Pragmatic aspects of communication and language comprehension in groups of children differentiated by teacher ratings of inattention and hyperactivity

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RUNNING HEAD: Inattention, hyperactivity and pragmatic language

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Abstract

Children with attention deficit hyperactivity disorder (ADHD) experience pragmatic language deficits, but it is not known whether these difficulties are primarily associated with high levels of inattention, hyperactivity, or both. We investigated pragmatic aspects of communication and language comprehension in relation to poor attention and/or high hyperactivity in a nondiagnosed population of 7-11-year-olds. Classroom teachers rated their pupils' attention and hyperactivity/impulsivity on the ADD-H Comprehensive Teacher Rating Scale (ACTeRS). The three groups were formed: children with poor attention and low hyperactivity (poor attention group), children with good attention and high hyperactivity (high hyperactivity group), children with both poor attention and high hyperactivity (poor attention/high hyperactivity group). Their performance was compared with that of same-age controls in two studies: Study One (N=94) investigated the comprehension of figurative language in and out of context; Study Two (N=100) investigated pragmatic aspects of communication using the Children's Communication Checklist – Second Edition.

Two groups, the poor attention and the poor attention/high hyperactivity groups, were impaired in both their comprehension of figurative language and their communication skills. The high hyperactivity group was impaired in their comprehension of figurative language but they did not exhibit communication impairments. The findings extend work with clinical populations of children with ADHD: Even in a nondiagnosed sample of children, poor attention and elevated levels of hyperactivity are associated with pragmatic language weaknesses.

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Pragmatics is defined as how language is used to convey meaning (e.g. Adams, 2002). Pragmatic language difficulties are specific to the use and comprehension of language in context, rather than problems with semantic or structural aspects of language. Difficulties in language use include poor turn taking and an inability to stay on topic in conversation; difficulties in language comprehension include a tendency to interpret figurative language literally. We report an investigation of these two aspects of pragmatic language in groups of 7-11-year-olds differentiated by teacher ratings of inattention and hyperactivity.

ADHD is a behavioural disorder, in which individuals exhibit levels of inattention and/or hyperactivity and impulsivity that are inappropriate for their age (DSM-IV, American Psychiatric Association, 1994). DSM-IV distinguishes between the inattentive and hyperactivity/impulsivity elements of the disorder, which may occur together or separately, resulting in three subtypes: predominantly inattentive, predominantly hyperactive-impulsive, and combined type. Some researchers advocate the use of a categorical approach, in which ADHD is regarded as a distinct syndrome. Others adopt a framework in which inattention and hyperactivity/impulsivity vary throughout the general population and children with a diagnosis of ADHD lie in the tail-end of a normal distribution (Levy, Hay, McStephen, Wood, & Waldman, 1997).

ADHD frequently co-occurs with language disorders (Tirosh & Cohen, 1998; Westby & Cutler, 1994). An analysis of the DSM-IV criteria for the ADHD subtypes demonstrates that specific aspects of pragmatic language form part of the diagnostic characteristics for all three subtypes (Camarata & Gibson, 1999; Westby & Cutler, 1994). These deficits may

influence the quality and/or the frequency of language learning experiences which may, in turn, lead to wider language impairments, for example in semantic and syntactic skills (Camarata & Gibson, 1999). Pragmatic impairments may also adversely affect performance on standardised assessments of language skill if they interfere with the child's ability to evaluate the contextual demands of the task (Oram, Fine, Okamoto, & Tannock, 1999). An investigation of the relations between specific aspects of pragmatic language skill and the separate symptoms of ADHD is required to fully understand the extent of pragmatic language deficits in relation to ADHD and how these affect other aspects of language use (Camarata & Gibson, 1999; Oram, et al., 1999; Westby & Cutler, 1994).

Assessments of the pragmatic aspects of children's communicative abilities include whether or not children can introduce and maintain a topic and their turn taking abilities during a conversation. These pragmatic behaviours typically emerge between 2-3 years of age (Adams, 2002). Teachers are more likely to report these difficulties in boys with attention problems than in groups with learning disability or average achievement (Humphries, Koltun, Malone, & Roberts, 1994). Children with ADHD also produce more inappropriate pragmatic behaviours in unstructured spontaneous conversations with adults than do typically developing children (Kim & Kaiser, 2000). Other pragmatic language deficits, such as a failure to take a listener's perspective into account when retelling a story, have been found in children with ADHD (Purvis & Tannock, 1997).

Another aspect of pragmatic language, which was considered in the current research, is the understanding of language in context. Assessments of this skill often examine how children interpret figurative language in context, to determine whether or not the child attends to the context when interpreting figurative expressions such as idioms, e.g. 'to get into hot water' (Adams, 2002). The ability to understand figurative language has an extended course

of development from early childhood through to early adolescence (Nippold & Taylor, 1995), although children as young as 5 years are able to use context to understand these expressions (Gibbs, 1991). A tendency to interpret language literally, rather than figuratively, is included in some teacher and parent checklists of communicative ability (e.g. Bishop, 1998). However, on formal tests that assess this skill, such as defining words that can take different meanings in different contexts, children with ADHD do not differ from controls (Purvis & Tannock, 1997).

This review indicates that children with ADHD may experience different types of pragmatic language deficit: impairments in communication and impairments in language comprehension in context. Work to date has not looked at the relation between pragmatic language skills and inattention and hyperactivity/impulsivity separately, although the need to explore the language skills of the subtypes of ADHD has been widely noted (e.g. Baird, Stevenson, & Williams, 2000; Camarata & Gibson, 1999; Kim & Kaiser, 2000; Oram et al., 1999; Westby & Cutler, 1994). Theoretically, it is important to determine whether or not inattention and hyperactivity/impulsivity make separate and distinct contributions to language skills. It is also necessary to determine whether one subtype is more at risk of a particular language deficit than another, in order to develop effective interventions.

This research, to the authors' knowledge, represents the first investigation in the literature to consider how hyperactivity/impulsivity and poor attention are separately related to schoolchildren's pragmatic language skills. To do this, teachers rated children's attention and hyperactivity using a standardised questionnaire based on the DSM-IV classification of ADHD. These ratings were used to identify children with poor attention and/or high hyperactivity. A similar selection procedure has been used previously by Wilding and colleagues (Wilding, 2003; Wilding, Munir, & Cornish, 2001) to explore the relations

between attention deficits and different components of attention, and by Adams and Snowling (2001) to investigate the relations between hyperactivity and executive function and reading impairment.

Teacher ratings of (hyper)activity and (in)attention usually inform the diagnosis of ADHD (Power, Andrews, Eirldi, Doherty, Ikeda, DuPaul, et al., 1998) although a formal diagnosis requires ratings from different informants (e.g. parents as well as teachers) and additional information to eliminate other causes of the behaviour. The children in our study were not formally diagnosed with ADHD, because we were interested to determine the relations between inattention, hyperactivity and pragmatic language skills in children who were (as far as possible) unaffected by additional behavioural problems, such as Oppositional Defiant Disorder and conduct disorder, which are often co-morbid. However, our findings can inform theoretical models of the relations between inattention, hyperactivity and pragmatic language skills, which have been developed from the ADHD research literature.

We report two studies, in which we investigated the relations between poor attention and high levels of hyperactivity/impulsivity (hereafter hyperactivity) and the interpretation of figurative language in and out of context (Study One), and pragmatic aspects of communication (Study Two). Our aims were to determine whether or not children with poor attention and/or high hyperactivity (who do not have a formal diagnosis of ADHD) show signs of pragmatic language difficulties and whether or not children with predominantly poor attention and predominantly high levels of hyperactivity are similarly at risk of pragmatic language impairments.

Study One: Interpretation of figurative language in and out of context

Method

Participants

Three experimental groups and matched controls participated in this experiment. The children were selected from five mainstream suburban primary schools serving middle and lower-middle class catchment areas in the East of England. Children whose first language at home was not English, who had a diagnosis of a hearing, speech, or language disorder, a formal statement of special educational needs, a diagnosis of ADHD, or for whom parental consent was not given were excluded from the study.

Assessment of inattention and hyperactivity. Teachers of all children aged 7-11 years completed the two subscales of the *ADD-H Comprehensive Teacher rating Scale* (*ACTeRS*: Ullmann, Sleator, & Sprague, 1999) relating to attention and hyperactive behaviour. The reliabilities of the two subscales are high: .93-.97. For the values reported throughout, the attention scale has been reversed thus, for each scale, high scores indicate a tendency towards inattention or hyperactivity. To classify children we used the following criteria. Scores of between 5-9 on the reversed Attention scale and 10 or less on the Hyperactivity scale were equivalent to the 50th percentile and considered developmentally appropriate. Scores of between 20-30 on the reversed Attention scale and 16-25 on the Hyperactive scale were equivalent to the 25th percentile and classified as 'poor attention' and 'high hyperactivity', respectively.

Measures of verbal and non-verbal ability. Receptive vocabulary was measured with a group-administered version of the *British Picture Vocabulary Scales - II* (*BPVS-II*, Dunn, Dunn, Whetton, & Burley, 1997: see Stanovich & Cunningham, 1992, for a similar modification). The *BPVS* is a measure of receptive vocabulary commonly used as a surrogate measure of verbal ability (e.g. Adams & Snowling, 2001). The modified test comprised one practice item and 50 test words. The experimenter read out the word and the child ticked the corresponding picture in their individual booklet. One point was awarded for each correct

answer. The reliability was assessed by calculating Cronbach's alpha over items and found to be adequate, $\alpha = .78$. Non-verbal reasoning ability was assessed with the *Matrix Analogies Test - Expanded Form* (*MAT-EF*, Naglieri, 1985).

The ACTeRs scores informed selection of three experimental groups: the poor attention group, the high hyperactivity group, and the poor attention/high hyperactivity group. Each experimental group had their own control group, comprising children who had developmentally appropriate scores in the key area for which they acted as controls. Each experimental group was matched with their appropriate control group on the following: chronological age, vocabulary, *MAT-EF* scores and sex (see Table 1). In addition, one-way ANOVAs demonstrated that the three experimental groups did not differ significantly in age, *MAT-EF* or vocabulary scores: no F (2,44) exceeded 1.9 and all p values were greater than .17.

TABLE 1 ABOUT HERE

Materials and procedure

Understanding multiple meanings in context. Children completed a modified version of the *Multiple Meanings in Context* (*MMC*) subtest of the *Understanding Ambiguity* test (Rinaldi, 1996) to assess their ability to understand pragmatic, or figurative, interpretations of speech. They were presented with ten short story dialogues, five of which contained an ambiguous phrase, "My little girl's room is a real pig sty", and five of which contained a homonym, e.g. "I've been getting very short with Suzie recently". Each item could take a literal and a figurative interpretation: the context of the story supported the latter. The task was adapted from the original to make it suitable to children who were distractible or inattentive: the

dialogue was spoken by the experimenter, instead of the audio-recorded presentation, which had been distracting to children in previous work.

After each dialogue children selected one from four pictures that illustrated what a character had said, e.g. "What does Joanna's mum mean?" The pictures illustrated the correct figurative and the correct literal interpretations, and an incorrect figurative and an incorrect literal interpretation. A "don't know" response was also available. Regardless of their first response, each child was asked the question: "Could it mean something else?" to determine whether they knew both meanings (literal and figurative) of each item. One practice trial with feedback preceded the experimental trials.

Two scores were computed and analysed. The number of first choice responses made by children was calculated (maximum = 10) to determine whether any of the experimental groups had a preference for figurative or literal interpretations relative to their controls. The sum of the correct figurative and correct literal choices made either on first or second choices was also calculated. For the latter, the maximum possible score of 20 indicates knowledge of both the figurative and literal meanings of all items.

Knowledge of multiple meanings out of context. Children completed modified versions of the *Ambiguous Sentences* and *Figurative Language* subtests from *The Test of Language Competence - Expanded Edition (TLC-E*: Wiig & Secord, 1989) to assess their understanding of figurative language without supporting context. Each trial comprised a spoken non-predictive sentence context, e.g. "Mum looks really low today" with four accompanying pictures. One picture represented the figurative interpretation, one the literal interpretation, and two were foils. The child was asked "Point to the two pictures that it could mean" with additional prompts, if necessary. A demonstration item was presented first, followed by a practice trial. There were 5 trials each of homonyms and phrases. One point

was awarded for each target item (figurative or literal) chosen on each trial and the results were summed (maximum = 20).

Results

Understanding multiple meanings in context

First choice responses. The numbers of first choice responses are shown in Table 2. Each experimental group was significantly less likely to select the correct figurative interpretation relative to their controls: high hyperactivity vs controls, $t(28) = 2.95$, $p < .01$, $d = 1.07$; poor attention vs controls, $t(30) = 4.14$, $p < .001$, $d = 1.89$; poor attention/high hyperactivity type vs controls, $t(30) = 3.57$, $p < .001$, $d = 1.47$. A one-way ANOVA with the experimental groups demonstrated that their performance did not differ, $F(2,44) = 1.74$, $p > .17$. The control groups made few errors indicating a strong tendency toward a figurative interpretation strategy. Therefore, paired sample t-tests comparing figurative and literal responses were computed for the experimental groups, only. None of the experimental groups revealed either a preference for figurative or literal interpretation: no t exceeded 1.06.

TABLE 2 ABOUT HERE

First and second choice responses. The sum of first and second responses is reported in Table 2. The difference between the high hyperactivity group and their controls was not significant, $t(28) < 1.0$. The poor attention and poor attention/high hyperactivity groups obtained significantly lower scores than did their controls: $t(30) = 2.77$, $p = .010$, $d = .98$, $t(30) = 2.32$, $p < .03$, $d = .82$, in order.

Knowledge of multiple meanings out of context

The experimental groups obtained lower scores than did their controls. There were no differences in performance between the high hyperactivity group and controls: *M*s = 15.60, 16.67; *SD*s = 3.58, 1.99, $t(28) = 1.00$, $p > .20$, nor between the poor attention group and controls: *M*s = 14.44, 15.81; *SD*s = 3.52, 2.97, $t(30) = 1.19$, $p > .20$. The group with poor attention and high hyperactivity differed significantly from their controls: *M*s = 15.44, 17.31; *SD*s = 2.56, 1.66, $t(30) = 2.46$, $p < .025$, $d = .87$. A one-way ANOVA with the experimental groups revealed no significant group differences, $F(2,44) < 1.0$.

Summary and discussion

All groups with poor attention and/or high hyperactivity were poor at using context to select appropriate meanings for ambiguous forms of language. The effect size for the comparison between each experimental group and their controls indicates a sizeable difference. Furthermore, the experimental groups did not differ from each other, suggesting comparable levels of impairments. The analysis of first and second responses was used as an indicator of knowledge: did children know both the literal and figurative interpretation of the expression? In this analysis, children with high levels of inattention obtained lower scores than did their controls. Children with elevated levels of hyperactivity alone were not similarly impaired, indicating that their difficulties on the task were not simply attributable to knowledge deficits.

The out of context task assessed knowledge directly: there was no supportive context from which to infer the figurative meaning of the expression. The total scores indicated that the experimental groups knew both meanings of most items, although the group with both poor attention and elevated hyperactivity differed from their controls on this measure. This finding indicates that difficulties with the in context task may be primarily due to difficulties in the interpretation of language in context, rather than knowledge. In both tasks, the

experimental groups demonstrated a reasonable level of knowledge for both meanings of the words and phrases, even when they differed significantly from their control group. However, when presented with ambiguous expressions in contexts that supported a figurative interpretation, the experimental groups were less likely than controls, to select the figurative interpretation as their first response.

Study Two: Parental reports of communication skill

Study Two focuses on a different aspect of pragmatics: the pragmatic aspects of communication. To examine this ability, we used the second edition of *the Children's Communication Checklist* (CCC: Bishop, 1998; CCC-2: Bishop, 2003), which was designed to measure pragmatic and structural aspects of a child's communication by parents and professionals who have regular contact with the child. In the original CCC, five subscales were designed to assess the following pragmatic aspects of communication: coherence, use of stereotyped language and use of context, instances of inappropriate initiation, and conversational rapport. A pragmatic composite derived from these scores reliably discriminates children with specific language impairment from children with pragmatic language impairment (Bishop, 1998; Botting, 2004). Thus, the CCC is considered a reliable indicator of pragmatic language difficulties. Children with ADHD show deficits on the pragmatic language subscales of the CCC (Bishop & Baird, 2001; Geurts et al., 2004). It is not known whether the subtypes are equally at risk of communicative deficits.

The CCC-2 is the latest version of this widely used assessment of communication skills. It provides standardised scores for two composite scores: A General Communication composite, which indicates children who have a significant communication problem and a Social Interaction Deviance composite, which indicates children who have a communication profile characteristic of children with autistic spectrum disorder (Bishop, 2003). The

Pragmatic composite, included in the CCC, is no longer available, although the five subscales relating to pragmatic language skills are retained. We calculated the pragmatic composite to determine whether pragmatic language deficits were associated with poor attention and high hyperactivity in general, or specific to a particular behavioural profile (compare with Bishop & Baird, 2001; Geurts et al., 2004).

The parents of the children who participated in Study One and an additional cohort of children, selected in the same way, were sent the CCC-2 to complete. The aims were to extend previous work with the CCC (Bishop & Baird, 2001, Geurts et al., 2004) to investigate: i) whether or not children with poor attention and/or high hyperactivity (who do not have a formal diagnosis of ADHD) show signs of pragmatic language difficulties; ii) whether or not children with predominantly poor attention and predominantly high levels of hyperactivity are similarly at risk of pragmatic language impairments.

Method

Participants

We obtained completed questionnaires for 16 children with high hyperactivity and 18 of their controls, for 16 children with poor attention and 19 of their controls, and for 14 children with poor attention/high hyperactivity and 17 of their controls. The return rate of questionnaires from the children who participated in Study One was 46% and the return rate for the additional cohort of children was 56%. Each experimental group was matched with their appropriate control group on the following: chronological age, sex, and vocabulary. Two of the experimental groups (poor attention, and high hyperactivity) differed from their controls in the scores obtained on the *MAT-EF* (an unavoidable consequence of the sample of returns). One-way ANOVAs demonstrated that the three experimental groups did not differ significantly in age, *MAT-EF* or vocabulary scores: no F (2,43) exceeded 1.75 and all p

values were greater than .19. The characteristics of each experimental group and their controls are reported in Table 3.

Results

We calculated the General Communication (GCC) and the Social Interaction Deviance (SIDC) composites as directed in the CCC-2. A Pragmatic composite based on the original CCC was also calculated. These scores are reported in Table 4.

The high hyperactivity group did not differ from their controls on any of the composite scores: no *t* exceeded 1.0, and the three experimental groups did not differ from each other on any of the composite scores, all Fs(2,43) < 1.03, all ps > .37. The poor attention group obtained significantly lower scores than their controls on the GCC, $t(33) = 2.44$, $p = .02$, $d = .81$. The mean percentile equivalents were 24 and 50, respectively. The poor attention and high hyperactivity group obtained lower scores than their controls, but the difference was not significant, $t(29) = 1.86$, $p = .078$, $d = .68$. The mean percentile equivalents were 32 and 58, respectively. Neither of these groups differed from their controls on the SIDC, both ts < 1.0, however, both groups with poor attention differed from their respective controls on the Pragmatic composite: poor attention group vs controls, $t(33) = 2.44$, $p < .025$, $d = .81$; poor attention/high hyperactivity group vs controls, $t(29) = 2.37$, $p < .03$, $d = .84$. Neither vocabulary scores nor nonverbal reasoning scores (*MAT-EF)* were correlated with any of the composite scores, no *r* exceeded .19 and thus none were significant (N = 100).

Summary and discussion

Children with poor attention showed evidence of weak communication skills compared to their controls; children with high hyperactivity but good attention did not show signs of communicative impairments. Children with both poor attention and high levels of

hyperactivity did not have wider-ranging difficulties with social interaction: No differences were found on the SIDC. Of note, there was considerable variability within both groups with poor attention (indexed by the standard deviations) suggested that communication difficulties experienced by these children were not uniform.

General Discussion

The important finding from this research was that the primary behavioural deficits of ADHD, poor attention and elevated hyperactivity, were associated with impairments in pragmatic aspects of communication and language comprehension. Children with poor attention obtained lower scores than matched controls on a formal test of language interpretation in context and a parental assessment of communicative skills. Children with elevated hyperactivity were impaired on the assessment of language interpretation in context but their communication skills were not rated as impaired. This study should be considered exploratory: we did not include a full range of pragmatic language assessments and we did not assess children with a diagnosis of ADHD. However, this work has important implications for theoretical models that posit relations between pragmatic language skills, inattention, hyperactivity, and it indicates directions for future research with children who have ADHD. We discuss theoretical models, how they relate to our current findings, and directions for future work, below.

Theoretical models of the relations between inattention, hyperactivity and pragmatic language skills have come from the ADHD literature. These models propose that children with ADHD may experience pragmatic language difficulties for, at least, two reasons. ADHD may result from poor behavioural inhibition, which affects executive control and leads to problems with attention, impulsivity, and hyperactivity (Barkley, 1997). Pragmatic language use taps into executive skills such as planning, organising and/or monitoring behaviours.

Thus, pragmatic language deficits might arise from the cognitive deficits that cause the behavioural symptoms of ADHD (e.g. Purvis & Tannock, 1997). This theory might explain the difficulties with figurative language in context experienced by all groups in this work. An inability to monitor and evaluate the appropriate context could lead to the literal interpretation of a figurative expression.

An alternative, though not mutually exclusive, hypothesis is that the behavioural characteristics of the different subtypes of ADHD influence the quality and frequency of their interactions with caregivers, which adversely affects their pragmatic language development (e.g. Camarata & Gibson, 1999). For example, poor attention may lead children to miss important environmental and conversational cues, which limits their ability to learn the range of meanings conveyed by different words and phrases. There was little evidence for deficits in knowledge of multiple meanings of words and phrases in the current work. However, the children in this study did not have a diagnosis of ADHD, thus we might infer that any impairment in attention or hyperactivity was less severe than that found in clinical populations and therefore might have less serious consequences for language learning. We found no evidence for a greater impairment in any group: that may not necessarily be the case for diagnosed children where predominantly inattentive or hyperactive children might suffer more. Further work is needed to disentangle the relative contributions of attention and hyperactivity to language learning and language comprehension in both nondiagnosed and clinical populations.

There was some evidence that children with poor attention had poorer communication skills than the children with only high hyperactivity. The effect sizes indicated moderately sized differences from controls but the three experimental groups did not obtained statistically different ratings from each other on the CCC-2. Our measure of communicative

skill was questionnaire based and, although it was completed by parents who presumably reflected on their own interactions with their child, analysis of naturalistic interactions with adults is also desirable as well as replication of these findings. Analysis of the behavioural characteristics of ADHD, suggests that both subtypes should show evidence of conversational weaknesses. Again, difficulties that were not apparent in our high hyperactive group might be apparent in a diagnosed sample.

Children with high levels of inattention may be at risk of a greater range of pragmatic language impairments than children who are predominantly hyperactive, but we did not find an association between elevated hyperactivity and communicative weaknesses. In relation to children with ADHD, these findings suggest that all subtypes may be weak at interpreting figurative language in context and that the inattention and combined subtypes may be at risk of communicative impairments in addition. Our tight group matching means that such weaknesses may be apparent over and above any other deficits in verbal ability. We studied an age range (8-11 years) in which substantial development in figurative language comprehension is found (Gibbs, 1991; Nippold & Taylor, 1995). This may have lead to the large standard deviations apparent on some measures. Future work might compare the time course of the development of different forms of figurative language comprehension and pragmatic language in ADHD subtypes to establish which aspects are to delayed and which are deviant in children with poor attention and/poor high hyperactivity.

Cohen et al. (1998) suggest that the language difficulties experienced by children with ADHD may lead to their social difficulties. Therefore, a greater understanding of this population's language deficits and why they arise has important implications and needs to be addressed. We have begun to address this issue in the reported work. In contrast to work with diagnosed populations (see Milich, Balentine & Lynham, 2001) we found no evidence for

impaired social skills in our sample. However, our test instrument (the CCC-2) was developed to look at the difficulties with language and social interaction experienced by children with autism spectrum disorders; assessments of more general social skills may reveal difficulties where we found none. In addition, it must be remembered that the children in this study were not diagnosed with ADHD, thus their difficulties may not have been as pronounced as those who had been clinically assessed.

In summary, we have shown that poor attention and high hyperactivity are differently associated with pragmatic language skills: high levels of hyperactivity and poor attention are associated with impairments in the comprehension of figurative language in context; poor attention is additionally associated with impairments in pragmatic aspects of communication. These findings are consistent with the idea of a continuum of attentional and activity problems. They indicate clear directions for future work. First, we need to consider how individual differences in attention and/or hyperactivity affect the language and learning of nondiagnosed children. Our methodology enables the investigation of the symptoms of ADHD in relation to cognitive skills of theoretical interest without the confounding factors of the accompanying deficits found in many clinically diagnosed individuals. Second, future work should determine whether clinically diagnosed subtypes can be differentiated on the basis of their pragmatic language skills: our work suggests that this might be the case. If so, different types of intervention will be required for the subtypes of ADHD.

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