

# Language and Mental Health Disorders: The Case of ADHD

## Introduction

The faculty of language, conceptualized as an outward behavioural expression of one mode of thought (symbolic representation), appears to be a uniquely human capacity.<sup>1-2</sup> On the one hand its precise nature and evolution remain resistant to full understanding by its human users. On the other hand, both lay and professional members of a particular language community develop clear intuitions about the community norms of language behaviour, adjusted for speakers of different ages and cultures, and for different social purposes. These intuitions are then used to judge when an individual's language behaviour is atypical.<sup>3-4</sup> This essay concerns the recognition, characterization, and pathogenesis of atypical language in a common mental health disorder of childhood – Attention-Deficit/Hyperactivity Disorder.

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## Attention-Deficit/Hyperactivity Disorder (ADHD)

ADHD is characterized by persistent, cross-situational, developmentally inappropriate and impairing levels of inattentive, impulsive and hyperactive behaviour. It is a major public health concern because of its prevalence (occurs in about 10% of children and 4% of adults across different cultures and countries), chronicity, increased risk for additional and serious psychopathology in adulthood, and detrimental effects on the

individual's educational, social, and occupational attainments that are valued by society.<sup>5-7</sup> Conceptualized as a neurobiological disorder, ADHD has high heritability (comparable to that of height) and a genetic basis.<sup>8</sup> Yet, this common 'disorder' lacks any biological markers and the diagnosis relies on descriptions

Child: "What are we gonna do next? Huh? What's in there? What's that?" (interferes by grabbing test materials)  
Adult: "You'll see *in a sec*"  
(adult reaches into case for next set of test materials)  
- a few minutes later, child interrupts testing -  
Child: "Where's the um...the things...um...where's the um...bugs?" (climbs on seat to peer into case)  
Adult: "Pardon? What bugs? There are no bugs here. Now, tell me what --"  
- child interrupts again -  
Child: (loud unmodulated voice) "–The bugs. You said I'll see the bugs. I don't wanna do this. I wanna see the bugs...the...um...secs... the *insecs!*"

**Figure 1.** A case of behavioral symptoms of ADHD or language problems? This language sample occurs 20 minutes after the start of a psychoeducational assessment of an 8-year-old boy who has received a diagnosis of Attention-Deficit/Hyperactivity Disorder. Text in red ink reflects defining behavioral symptoms of ADHD, according to DSM-IV.

of the child's behavior by parents, teachers, and significant others. It is not surprising then that two centuries after its initial recognition by the medical community, ADHD continues to defy understanding and remains suspended between medical reductionism and social skepticism. Here, I highlight various clinical and scientific interpretations of language difficulties exhibited by individuals with ADHD (see Figure 1), including a subset of the defining behavioral symptoms of ADHD (see Figure 2), which may be the outward behavioral expression of underlying problems in symbolic representation and/or motoric control.\*

- **Inattention**

- Doesn't appear to listen when spoken to directly
- Difficulty following through on instructions

- **Impulsiveness**

- Blurts out answers before question has been finished
- Interrupts and intrudes on others (e.g., butts in on conversations)
- Difficulty awaiting turn

- **Hyperactivity**

- Excessive talkativeness
- Difficulty playing quietly

**Figure 2.**

A subset of the 18 possible diagnostic symptoms of ADHD that are indicative of language or communication problems.

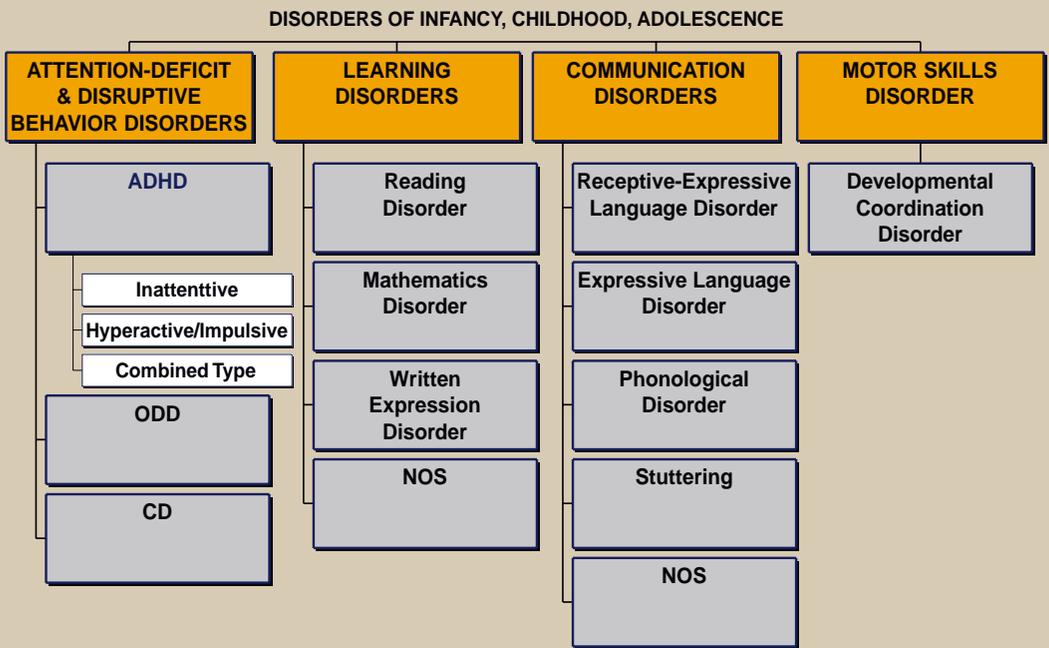
## Two conceptions of the language faculty

The meaning of the word 'language' itself is divergent and varies across contexts and disciplines. Two conceptions, proposed by Hauser and colleagues<sup>1</sup> are used here because they reflect the differential perspectives on atypical language in ADHD that are evident in medicine and allied health disciplines (psychiatry, psychology, speech/language pathology) and linguistics (Formal/Structural Linguistics, Functional Systemic Linguistics). One conception reflects a narrow sense of the word – an *abstract linguistic computational system* with a core property of recursion (i.e., use of a finite set of elements to yield a potentially infinite set of discrete expressions – discrete infinity), which is attributable to narrow syntax and is perhaps uniquely human. The second conception reflects a broader and more inclusive sense – a *social communication system* – which includes the internal abstract linguistic computational system and at least two other internal systems: sensory-motor and conceptual-intentional. The discrete expressions generated by the linguistic computational system are transmitted to, processed and elaborated by, the sensory-motor and conceptual-intentional systems in the *use* of language, with each expression reflecting a pairing of sound and meaning.<sup>1</sup> Thus, I debate whether 'language' problems in ADHD reflect problems in the abstract linguistic computational system, the social communication system, sensory-motor systems, or in all systems.

## Multidisciplinary perspectives on atypical language in ADHD:

### Clinical/Psychiatric perspectives

Psychiatric taxonomies impute diagnostic boundaries between several behavioral/psychological syndromes in childhood that are defined on the basis of deviancy from societal standards of normality.<sup>9-10</sup> For example, unexpected and impairing problems in understanding and producing spoken language (Communication Disorders) are distinguished from



**Figure 3.** Categorical distinctions between ADHD and Communication Disorders according to the DSM-IV taxonomy of mental health disorders of infancy, childhood, and adolescence.

otherwise-unexplained and impairing developmental problems in attention, impulsivity, and hyperactivity (ADHD), motor skills (Developmental Motor Coordination Disorder) and learning (Learning Disorders) (see Figure 3). The inherent assumption is that these disorders (like medical diseases) represent distinct categories in terms of their pathophysiology, etiology, outcomes, and treatments, despite inadequate validation in some instances.

Paradoxically, although the psychiatric diagnostic classification of “Communication Disorders” implies a focus on language as a social communicative system, clinical/medical investigations rely almost exclusively on standardized language tests purported to measure the abstract linguistic computational system. Epidemiological studies suggest that 30% to 50% of children with ADHD are impaired in receptive and/or expressive components of the linguistic computational system, with the implication being that the remaining children with ADHD do not exhibit any language or communication problems.<sup>11</sup> Conversely, about 60% of children in kindergarten who manifest specific speech and language impairments (communication disorders) also meet diagnostic criteria for ADHD.<sup>12</sup>

Several problems exist with this medical/clinical approach to understanding language problems associated with ADHD. First, current behavioural genetics indicates that human traits (e.g., inattention, impulsivity, hyperactivity, language abilities) are distributed as continuous quantitative traits rather than qualitatively discrete categories.<sup>13-14</sup> Thus, children who do not meet the full diagnostic criteria for Communication Disorder may still manifest problems that fall along a continuum of severity. Also, clinical tests of language abilities place heavy demands on other cognitive functions, such as working memory, organization, and attention. Moreover, these tests assess small and decontextualized units of language (e.g., word, phrase, sentence or utterance), and so may be insensitive to problems manifest in discourse or other forms of extended text. Thus poor test performance may not necessarily indicate deficits in the abstract linguistic computational system; and adequate test performance may not necessarily indicate problem-free language or communication.

Cognitive psychology perspective

By contrast to clinical measures of language which focus on the number of correct responses, cognitive methods permit more precise fractionation of performance parameters (e.g., error analysis, response latencies) in an attempt to delineate reasons for poor performance. Error analysis has indicated that underlying problems in cognitive control processes and inadequate evaluation of the social context and demands of the task rather than basic linguistic difficulties contribute to poor performance by children with ADHD on specific subtests of expressive language.<sup>15-18</sup> Additional evidence of the impact of cognitive control failure on spoken language in ADHD comes from investigations of children's generated narratives based on a wordless picture-book – a well-established research procedure used internationally – using story grammar theory and causal network models.<sup>19-21</sup> Children with ADHD are less likely to include the attainment of the overall goal – the *sine qua non* of a complete story representation – or exhibit sustained use of a goal plan in their narration. Also, they make more errors (ambiguous references, dysfluencies) and are less able to stop quickly to correct the detected errors.<sup>20-22</sup> Moreover, analysis of children's elicited conversations reveal problems in use of social communication conventions (e.g., failure to mark topic changes, turn-taking) and in dysfluency (e.g., false starts, hesitations, repetitions) rather than in components of the linguistic computational system.<sup>21-22</sup> These narrative problems are believed to reflect the well-documented inhibitory control and planning deficits inherent in ADHD.<sup>8</sup> Notably, stimulant medication, which improves sustained attention and inhibitory control, also improves relevant aspects of the children's narratives.<sup>25</sup>

Problems in comprehension of extended stretches of spoken language emerge as the linguistic material becomes more complex. For example, students with ADHD exhibit marked difficulty making inferences and self-monitoring their own comprehension when required to listen to expository texts (e.g., science lectures).<sup>26</sup> These problems are associated with deficits in working memory – a specific executive control process that is impaired in ADHD<sup>27</sup> and is a powerful predictor of later academic attainment.<sup>28</sup> By contrast, children with SLI or with ADHD and comorbid SLI manifest grammatical errors (grammatical abandonment and omission, morphosyntactic errors), which are indicative of impairments in the abstract linguistic computational system.<sup>17, 24</sup>

Analysis of speech parameters during conversation, such as voice rhythm (rate and duration of pauses and vocalization, response latency), intensity, and frequency, has revealed marked differences in the timing and modulation of speech between children with ADHD and those with and without specific learning disabilities.<sup>29</sup> They speak louder, fail to modulate their voice volume, speak for much longer at a stretch with many short pause durations during their talk, but take much longer to respond to the conversational partner. Voice modulation requires continuous fine muscle adjustments of the vocal tract, suggesting an immature motor system may underlie these speech problems in ADHD. Pauses during continuous speech are believed to reflect the planning of forthcoming verbal output (what to say and how to articulate it).<sup>30-31</sup> The frequent pauses in the speech of children with ADHD appear too short to permit thought, organization of information, or speech planning, as well as too short to

## Language and Mental Health Disorders: The Case of ADHD

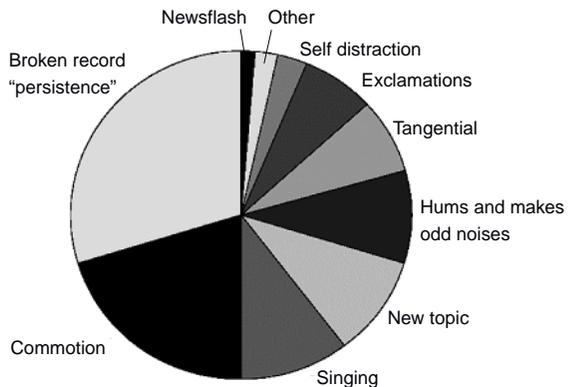
permit others from taking a turn. Moreover, the marked dysfluency in their spoken language is indicative of verbal retrieval problems, often resulting in a higher frequency of non-specific terms (see Figure 1).

Thus, the application of methods from cognitive psychology to investigate comprehension and production of extended contextualized language (e.g., narratives, discourse, expository lectures) have delineated socially based communication difficulties, as well as motorically based speech problems in individuals with ADHD in the presence of a seemingly intact linguistic computational system.

### Systemic functional linguistics perspective

By contrast to formal linguistic theory, Systemic Functional Linguistics (SFL) is concerned with language in everyday discourse: on what language accomplishes during social interaction.<sup>4, 32</sup> It starts from the premise that language is used primarily to convey meanings in contexts and views grammar, vocabulary, and the sounds of language (components of linguistic computational system) as linguistic resources used by speakers to encode the meaning. SFL analysis of children's disruptive talk in a classroom revealed nine subtypes of disruptive talk, most of which could be related to the diagnostic criteria for ADHD, as well as one subtype ("Broken Record") which mapped onto a cognitive feature of persistence (periodic difficulty in shifting mental set) that has not been recognized clinically as a characteristic of ADHD.<sup>33</sup> Also, by contrast to clinicians' and teachers' beliefs, the disruptive talk did not usually occur as a result of failure to listen; rather the children incorporated the preceding verbal or nonverbal contexts into their disruptive talk. An accompanying novel Phasal Analysis reveals the temporal patterning of the children's disruptive talk and its detrimental impact on the ongoing lesson (see Figures 4–5).

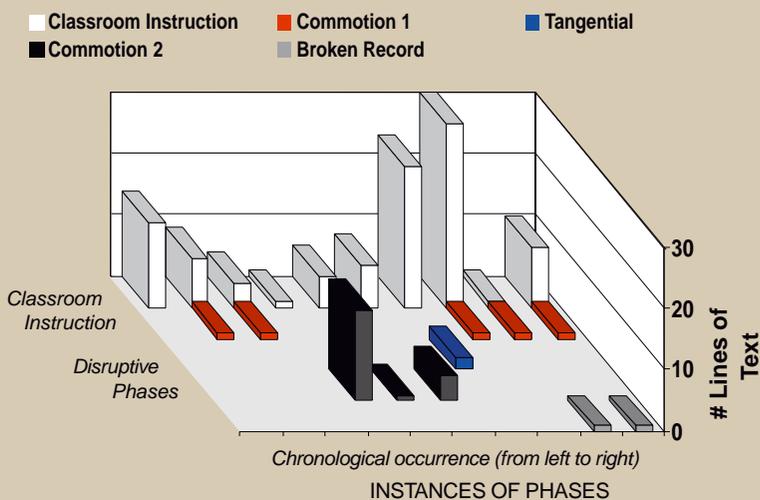
According to an SFL perspective, language



**Figure 4.** Distribution of various types of disruptive talk manifest by a small group of children with ADHD during a reading lesson in a special education classroom, as identified by phasal analysis based on functional systemic linguistics.

**Figure 5.**

Disruptive talk in the classroom. An example of phasal coding of 3 pages of transcript of all instances of verbal and vocal behavior produced by the teacher and children with ADHD.



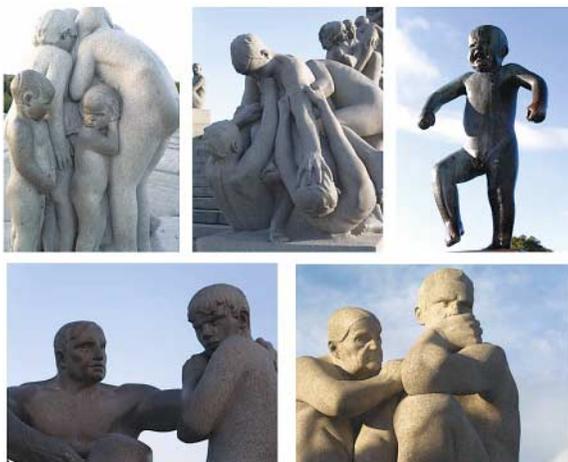
ADHD Symptoms & their linguistic manifestation	Examples of linguistic manifestation
<b>Problems sustaining attention</b>	
<ul style="list-style-type: none"> <li>• Jumps stages of social process (e.g., inappropriate responses)</li> <li>• Changes in topic of interaction</li> </ul>	<i>Adult:</i> "Hi how are you?" <i>Child:</i> "I want to play with that"
	<i>Adult:</i> "What flavour would you like?" <i>Child:</i> "Well, I want a chocolate one...no, a vanilla one with chocolate... no, with um...You know what? My brother is going to get his...um...badge-thing"
<b>Doesn't appear to listen</b>	
nonverbal	<i>Adult:</i> "So, Jonathan, tell me what happened yesterday – first thing in the morning and then later in the afternoon" <i>Child:</i> Looks away, pulls at shirt sleeve, turns to look at picture on wall...while speaker is talking
verbal (e.g., fails to respond contingently in set of verbal exchanges; uses ellipsis inappropriately)	<i>Adult:</i> "So what happened, what did you do?" <i>Child:</i> "Can't" (as in can't remember)
<b>Always on the go, driven like a motor Talks excessively</b>	
<ul style="list-style-type: none"> <li>• Fails to pause or use other turn-passing signal to allow others to take a turn</li> <li>• Talks fast in run-on sentences, stringing sentences together with 'and'</li> </ul>	<i>Teacher:</i> "How old was the boy?" <i>Child:</i> "Grade one...seven and...so she..um.. we went on it and he was... he got pushed a little bit on the swing you know and then...pow...down he falls and then we called his brother over...he was really really rough and...he was really light too and um he went on the swing and...and my friend you know she put it in again and we said come on and I don't know I ...forget the boy's name...but we...told him to come over and sit on the swing and...so he came over and sat on the swing..."

**Figure 6.** Linguistic manifestation of ADHD symptoms (derived from Fine J. (2005). *Language in psychiatry: a handbook of clinical practice*. London, U.K.,: Equinox Textbooks & Surveys in Linguistics)

problems are inherent characteristics of ADHD because clinicians use (albeit implicitly and non-systematically) both verbal and nonverbal communicative behaviour as evidence of the core behavioral symptoms.<sup>4</sup> That is, the characteristics of ADHD may be defined in terms of the language that is indicative of the disorder (see Figure 6).

#### Neuroscience and evolutionary linguistics perspectives

Functional neuroimaging studies suggest that the neural basis of human language is not compartmentalized in modules as proposed by many linguists and cognitive psychologists, but rather it is intertwined with other aspects of cognition, motor control, and emotion.<sup>34</sup> Also, some evolutionary linguists propose that language evolved from gesture, rather than as a unique and modular human capacity.<sup>34-37</sup> A full discussion is beyond the scope of this essay; thus I focus on the cerebellum, which plays a



**Figure 7.** Problematic social communication in Vigeland Park, Oslo

Gustav Vigeland: Sculptures from the Vigeland Park. © Vigeland-museet/BONO 2005. Photo: © Rosemary Tannock

**Figure 8.** Effective social communication in Vigeland Park, Oslo



Gustav Vigeland: Sculptures from the Vigeland Park. © Vigeland-museet/BONO 2005. Photo: © Rosemary Tannock

critical role in gesture, as well as in the planning and execution of articulatory movements involved in speaking, speech perception, the temporal organization of inner speech, and verbal fluency (particularly in phonemically related retrieval strategies that are impaired in ADHD).<sup>18, 35-39</sup>

Gesture both precedes and acts as a harbinger of oncoming changes in the child's developing language system and may serve as a temporary symbolic representation.<sup>40</sup> Moreover, gesture appears to ease the process of speech production in that conveying information manually rather than verbally is less demanding in terms of fine motor control, and it also reduces cognitive load.<sup>40</sup> Thus use of gesture frees up cognitive resources for the production of more complex thought and its translation to verbal utterances. Given the robust evidence that the cerebellum differs in both size (smaller) and function in ADHD<sup>41-43</sup> it is plausible that cerebellar dysfunction contributes to many of the documented social communication problems in ADHD. Perhaps the combined problems of cerebellar dysfunction and cognitive control deficits (e.g., inhibitory control, emotional regulation), might account for why children with ADHD communicate by action (fists, stamping and yelling) rather than by words (see Figures 7 & 8).

## Conclusions

Interdisciplinary collaboration from multiple fields (e.g., psychiatry, speech-language pathology, education, developmental psychology, cognitive psychology, linguistics, neuroscience, evolutionary biology) is required to advance scientific and clinical understanding of atypical language in childhood mental health disorders, such as ADHD. Current understanding is limited by lack of data as well as by lack of interdisciplinary collaboration. To date, there is little evidence that the abstract linguistic computational system is impaired in ADHD, but rather the available data suggest that the problems reside in components of the social communicative system. Social proficiency in oral communication and movement may have a common genesis.

\* My scientific thinking has been shaped further during my year at CAS, during which time I was living in a different culture – one that often necessitated on-line changes in my social communication and timing of movement. For example, by contrast to the fast-paced, unpredictable, and egotistical monologues common among North-Americans, Norwegians (at least from my perspective) emphasize calmness, order, and societal dialogue. In North America, pedestrians must move rapidly and give way to cars, whose pacing is externally controlled by Stop-signs at

## Language and Mental Health Disorders: The Case of ADHD

every intersection; generally in Norway, cars still give way to the slower-pace of pedestrians and self-regulate their progress through intersections! Also, appreciative applause at the end of public performances in North America is individualistic and asynchronous, but collective and synchronous in Norway. Moreover, this year at CAS offered opportunities to think about behaviour, language, and movement under different contexts and time scales – as studied by historical linguists and plasma physicists, respectively, and while reflecting and walking in Vigeland Park (see Figures 7–8 for examples of effective versus problematic communication between Gustav Vigeland's life-size human statues).

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