russell Barkley).

M: [Question posed specifically to Professor Barkley.] As I understand it, the inhibition actually provides the time for these processes to occur?

“It gives you the time for it, but the other thing which I don’t think came across quite so clearly in the book [i.e., ADHD and the nature of self-control; Barkley, 1997c] is it is the mechanism that privatises the behaviour. You can’t privatise a public behaviour if you don’t inhibit the public manifestation of it. So not only does it give you the time to do these things because it’s delaying the prepotent response, it’s also precluding the public aspects of these private activities while you’re thinking about it. And because ADHD is disrupting this inhibitory mechanism, not only are more prepotent responses being released, but more behaviour is being engaged in publicly that others would have been doing in private” (Professor Russell Barkley).

All of the other participants were familiar with the theory and were very positive about the contribution that Barkley’s (1997a) model has made to the theoretical understanding of ADHD. Whilst participants’ comments were

largely favourable, they nevertheless raised a number of significant issues that they suggested should be addressed in subsequent research.

M: A recent theory by Barkley (1997) has response inhibition as the core deficit in ADHD, which in turn leads to impairment in specific EFs. What is your view on this theory?

“This has truly been a major, major advance in the field because it’s put out a model - and a model is there to be tested empirically, to be supported, or challenged... from the neuropsych findings to date it lent itself to the notion that inhibition may be the core feature...and whereas this has certainly been within our group, believed to be a major component of ADHD, our recent findings are really challenging that... we have not found robust differences between the Predominantly Inattentive and Combined Type in terms of behavioural inhibition, yet according to both Barkley’s model and the model proposed by Quay based on Gray’s model, they both argue that in fact the inhibition-impulsivity - the inhibitory control problems - would be restricted to this Combined Type, and primarily that’s therefore being accounted for by the hyperactive-impulsive symptom clusters. And we don’t find evidence for that” (Associate Professor Rosemary Tannock).

“Yes. This sounds very plausible and again in examining empirical evidence on the neuropsychological functioning of individuals, it seems that the ability to inhibit responses to a task is a central problem in children with ADHD” (Dr Annemaree Carroll).

“Yes, I am familiar with that and I think that that’s appropriate for hyperkinetic forms of ADHD and of course that’s all that Barkley explained - and in that context I am comfortable, but I am not comfortable in that where either of the

other groupings are not allowed in the spectrum and that clearly is meant to transpose across because I clinically don't think you'd see it" (Dr Trevor Parry).

"I think of his model as a very good one... except when he gives primacy to the specific function of behavioural inhibition... My model... needs to have his behavioural inhibition added to it and I think his model needs to be levelled so that you don't have that behavioural inhibition as the chief among equals" (Dr Thomas Brown).

M: How do you conceptualise the EFs, their range and their role?

While a precise definition of the executive functions continues to elude researchers even after many years of study, there appeared to be a general consensus among the participants that the construct refers to those higher-order cognitive processes responsible for the organisation and self-regulation of thought and behaviour.

"Executive functions are basically those strategies or processes that exist to help us self-regulate our behaviour - our ability to problem solve, shift from one thing to another, self-monitor, inhibit responses, sustain attention, and set maintenance" (Dr Annemaree Carroll).

"Well, executive function is the business of frontal lobe - it is the business of self-monitoring - that is absolutely central to ADHD" (Dr Christopher Green).

"I think the most important is working memory... and then problems with activating and organising as probably most central - and most frequently neglected in most of the formulations" (Dr Thomas Brown).

“The ultimate function I believe is the maximisation of future over immediate consequences... if you read Leda Cosmides’ work on social exchange... her paper with John Tooby lists the mental mechanisms that would need to be in place to allow social exchange to occur. And if you read the list it is: sense the past, project to the future, evaluate the changing value of a consequence over a period of time, and enter into a commitment with another person and then follow the commitment. You’ve just described each of the executive systems” (Professor Russell Barkley).

“The executive functions is a woolly concept - fuzzy. You can’t define it - nobody can agree on what they are. Rather I think we assume that executive functions are the superordinate processing involving wide distributive networks - neural networks - that integrate a whole range of more basic processes - like perception and so on... And I think that what we may be detecting is evidence of developmental anomalies in the networks that support constructs like inhibition or like working memory” (Associate Professor Rosemary Tannock).

M: Children with ADHD (and in particular, the Combined Type) appear to have difficulty inhibiting their immediate responses even when deferral of the response would lead to future gratification. Can you give some examples of where this may happen?

Participants described a range of situations in which this phenomenon might be observed in children with ADHD. However, Professor Barkley identified that the establishment of a competing schedule of rewards appears to be common to these tasks:

“The most immediate examples that come to mind are the ones I cite in the book which is Campbell’s cookie delay task and Joel Newman’s delay of gratification software program... But any task that sets up a competition between two schedules of reward, one involving an immediate and the other involving a delayed but larger one. Now what examples in life might that pertain to? Well anything that involves a reinforcer being available, but socially you have to wait for it” (Professor Russell Barkley).

This was supported by Dr Trevor Parry who commented:

“In the younger child particularly, who has great, great difficulty understanding in a formal way of what is anticipated, which might be going to the pictures - you know - having a reward, waiting for a birthday, having a holiday, or playing Nintendo - if it’s got to be in two days’ time rather than now... you see a very characteristic feature of all of the groups but particularly the inattentive of an over-focusing on the issue of the now to the exclusion of all other things” (Dr Trevor Parry).

“Often they’ll say the first thing that comes to mind in a conversation, and in the process sometimes even interrupt people because what they’ll tell you is that if they don’t say it when they think of it, they’re not going to remember it later... it’s part of their cognitive style - they tend to often think quickly and be thinking about a lot of different things all at one time... And in some tasks, where you need to be able to think in this multi-tasking way, their ADHD style is really an asset” (Dr Thomas Brown).

“Yes. An example of this would be if they were told they could play on the computer for five minutes now or if they waited until after lunch they could play for half an hour. Examples of interference might be: giving a set of instructions and then someone saying something which throws out the ability

to complete what has been asked. Inhibition: not being able to stop yourself calling out, hitting the person next to you, or throwing the rubber” (Dr Annemaree Carroll).

“Well if you were to listen to parents, probably the number one thing that they would tell you - of certainly young ADHD children - is an inability to take frustration... when things don’t go well, we can walk away from them. When the ADHD child’s brother takes their toy, they wallop them. When things don’t go to plan - when it’s raining and they can’t play - they can’t take that. It is that business of inability to take frustration that would be one of the classic things that you would see” (Dr Christopher Green).

“With difficulty these days. I think at one time I would have said yes. I’m really struggling with this notion - do they really have difficulty withholding responses? I look at these youngsters in our laboratory situation, and I look at them doing any of our so-called tasks - they don’t actually seem to have difficulty withholding - in fact they’re often slow to respond. And I can’t find many instances where they respond too quickly. On the other hand, a child who is anxious can often respond too quickly. So I’m not really sure what I’m seeing any longer” (Associate Professor Rosemary Tannock).

M: Many ADHD children may persist in giving incorrect responses (perseverate) even when corrected. Can you think of any examples where this may occur?

All participants provided examples and generally attributed the problem of perseveration to the inability to switch between two competing tasks or to inhibit an ongoing response. The comments received included:

“The Wisconsin Card Sort is a classic example of that where a reinforced pattern of behaviour is occurring, a shift occurs in the strategy, the rule, the concept that must now be applied and the individual must use their errors to detect that a change has occurred and then analyse those errors for a possible strategy... that would be perseveration on a psychological task. Now in the real world, what would it be? You’re engaged in an academic task in school and the sign or the symbol of your math problems change and you start to get errors” (Professor Russell Barkley).

“The perseveration is part of their demand-insatiability and also part of their problems of focus... Some of these children have got not an attention deficit but in fact they’ve got attention surpluses - i.e., they get an idea in their mind and they’re like a dog with a bone you can’t budge them... And also with ADHD there is this insatiability of not knowing when to back off - you know ‘Can we have it, can we have it, can we have it?’ - when most people look their mother in the eye and think ‘This is inappropriate, back off!’” (Dr Christopher Green).

“Yes, they’ll sometimes get stuck on things and I think sometimes it’s just the ADHD and sometimes they’ve got an unrecognised OCD problem... But there again you’re talking about a dimensional variance of executive function which has to do with being able to shift gears, which you could subset under prioritising, or you could deal more specifically with it in terms of Russ Barkley’s notion of reconstituting - of being able to shift from one task to another” (Dr Thomas Brown).

“Parents find it in their parenting. You know, ‘Can I buy such and such?’, ‘No, you can’t’, and it goes on and on and on and on... Or again, just a concept, just something they’ve seen or something which has happened. An injustice that has been done for the older child when they’ve reached that sort of moral stage

of awareness of that which is just and unjust and will be exaggerated in their sense of affront, without any awareness of what they their participation in that issue might be” (Dr Trevor Parry).

“Oh, frequently. In some ways it’s a fascinating issue - because to what extent are perseveration and inhibition related - if you fail to inhibit, you’ll continue doing the same thing... if I looked in a classroom situation, I can recall clearly one child who had a topic on his mind. And he kept reintroducing this topic over and over again at the most bizarre moments and he couldn’t let it go. Parents likewise often tell us that they often - although the kids don’t seem to pay attention - they’ll suddenly get stuck with something and won’t let go of it and it can go on and on and they don’t want to stop, which to me is that perseveration. And yet is that also a failure to inhibit? I don’t know” (Associate Professor Rosemary Tannock).

(4) Verbal and non-verbal working memory

M: It appears that working memory may also play a significant role in ADHD. What are your thoughts on this?

The consensus among participants appeared to be that an impairment in working memory may indeed play an important role in ADHD. However, participants were also careful to stress that problems in working memory are not necessarily the result of an underlying deficit in memory itself.

“I think that it is central... I think that the aspect of working memory that’s most important for most people is verbal working memory... we are using the Children’s Memory Scale and find that if we use the Story Memory there that we often get better registration of short term working memory impairments in

people with ADHD than we do if we were using digit span alone” (Dr Thomas Brown).

“I do believe it plays a major role - and in fact many of the tasks that we use to measure inhibition and a whole range of other more complex processes, for children - if you take a developmental perspective - make heavy demands on working memory... It could be that we’ve got an impairment first of all just in the amount of information one could hold momentarily - the span - and it also could be in fact manipulating information. What seems to be the problem with ADHD that’s emerging in the literature now is that if we take the verbal span (that ability to hold a certain amount of information on-line - verbal information), it doesn’t seem to be a problem - when we manipulate it in some way, there is a problem... there is evidence in the literature... that the ability to hold and represent spatial information and manipulate it seems to be quite impaired in ADHD” (Associate Professor Rosemary Tannock).

“Working memory - short term memory is a symptom that parents talk of and working memory is a major problem with the learning part of this which teachers complain about. But not all ADHD children necessarily have problems with working memory - most probably do - but it certainly causes problems with reading... you see the words but you’ve forgotten by the time you get to the end of the page. It causes problems with mental arithmetic. So in many ways it is causing problems” (Dr Christopher Green).

“We see it when the kids get into trouble with school for disciplinary reasons and they’re absolutely outraged or even just confused and puzzled as to why something which was last Tuesday which they’ve now not remembered is having to have its detention Friday, or not being allowed to go on the school trip or the school camp or whatever else” (Dr Trevor Parry).

“I would say that while they have the capacity for recalling the past - that is to say that there is not a memory deficit - the past has been processed and stored, maybe not as well or as efficiently or as organised, but they have a past and it’s there. And on cued recall they can tell you about the past. What happens however, is at the point where a response must be initiated, that response is not inhibited to allow time for this recall of the past back into working memory in order for the results of that analysis of the past to then decide the response” (Professor Russell Barkley).

M: It has been suggested that children with ADHD may be less proficient at analysing their previous experiences, and using this information to formulate appropriate responses in new situations. Have you seen any evidence of this?

“Well that depends on what they’re doing. If it’s one of those domains in which they have special interest they often make very good use of their past experience. And if it’s something where there’s been a big jolt of positive or negative reinforcement on it they may very well remember - it’s the routine stuff they have trouble with. And often they don’t remember the stuff that’s not dramatic” (Dr Thomas Brown).

“Children with ADHD will often make the same mistake over and over again although they have had negative consequences given to them. So basically they either forget this has happened or don’t learn from the mistakes they have made” (Dr Annemaree Carroll).

“Sometimes they can be remarkably sensible... the problem with ADHD is just when you think you’re on top of them they then do something utterly bloody stupid. It’s not predictable at every time. Their frontal lobe is working, it just keeps letting things slip through. So it is one of their great problems that they

walk into difficulty because they do not use their frontal lobe to say “Is this wise? What happened last time I did it?” - so it’s a big problem” (Dr Christopher Green).

“At a cognitive level they would have long term memory which gives them prompts, but in terms of the application of that into choices of the now, they are people of the now” (Dr Trevor Parry).

“I think they have great difficulty... if we think of what is required to do that, you’re typically on-line moment by moment bringing up from your long term memory information that you have learned from consequences or whatever, or your previous experience doing something - to work out how to integrate it with the current moment or how to work it with the planned future action. And I think again, if you cannot either rapidly retrieve this knowledge that you actually have and can’t access it quickly, or that you can’t integrate it rapidly enough to make an appropriate decision, it will appear that you can’t utilise and learn from past mistakes or past behaviour” (Associate Professor Rosemary Tannock).

M: Recent research has suggested that ADHD children may have an impaired sense (or perception) of time. What do you understand this to mean?

When asked to discuss the predicted impairments in the sense of time of ADHD children, participants tended to cite problems such as learning to tell the time and reduced awareness of the passage of time. While there was some limited support for the notion of an impaired sense (or perception) of time amongst ADHD children, all participants seemed to agree that ADHD children have difficulty with the self-regulation of their behaviour with respect to time (i.e., the sequencing and organisation of behaviour). For example:

“Many [ADHD] youngsters do appear to be unaware of how to tell the time - which is an important start - they don't seem to have a concept of time... the children seem to have difficulty in terms of working out how much time will be required to complete a task, to allow themselves to prepare for a project - each component. And I think maybe what's happening is that the children don't seem to have the appropriate language to use to represent those concepts of time... Another area we've found where they have difficulty is when we actually measure the perception of time. So if we use a cognitive method to measure perception of time, they do seem to have - and this is with short intervals - they seem to have remarkable difficulty distinguishing between intervals that are very brief - like less than half a second... what happens there is that they produce a much longer interval. However when we ask them to produce a longer interval, say two seconds or six seconds, they actually reproduce it as though it was much shorter” (Associate Professor Rosemary Tannock).

“The sense of time derives from the ability to analyse the environment in a sequence, so that as the environment is changing there is a sequence of changes that is taking place. In order to sense time, the person has to have the ability to hold slices of the environment in mind in a sequence... that's working memory... Because working memory is being disrupted by the inhibitory problems, people with ADHD are unable to retain sufficient sequences of information in mind that allow for a normal sense of time” (Professor Russell Barkley).

“Children with ADHD have very poor time management and organisational skills. They have difficulty sequencing activities - for example they will not know in the morning to do the necessary activities in time to get to school. They

have little concept of distance in time, and have difficulties pacing their work so they finish it in the time given" (Dr Annemaree Carroll).

"ADHD people are - one of their greatest problems is a problem with organisation. And ADHD adults will tell you that if they get on top of their organisation - that is when their life comes together. Now central to organisation is time. So I wouldn't see it as a specific thing - it is a problem of organisation" (Dr Christopher Green).

"They're people of the immediacy - is the number one factor and it's very difficult to extrapolate beyond the immediate. But there's also that which is compounded in the now by the multiple... whereas if they have been helped to break it into manageable aliquots... and they need to learn that because it just doesn't come. It's more organisation. That's why I personally think this is much more a struggle that relates to difficulty with organisation rather than time per se (Dr Trevor Parry).

"That's not something I've studied very much... I certainly have seen the problem that many of these folks have in estimating correctly how much time it's going to take them to do things - for example, they'll plan an errand and need to get from - they're here at 3:00 and they want to be someplace else at 3:30 - and they have no problem in thinking about themselves as being there at 3:30 but allow no time for travel" (Dr Thomas Brown).

M: What do you see as the role of language in children with ADHD?

Barkley has previously described the importance of language in the self-regulation of behaviour (Barkley, 1997a, c). In response to this question the other participants discussed the importance of language in relation to reading, and its role in the sequencing of information and behaviour. Participants also

described the frequent comorbidity between ADHD and language impairments:

“I think this is a crucial element. Don’t forget that obviously as soon as we get to school-age children, how we are determining whether a child has the symptoms of ADHD is often heavily based on the children’s everyday language. And I think one of the notions of the language is that it allows you to map and sequence and store in your mind these representations... And certainly this ability to sequence seems to be very crucial both in terms of utilising language to explain ideas and utilising language to represent sequencing, and therefore also to guide one’s behaviour in an orderly, sequenced manner” (Associate Professor Rosemary Tannock).

“That’s a complex one. I mean first of all, language disorder is a much more common comorbidity than we would realise. Secondly, language is often, as spoken, circuitous - slips off target. If you listen to some of these adult ADHD experts talking - there will be one talking this afternoon - you will go mad because he’s all over the place - it is like an interrogation, so there’s a big problem there. And of course language is the basis of dyslexia and dyslexia is another comorbidity so certainly it’s tied up with it all” (Dr Christopher Green).

“I think the link between ADHD and language impairments is short term working memory. A lot of the people we see who have ADHD also have a Disorder of Written Expression where working memory is crucial but I think it’s also important in the development of language skills... there’s some peculiar problems that many people with ADHD have in their reading where they have difficulty retaining what they’ve read and being able to remember what happened in the first half of the sentence when they read the second half of the sentence” (Dr Thomas Brown).

M: Have you noticed any patterns in the verbalisations of children with ADHD?

“Well I know they tend to have a little more trouble with narrative - the work that Rosemary Tannock herself - and has been summarised in the book that Brooks published on language and behaviour and attentional impairments - I think addresses this pretty well. Often they sort of jump around in the details that they give you and have a little difficulty in sequencing their accounts so that you end up with fragments as they talk with you about things and you have to sort of weave the pieces together yourself” (Dr Thomas Brown).

“There is no doubt that a lot of kids with ADHD also have a specific difficulty with language processing... But is this bit that we’re seeing here intrinsic to call it ADHD or is it in fact one of the comorbid issues, as I would label it, where whatever it is, 35-55% of the kids have specific learning disability and that’s mostly in language based areas” (Dr Trevor Parry).

“They have problems sequencing the language. If given a set of instructions or giving a set of instructions, they will often have problems getting them in the correct and sequenced order... Actual verbalisation of sequences may actually assist children with ADHD to complete tasks in the correct order” (Dr Annemaree Carroll).

M: In your experience, do ADHD children have trouble with the internalisation of speech?

“They have difficulties thinking silently rather than actually rehearsing things out loud. Therefore, they often need to talk to themselves out loud if they are faced with a task” (Dr Annemaree Carroll).

“That’s what Vygotsky said, the more difficult the problem, the more you have to fall back on earlier stages of private speech, because they’re more influential than quiet speech happens to be. So even normal children can be induced to speak publicly – even adults – if you give them a difficult problem” (Professor Russell Barkley).

“I’m not sure. Some people say that the reason that all of us don’t get into trouble is that we internalise our language like a pilot before he takes off saying “Have I got the fuel, are the flaps working?” - this way - and that is what stops pilots crashing and it’s what stops you and I crashing. But ADHD it is said maybe they don’t internalise, maybe they don’t do a dry run in their head - they just crash” (Dr Christopher Green).

(5) Further comments and unresolved issues

In line with the exploratory nature of the semi-structured interviews, when topics of interest were raised during the interviews, participants were encouraged to provide as much relevant information as possible. Each of the participants was also given the opportunity to make additional comments at the conclusion of their interview. Whilst not all of the data obtained in this manner were pertinent to the present study, a number of significant comments were made and are reported in the present section.

M: Do you see “Attention-Deficit/Hyperactivity Disorder” as an appropriate name for the disorder?

The results revealed considerable agreement between participants who regarded the current terminology as restrictive and increasingly inappropriate. A range of alternatives were also suggested.

“No. I don’t know what to call it. And I think it’s because at the moment it’s very hard not only for us as professionals and scientists but I think also for parents, it’s hard when you have a very dreamy, inattentive child to know that this child also has the same label as a child who’s bouncing off the walls - just that alone doesn’t make sense... I’ve seen in the literature terms like executive dysfunction disorder emerging in the adult literature, and I wouldn’t be surprised if this doesn’t sort of filter down to the child level. What we call it I don’t know because we simply don’t know what the fundamental problems are with ADHD” (Associate Professor Rosemary Tannock).

“The first thing that I want to say is that I think the terminology is becoming to me increasingly inappropriate and unhelpful, in terms of the complexities of problems that I see children struggling with” (Dr Trevor Parry).

“No, I don’t think Attention Deficit Disorder is a very good term for it because we’re beginning to realise that attention is multi dimensional and that maybe only one aspect of attention is involved... Behavioural inhibition disorder might be a better term for this. Executive Function deficit disorder might also be close to the mark. Developmental disorder of executive function. But I think those would be much closer to the core of the disorder than Attention Deficit Disorder has been. Also realising that we may have another attention disorder on our hands here, that really is an attention deficit and that’s the inattentive type of ADHD. So I don’t like the name, but we’re going to keep it for a while” (Professor Russell Barkley).

“No. I think that we ought to separate out the term ‘hyperactivity’ from the name of the disorder. Some people want it to come to things like ‘Executive function impairment’ or ‘Mild neurological impairment’ or something like that. And I think that because of the history of research that it makes sense... to think

of it as an attentional disorder rather than as a disruptive behaviour disorder because it's not always accompanied by disruptive behaviour... But I think that the term 'Hyperactivity-Impulsivity' or even just 'hyperactivity' in the name of the Predominantly Inattentive Type is an oxymoron" (Dr Thomas Brown).

"The name will change and I predict it will change next time to BID - behavioural inhibition disorder - for the short fused, and ADD for the learning problems" (Dr Christopher Green).

"ADHD has been fraught with so much controversy over the past decade or more. If it could be established that there are two distinct disorders... then I think a change in name could be useful to distinguish the two disorders from each other. My only concern in this however, is that there have been so many name changes over the past four decades, that people may just think here we go again without truly understanding the major breakthroughs that have been made in the field" (Dr Annemaree Carroll).

M: Do you agree with its placement in the Disruptive Behaviour Disorders category of the DSM-IV?

Some participants firmly agreed with the placement of ADHD under this category, while others did not. The responses received included:

"Well it's a major problem of disruptive behaviour. My interest with ADHD is I think its number one problem is that it's a wrecker of relationships. It wrecks relationships between mothers and children and children and mothers, children and peers. It breaks up adult relationships - a massive break up in relationships of ADHD adults - so it's a disruptive one most certainly" (Dr Christopher Green).

“I think that the Combined Type that involves the hyperactive-impulsive behaviour clearly does because of its high comorbidity with Oppositional and Conduct Disorder. Statistics ranging anywhere from 35-60% have Oppositional Disorder and 15-20% have Conduct Disorder - that’s a good placement for them. I think that the Inattentive group on the other hand, as has been repeatedly shown, shares very little comorbidity with the other disruptive behaviour disorders and consequently I don’t think it belongs under that hierarchy” (Professor Russell Barkley).

“Where else do you put it? Some researchers would suggest that ADHD would be better placed under the Pervasive Developmental Disorders because of the links that have been found to Autistic Spectrum Disorder. More research needs to be done” (Dr Annemaree Carroll).

“Absolutely not. I think this is probably the greatest disservice we’re doing to these youngsters. And it also leads to a different type of treatment, which is the biggest concern. And if indeed this condition or at least a huge chunk of it - a group of individuals with this condition - are truly showing these neurodevelopmental/cognitive impairments, this really is simply doing them a major disservice, because we’re misunderstanding why this child may be being inattentive or impulsive or disorganised. And therefore by just using these treatment approaches - behavioural modification techniques - sure we can using various response costs you can train even animals to respond appropriately, but that’s not getting at the core problem. And I think it’s truly blaming a child for misbehaving when it’s truly a processing problem” (Associate Professor Rosemary Tannock).

Chapter summary

The purpose of this exploratory study was to examine the current conceptualisation(s) of ADHD held by leading professionals in the area of ADHD research. The data obtained from the semi-structured interviews, which was presented here, will be critically examined in the following chapter, where it will serve to provide key directions for the subsequent phase of the research. In particular, the predicted executive impairments of children with ADHD will be identified and discussed, with a view to their further investigation in Study Two. Furthermore, Chapter Four will serve to discuss the selection, and nature, of the instrumentation to be used in Study Two, with a view to ensuring that the measures chosen are designed to be sensitive to the constructs under examination.