

# Structural and Pragmatic Language in ADHD – Factors Contributing to Development of Pragmatic Competence

Chrysoula Vassiliou<sup>1</sup>, Angeliki Mouzaki<sup>2</sup>, Faye Antoniou<sup>3</sup>, Asimina Ralli<sup>3</sup>, Vasiliki Diamanti<sup>4</sup>, Sophia Papaioannou<sup>5</sup> & Napoleon Katsos<sup>1</sup>

<sup>1</sup>University of Cambridge, <sup>2</sup>University of Crete, <sup>3</sup>National and Kapodistrian University of Athens, <sup>4</sup>University of Oslo, <sup>5</sup>University of Thessaly  
cv335@cantab.ac.uk, amouzaki@edc.uoc.gr, fayeantoniou@ppp.uoa.gr,  
asralli@psych.uoa.gr, vasiliki.diamanti@isp.uio.no, papaioannousophia@gmail.com,  
nk248@cam.ac.uk

## Περίληψη

Μελετήσαμε τα γλωσσικά προφίλ παιδιών με Διαταραχή Ελλειμματικής Προσοχής/Υπερκινητικότητα (ΔΕΠ-Υ), ηλικίας 4.50-8.15 ετών ( $M = 6.58$ ), προκειμένου να ελέγξουμε τις δομικές και πραγματολογικές τους ικανότητες. Τα συγκρίναμε με παιδιά τυπικής ανάπτυξης (ΤΑ) και παιδιά με Αναπτυξιακή Γλωσσική Διαταραχή (ΑΓΔ). Επιπλέον, εξετάσαμε ορισμένους παράγοντες που πιθανώς επηρεάζουν την πραγματολογική επίδοση. Στις λεξιλογικές και δομικές πτυχές, τα παιδιά με ΔΕΠ-Υ είχαν σαφώς χειρότερη επίδοση από τα παιδιά ΤΑ, αλλά καλύτερη από τα παιδιά με ΑΓΔ. Στις πραγματολογικές δοκιμασίες, είχαν τη χειρότερη επίδοση από όλες τις ομάδες, αλλά οι διαφορές δεν ήταν στατιστικώς σημαντικές. Ο μόνος παράγοντας από όσους μελετήθηκαν που φάνηκε να επηρεάζει την πραγματολογική επίδοση ήταν η επίδοση στις δομικές και λεξιλογικές δοκιμασίες. Τα παιδιά με ΔΕΠ-Υ αντιμετωπίζουν σημαντικές δυσκολίες σε δομικές και λεξιλογικές πτυχές της γλώσσας. Αυτό σε συνδυασμό με το γεγονός ότι η επίδοση σε αυτούς τους τομείς αποτελεί προβλεπτικό παράγοντα της πραγματολογικής επάρκειας υπογραμμίζουν την ανάγκη γλωσσικής υποστήριξης σε παιδιά με ΔΕΠ-Υ.

Λέξεις-κλειδιά: ΔΕΠ-Υ, δομική (μορφοσύνταξη, λεξιλόγιο) γλώσσα, πραγματολογία

## 1 Introduction

Structural language skills are related to ability in vocabulary, morphosyntax, and phonology and are necessary for comprehension and production of proper sentences (Reetzke, Zou, Sheng & Katsos, 2015). Pragmatic language skills concern the use of language in different conversational contexts (Andrés-Roqueta & Katsos, 2017). Among them are topic management, non-literal language, narratives, request comprehension/production, providing adequate information, polite register, etc. (Matthews, Biney, & Abbott-Smith, 2018).

Both structural and pragmatic language are vital for academic achievement, employment and emotional development. Children with developmental disorders often also face language difficulties and these impede their communication and lead to problems in the aforementioned areas (Catts, Adlof, Hogan & Weismer, 2005; St Clair, Pickles, Durkin & Conti-Ramsden, 2011).

Children with Attention Deficit/ Hyperactivity Disorder (ADHD) primarily exhibit inattentive and/or hyperactive-impulsive behavior (5th Ed.; *DSM-5*; American

Psychiatric Association, 2013). For children with ADHD, language difficulties have been deemed secondary in research, assessment and intervention, and there are ambiguous results regarding their language skills.

The reason for lack of extensive research in this area is that the focus has been placed on the behavioral problems children with ADHD face. Hence, systematic and reliable language assessment is rarely completed. When language skills are assessed, evaluation mostly relies on parent and teacher reports and can thus be overshadowed by the more prominent behavioral problems children with ADHD face (Westby & Watson, 2010). In addition, the scales used to evaluate ADHD contain items which are indicative of language problems, but are not categorized as such. Behaviors related to these items are misattributed as symptoms of ADHD. This raises further difficulties in evaluating rates of comorbidity between ADHD and language impairment (LI) (Mueller & Tomblin, 2012). Furthermore, pragmatics are generally found more challenging and shortfalls in this domain are considered to be dispersed among the ADHD population (Cohen et al., 2000; Geurts & Embrechts, 2008; Helland, Biringier, Helland & Heimann, 2012; Helland, Helland & Heimann, 2014).

Nevertheless, factors contributing to development of pragmatic competence are also scarcely studied, especially in atypically developing children.

There is theoretical justification and some empirical evidence linking ADHD with structural and pragmatic language problems. Attention limitations and hyperactivity traits may have a negative impact on a child's early transactions, hindering language acquisition (Camarata & Gibson, 1999; Väisänen, Loukusa, Moilanen & Yliherva 2014) and there are studies noting difficulties in semantics and syntax (Jonsdottir, Bouma, Sergeant & Scherder, 2005). Furthermore, clinical levels of inattention, like being easily distracted and unable to understand instructions, makes it difficult to converse efficiently. Hyperactive traits, like excessive talking and interrupting, affect topic management and can disrupt conversation cohesion. Impulsive behaviors, like giving answers before a question is finished, reveal inability in turn-taking. Clearly, ADHD symptoms can impede development of pragmatic competence (Camarata & Gibson 1999).

On the other hand, there is a group of children who are primarily challenged with language. Developmental Language Disorder (DLD) is the term proposed to describe the unexplained language difficulties these children face. Language problems impede their everyday communication and are unlikely to be resolved by 5 years of age (Bishop et al., 2017). DLD incorporates Specific Language Impairment (SLI), which was previously used for language difficulties faced in the absence of other symptoms.

## **2 Research Aims**

The aims of this study were therefore to thoroughly and directly assess structural and pragmatic language of children with ADHD –using objective measures, rather than relying simply on teacher or parent reports– in order to ascertain relative strengths or weaknesses. In addition, we aimed to detect factors contributing to development of pragmatic competence.

To achieve the afore-mentioned goals, we compared children with ADHD with TD and DLD peers in structural and pragmatic language tasks. By including a group know to

primarily face weaknesses in language, we included two baselines for comparison. We also looked at the effect of certain factors (age, disorder, structural language level) on our sample's pragmatic performance.

Our research questions can be summarized as follows:

1. Do ADHD children differ from age-matched TD and DLD peers in their performance in structural and pragmatic aspects of language? <sup>[1]</sup><sub>[SEP]</sub>
2. Is structural language an important predictor of the performance in pragmatic language? Can other factors, such as features of the disorder or age, explain differences in pragmatic skill? <sup>[1]</sup><sub>[SEP]</sub>

### 3 Methodology

Participants were selected from schools across Greece and were native speakers of Greek. Children in all three groups had a Non-Verbal IQ > 85 (Raven-CPM, Sideridis et al., 2013).

For our first research question, we used the following groups:

- ADHD group (N = 29, 18 boys) 4.50 to 8.15 years (M = 6.58).  
Inclusion based on diagnosis and ADHD rating scales (Kalantzi-Azizi, Aggeli & Efstathiou, 2012).

- Age-matched DLD group (N = 25, 17 boys).  
Inclusion based on score on Expressive Vocabulary Test (Vogindroukas, Protopapas, & Sideridis, 2009) (below 10<sup>th</sup> percentile). Children in this group did not match criteria for another disorder group (ADHD or ASD).

- Age-matched TD group (N = 29, 18 boys).  
Language tasks administered individually through an Android application (Logometro) (Mouzaki, Antoniou, Ralli, Diamanti & Papaioannou 2017).

Two scores were formed: a Structural Language (SL) composite, including measures of Receptive and Expressive Vocabulary and Morphosyntax and a Pragmatic Language (PL) composite, including measures on Informativity, Politeness and Request Formation. Those were combined into a General Language (GL) Score.

More specifically, regarding the Structural Language tasks, the Receptive Vocabulary task, children had to listen to a word and select the image it corresponded to, out of four options. The Expressive Vocabulary tasks included word definition and naming. The Receptive Morphosyntax tasks involved identifying inflectional suffixes in pseudo-nouns and pseudo-verbs. The Expressive Morphosyntax tasks involved producing inflectional suffixes in pseudo-nouns and pseudo-verbs and producing derivational suffixes in nouns and adjectives. As for the Pragmatics tasks, the Logometro battery included extensive evaluation of social and linguistic pragmatic skills through scenarios depicted in images. However, in this study we solely focused on linguistic pragmatic skills. These were: Politeness, in terms of linguistic indexes used, i.e. overt markers like "please", "thank you", "sorry", Request formation and Informativity, i.e. providing necessary information to an interlocutor.

For the second research question, we additionally included two TD groups language-matched to the ADHD and DLD groups:

- TD language-matched to ADHD (TD-LM-ADHD) (N=29, 18 boys. Mean Age = 5.75. Mean SL score = 66.2306 ( $t = .12$ ,  $p = .99$ ))
- TD language-matched to DLD (TD-LM-DLD) (N=25, 18 boys. Mean Age = 5.55. Mean SL score = 55.24 ( $t = .016$ ,  $p = .99$ )).

We performed a Multiple regression analysis with PL as the dependent variable and Group, Age and Structural Language level as predictors.

#### 4 Results

Regarding General Language (GL) Scores, we performed a Two-Way Mixed ANOVA and a significant interaction between language skill and group on overall language scores was revealed ( $F(2, 80) = 12.737$ ,  $p = .000$ ,  $\eta^2 = .242$ ). Planned pairwise comparisons showed that TD children significantly outperformed children with ADHD ( $p = .010$ ), and children with DLD group ( $p < .001$ ). There was no statistically significant difference between the ADHD and DLD groups in GL scores ( $p = .166$ ).

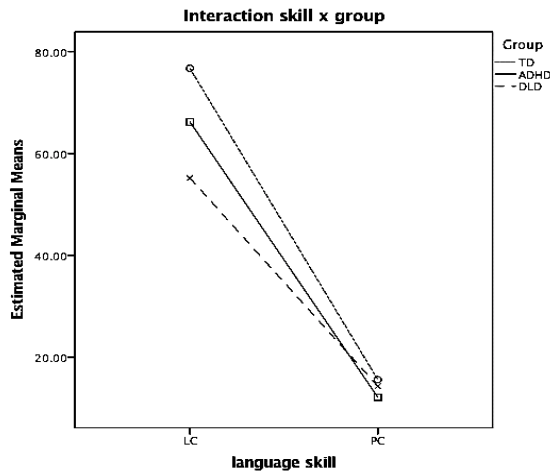


Figure 1: Interaction of language skill and group (ADHD vs. DLD vs. TD)

	TD (n=29)	DLD (n=25)	ADHD (n=29)	<i>p-value</i>		
				<i>TD vs. DLD</i>	<i>TD vs. ADHD</i>	<i>ADHD vs. DLD</i>
Age (years)*	6.60 (0.50)	6.61 (0.58)	6.58 (0.59)	0.36	0.99	0.40
Gender (% girls)	34.5	32.0	32.0			
Structural Language	76.70 (12.10)	55.16 (17.53)	66.19 (13.28)	<0.001	0.018	0.016
Pragmatics	15.55 (8.33)	14.28 (8.94)	12.08 (6.18)	0.592	0.077	0.292
General Language	46.13 (8.29)	34.72 (10.07)	39.13 (8.23)	<0.001	0.010	0.166

**Table 1: Age-matched pairwise comparisons (ADHD vs. DLD vs. TD)**

For Structural Language measures, we performed an omnibus ANOVA and a main effect of group on SL ( $F(2,80) = 15.21, p < .001$ ) was found. Planned pairwise comparisons revealed that TD children significantly differed from children with ADHD ( $p = 0.18$ ) and children with DLD ( $p = 0.16$ ). For Pragmatic Language, the omnibus ANOVA did not reach significance ( $p > .2$ ). The pairwise comparisons revealed that the order of performance was TD children first, followed by DLD children and then children with ADHD, but differences did not reach significance. Only the difference between TD and ADHD children approached significance ( $p = .077$ ).

Regarding our second research question on the factors contributing to the development of pragmatic competence, our model including the whole sample ( $N = 162$ ) was found significant ( $R^2 = .070, F(4,157) = 2.97, p = 0.021$ ), but the only factor found to significantly contribute to performance in the pragmatic indices we measured was Structural Language skill ( $B = .115, SE = .042, p = .007$ ).

	B	SE	$\beta$	p
age	.236	.938	.022	.802
Structural Language	.115	.042	.241	.007
Group (DLD vs. other)	1.298	2.020	.056	.521
Group (ADHD vs. other)	-2.164	1.778	-.100	.225
Constant	5.076	5.282		.338

**Table 2: Regression Model predicting pragmatic performance.**

## 5 Discussion

Our study shows that children with ADHD face substantial difficulties with structural language. These have not been sufficiently studied or addressed in existing literature, which focuses more on behavioral issues these children may face. By including both TD and DLD control groups in our analysis, we were able to *quantitatively* evaluate ADHD children's difficulties and detect strengths and weaknesses. Our findings demonstrate that

while both DLD and ADHD groups face difficulties in structural language compared to TD peers, these difficulties are not quantitatively the same, since the DLD group achieved significantly lower scores in structural language aspects. However, more research needs to be conducted in order to assess whether difficulties are *qualitatively* similar as well and to establish whether a language impairment is inherent to ADHD.

Regarding the pragmatic skills of the children under study, we identified subtle differences in performance among groups. The control groups, TD and DLD, had comparable performances. Children with ADHD were nearly significantly impaired compared to the TD group, while the DLD group, despite greatly impoverished structural language skills, performed better than the ADHD group. Nevertheless, our findings do not suggest that pragmatic language was the main area of weakness in children with ADHD as other studies indicate (Helland et al., 2014; Staikova et al., 2013). Experimental setting should be taken into consideration while interpreting the finding. Differences may have been more obvious, if the children were tested in more natural circumstances. Additionally, we focused on linguistic pragmatics. The Pragmatic Composite we used to estimate pragmatic competence was restricted to specific items (Politeness, Request formation and Informativity), selected from a broader pragmatic task, resulting to relatively subtle differences between groups. Hence, difficulties in pragmatics, at least in these linguistic indices, were evident but not substantial.

Consequently, we found that challenges faced by children with ADHD in pragmatics are only secondary compared to their difficulties in structural language. Our findings diverge from previous reports which underestimate weaknesses in the latter area (Geurts & Embrechts, 2008). This observation is important and has critical consequences for intervention planning. Assessing the language problems of ADHD children may additionally be beneficial in the behavioral and academic domains (Gremillion & Martel, 2012; Staikova et al., 2013).

What was further shown in our study is that, in our sample of 162 children of either TD or with ADHD or DLD, Structural Language skills are an important predictor of pragmatic performance of typically and atypically developing children. Our findings confirm the overall image emerging from the literature, i.e. that structural and pragmatic language skills are moderately to highly correlated (Matthews et al., 2018; Bernard & Deleau, 2007). Since the pragmatic scores we composed were based on children's performances in Request, Informativity and Politeness, our results indicate that this general notion can be extended to these particular areas.

## 6 Conclusions

The conclusion that can be drawn from our study is that even though children with DLD are indeed the most challenged in structural language, children with ADHD face substantial difficulties that should not be disregarded. Our findings highlight the need for support with structural language for children with ADHD and the importance of further identifying *qualitative* differences between ADHD and DLD. This will allow for more effective intervention design and implementation in the future. Furthermore, even though literature on language skills of children with ADHD is limited, it has shown that they are mainly challenged in pragmatics. Our results demonstrate that pragmatic skills are not the

primary area of weakness, at least not the pragmatic aspects we focused on. More emphasis needs to be placed on structural language skills.

This is further corroborated by the second finding of this study that is that structural language level is an important contributor to pragmatic performance. Hence, by targeting structural language skills, pragmatic competence will also be enhanced.

## References

- American Psychiatric Association. 2013. *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.
- Andrés-Roqueta, Clara, and Katsos, Napoleon. 2017. The contribution of grammar, vocabulary and theory of mind in pragmatic language competence in children with Autistic Spectrum Disorders. *Frontiers in Psychology*, 8, 996.
- Bernard, Stéphane, and Deleau, Michel. 2007. Conversational perspective-taking and false belief attribution: A longitudinal study. *British Journal of Developmental Psychology*, 25(3), 443-460.
- Bishop, Dorothy V. M., Snowling, Margaret J., Thompson, Paul A., Greenhalgh, Trisha, Catalise-2 Consortium, Adams, Catherine, ... and Boyle, Christopher. 2017. Phase 2 of CATALISE: A multinational and multidisciplinary Delphi consensus study of problems with language development: Terminology. *Journal of Child Psychology and Psychiatry*, 58(10), 1068-1080.
- Camarata, Stephen M., and Gibson, Terrie. 1999. Pragmatic language deficits in attention-deficit hyperactivity disorder (ADHD). *Mental Retardation and Developmental Disabilities Research Reviews*, 5, 207-214.
- Cohen, Nancy J., Vallance, Denise D., Barwick, Melanie, Im, Nancie, Menna, Rosanne, Horodezky, Naomi B., and Isaacson, Lila. 2000. The interface between ADHD and language impairment: An examination of language, achievement, and cognitive processing. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 41(3), 353-362.
- Geurts, Hilde M., Embrechts, Mariëtte. 2008. Language profiles in ASD, SLI, and ADHD. *Journal of Autism and Developmental Disorders*, 38, 1931-1943.
- Gremillion, Monica L., & Martel, Michelle M. 2012. Semantic language as a mechanism explaining the association between ADHD symptoms and reading and mathematics underachievement. *Journal of abnormal child psychology*, 40(8), 1339-1349.
- Helland, Wenche Andersen, Biringer, Eva, Helland, Turid, and Heimann, Mikael. 2012. Exploring language profiles for children with ADHD and children with Asperger syndrome. *Journal of Attention Disorders*, 16(1), 34-43.
- Helland, Wenche Andersen, Helland, Turid, and Heimann, Mikael. 2014. Language profiles and mental health problems in children with specific language impairment and children with ADHD. *Journal of attention disorders*, 18(3), 226-235.
- Jonsdottir, Solveig, Bouma, Anke, Sergeant, Joseph A., and Scherder, Erik J. 2005. The impact of specific language impairment on working memory in children with ADHD combined subtype. *Archives of Clinical Neuropsychology*, 20(4), 443-456.

- Kalantzi-Azizi, Anastasia, Aggeli Katerina, and Efstathiou, Giorgos. 2012. Η ελληνική κλίμακα αξιολόγησης της ΔΕΠ/Υ-IV. [The Greek scale for ADHD-IV evaluation]. Athens: Pedio.
- Matthews, Danielle, Biney, Hannah, and Abbot-Smith, Kirsten 2018. Individual differences in children's pragmatic ability: A review of associations with formal language, social cognition, and executive functions. *Language Learning and Development*, 1-38.
- Mouzaki, Angeliki, Antoniou, Faye, Ralli, Asimina, Diamanti, Vasiliki, and Papaioannou, Sophia. 2017. *Λογόμετρο [Logometro]*. Athens: Intellearn.
- Mueller, Kathryn L., and Tomblin, J. Bruce. 2012. Examining the comorbidity of language disorders and ADHD. *Topics in Language Disorders*, 32(3), 228-246.
- Reetzke, Rachel, Zou, Xiaobing, Sheng, Li, and Katsos, Napoleon. 2015. Communicative Development in Bilingually Exposed Chinese Children With Autism Spectrum Disorders. *Journal of Speech, Language and Hearing Research*, 58(3), 813-825.
- Sideridis, Georgios, Antoniou, Faye, Simos, Panagiotis, and Mouzaki, Angeliki. 2013. *Raven Colored Progressive Matrices (RAVEN)*. Athens: Topos Editions.
- St Clair, Michelle C., Pickles, Andrew, Durkin, Kevin, and Conti-Ramsden, Gina. 2011. A longitudinal study of behavioral, emotional and social difficulties in individuals with a history of specific language impairment (SLI). *Journal of communication disorders*, 44(2), 186-199.
- Staikova, Ekaterina, Gomes, Hilary, Tartter, Vivien, McCabe, Allyssa, and Halperin, Jeffrey M. 2013. Pragmatic deficits and social impairment in children with ADHD. *Journal of Child Psychology and Psychiatry*, 54(12), 1275-1283.
- Väisänen, Raija, Loukusa, Soile, Moilanen, Irma, and Yliherva, Anneli. 2014. Language and pragmatic profile in children with ADHD measured by Children's Communication Checklist 2nd edition. *Logopedics Phoniatrics Vocology*, 39(4), 179-187.
- Vogindroukas, Ioannis, Protopapas, George, and Sideridis, Georgios. 2009. Δοκιμασία Εκφραστικού Λεξιλογίου. [Expressive Vocabulary Test]. Chania: Glafki.
- Westby Carol E., and Watson Silvana Maria Russo 2010. ADHD and communication disorders. In Damico Jack S., Muller Nicole, Ball Martin J. (Eds.), *The handbook of language and speech disorders*, 529-555. Oxford, England: Wiley-Blackwell.