EXPRESSIVE VOCABULARY IN CHILDREN WITH ASPERGER SYNDROME: INSIGHTS INTO THE ORGANIZATION OF THE MENTAL LEXICON IN AUTISM SPECTRUM DISORDER FROM ITEM ANALYSES

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ABSTRACT

The current study explores the expressive vocabulary skills of twenty 5-to-13-year-old monolingual children with Autism Spectrum Disorder (ASD), as well as 20 age- and IQ-matched monolingual children of typical development (TD). All children were administered a standardized expressive vocabulary test that includes pictures depicting commonplace, high-frequency items. The naming errors that both groups committed were classified into six different categories, namely, phonological, semantic, visual errors, circumlocutions, irrelevant, and 'no response' errors. The results revealed that TD children outperformed children with ASD, suggesting and expressive vocabulary deficit in the group with ASD. Crucially, children with ASD tended to produce significantly higher proportions of semantic and visual errors, as well as circumlocutions. Findings are interpreted in light of cognitive control deficits or/and atypical organization of ASD children's mental lexicon.

Keywords: Autism, expressive vocabulary, weak central coherence, shape bias.

INTRODUCTION

Autism Spectrum Disorder (ASD) is a complex pervasive neurodevelopmental disorder, demonstrating large heterogeneity in terms of symptomatology and traits. With respect to the degree of severity, ASD can be described in terms of impairments in social interaction, verbal and non-verbal communication, and restricted and repetitive behaviours (Sicile-Kira, 2014). Cognitive and social skills also present great variability in individuals with ASD (Kasari and Patterson, 2012). The spectrum roughly ranges from high-functioning autism to low-functioning autism associated with cognitive impairment and learning difficulty (Attwood, 2006). It is evident that individuals within the spectrum present variability in the level of intelligence, fluctuating from deep mental retardation to intelligence scores which are higher than normal standards. In addition, comorbidity between ASD and other medical syndromes is possible, therefore, the variability in intelligence and in the severity of symptoms are dominant factors responsible for the wide variety of the spectrum's clinical manifestation. The present chapter will provide an overview of the core phenotypic characteristics of ASD in a language domain that is largely underexplored, namely, expressive vocabulary in children with a diagnosis of Asperger's syndrome.

Despite the fact that the diagnostic term 'Asperger's syndrome' as an individual disorder does not qualify according to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), which unified the symptomatology under one disorder classified as "spectrum", the term is still used in the International Statistical

Classification of Diseases and Related Health Problems (ICD-10 and ICD-11) of the World Health Organization (WHO) as one of the subtypes of ASD. Up to recently, the term Asperger Syndrome was considered to be at the milder end of the autistic spectrum, with classic autism being at the opposite end. The two major differences that distinguish it from classic autism are that individuals with Asperger Syndrome present very good levels of cognitive function and appear to have almost no impairments in language development. Use of language within context, however, is qualitatively different from that of typically-developing (TD) individuals mainly due to Asperger individuals; major difficulty with discourse fluidity (reciprocal conversation) and social pragmatics (McPartland & Klin, 2006).

LITERATURE REVIEW

Dominant problems in children with Asperger syndrome are emotional and social interaction, stereotypical and repetitive behaviours and interests, obsession with specific objects, monotonous verbocity and physical clumsiness, as well as general delay in language (Baskin, Sperber & Price, 2006). Children who have been diagnosed with the syndrome are observed to have IQ levels ranging from normal to higher than average scores. Therefore, it has been suggested that Asperger Syndrome is of the same kind as high-functioning autism. The latter is defined as a form of autism in children with no mental retardation and IQ scores above 70. Since high-functioning autism does not constitute a separate type of autism, scientists have not yet concluded whether or not it fully identifies with Asperger Syndrome (Howlin, 2003).

In concert with social difficulties, language development in children with Asperger Syndrome exemplifies differences from TD children. Children within the spectrum use language, but not in a communicative manner. In verbal communication, there is clear difficulty in perceiving and expressing speech (Wing, 2002). Phonological production occurs later than in the case of normally developing children, and even the acquired functional spoken language skills remain underdeveloped in most children (Foudon et al., 2007). In terms of morphosyntax in ASD, there are deficits in the use of personal pronouns, stereotypical expressions as well as absence of functional words (Bishop, 2010). Semantics show more severe deficits, since individuals with ASD show delays in vocabulary development and have difficulties understanding the deeper meanings of words, which affects the metaphoric and functional use of language. Though in typical development, sematic relatedness of children's lexicons predicts learning (Hills et al., 2010), the lure-of-the-associates model does not seem to explain lexical acquisition in ASD. Sematic differences may emerge over developmental time, with young children with ASD showing typical sematic processing (Rescorla, 2013), yet, and others showing semantic weaknesses later in childhood (Ellawadi et al., 2016; Norbury et al., 2010).

Indeed, research suggests that children with autism demonstrate deficits in vocabulary in both the receptive and expressive modalities very early in their development (Weismer, Lord, & Esler, 2010; Luyster & Lord, 2009), yet, the nature of vocabulary deficits involved in this process remains unclear. Difficulties with how words are represented, organized and accessed have been observed in individuals with ASD. Category formation and generalization abilities are also often atypical in ASD, with school age children and adolescents frequently performing inconsistently on categorical induction tasks. For example, they often restrict properties assigned to specific instances of a named category to the taught instance itself rather than extending to new instances of that named category (Kelley et al., 2006). Researchers have suggested that compared

to TD children, children with ASD may acquire partial knowledge of a learned language form and encounter more difficulties generalizing across settings ad modalities (Wynn & Smith, 2003). This study aims to investigate differences in expressive vocabulary between children with ASD and age- and IQ-matched TD children, and identify the most prominent error types in the picture naming performance across the two groups of children as well as highlight properties of entities (e.g. semantic or perceptual/visual) that may be affecting naming abilities in ASD.

METHODOLOGY

Participants

A total of forty 5 to 13 year old Greek-speaking monolingual children participated in this study: 20 typically-developing (TD) children (Mean age: 9;9, *SD*: 1.9), and 20 age- and gender-matched children with High Functioning Autism Spectrum Disorder (Mean age: 9;10, *SD*: 2.3). All children's non-verbal intelligence (or else, performance IQ/PIQ) was above clinical levels of intellectual impairment, as measured through the percentile scores on the Greek version of the Wechsler Intelligence Scale for Children-Revised (WISC-III) (Wechsler, 1992; adapted in Greek by Georgas, Paraskevopoulos, Besevegis, Giannitsas, & Mylonas, 2003). There was no significant difference in PIQ percentiles among the two groups, F (1, 39) = .006, p = .941.

Typically-developing children were recruited from mainstream schools in Greece and they were included in the study if they had normal hearing and no speech, emotional or behavior problems, and no neurological or severe articulation/phonological deficits. Typically-developing children's profile was confirmed by information from health screening protocols, which were implemented prior to data collection as part of the Governmental Public Health Policy in Greek public education, and teachers' and parents' reports. Experimental data were collected following all children's parents' written consent, children's assent and obtainment of approval from the Research Ethics Committee of the Greek Ministry of Education.

Children with ASD were recruited from public diagnostic centers in Greece. In line with DSM-5 criteria (American Psychiatric Association, 2013), the children already had a speech and language therapist's/clinician's diagnosis of ASD in the absence of any hearing loss, autism, obvious neurological dysfunctions or motor deficits. None of the children with ASD had received speech and language therapy before inclusion in the study, while all of them attended inclusive classes in schools in which they received literacy skills support by a special education teacher.

Material

The Test of Production Vocabulary normed for monolinguals in Greek was used to assess children's knowledge of Greek (Vogindroukas, Protopapas and Sideridis 2009; adaptation from Renfrew 1995). The task consists of 50 black-and-white pictures depicting commonplace objects which each child was required to name. Testing was terminated when the child either finished all naming trials or failed to respond correctly in five consecutive trials. Each correct naming was given one point, so that the maximum score was 50.

Procedure

All four groups of children completed the expressive vocabulary test. Regarding scoring, besides target responses, errors were classified into the following categories: phonological, semantic, visual, circumlocutions, irrelevant, and 'no response'. Examples of questions per category and children's answers are provided below:

(1) Phonological error: keramiδia/ 'rooftiles' (target response: kerea/ 'antenna')
(2) Sematic error: violin (target response: guitar)
(3) Visual error: round (target response: dome)
(4) Circumlocution: 'a box with insects inside' (target response: hive)
(5) Irrelevant: child (target response: binoculars)

RESULTS

Table 1 below presents each group's mean raw scores in target responses, error scores as well as the distribution of errors per error category. The reader is reminded that the maximum score in the expressive vocabulary test is 50.

Table 1. Group's mean raw target and erroneous responses in the expressive vocabulary test.

Group	Target	Errors	Phonological errors	Semantic errors	Visual errors	Circumlocutions	Irrelevant responses	No response
ASD (n=20)	36.4 (*6.7*)	12.8 (*5.8*)	1.4 (*1.6*)	4.1 (*3.7*)	3.4 (*2.4*)	2.3 (*2.0*)	0.8 (*1.2*)	1.7 (*2.1*)
Control (n=20)	47.1 (*4.0*)	2.9 (*4.0*)	0.5 (*0.2*)	0.8 (*1.5*)	0.3 (*0.5*)	0.9 (*1.4*)	0.4 (*0.4*)	0.6 (*0.8*)

There was a significant Group effect in target responses, since the control group scored higher than children with High Functioning Autism, F (1, 39) = 37.039, $p < .001$. Regarding errors across categories, there were more instances of errors in ASD children compared to control children across all error categories except irrelevant errors and 'No response' errors (F (1, 39) = 13.383, $p = .001$ for phonological errors; F (1, 39) = 13.054, $p = .001$ for semantic errors; F (1, 39) = 30.356, $p < .001$ for visual errors; F (1, 39) = 6.963, $p = 012$ for circumlocutions; F (1, 39) = 1.882, $p = .178$ for irrelevant errors; and F (1, 39) = 2.872, $p = .063$ for 'No response' errors). Further paired t-tests within each group revealed that the children with ASD committed significantly more semantic errors than phonological (t(19)=3.190, p=.005), irrelevant (t(19)=7.111, p<.001), and no responses (t(19)=2.165, p=.043); visual errors were significantly more than phonological (t(19)=2.826, p=.011), irrelevant (t(19)=7.113, p<.001), and no responses (t(19)=2.091, p=.05); circumlocutions were significantly more than phonological (t(19)=2.131, p=.046), and irrelevant errors (t(19)=2.601, p=.018). There were no significant differences between semantic and visual errors (t(19)=1.702, p=.105), semantic errors and circumlocutions (t(19)=1.747, p=.097), visual errors and circumlocutions (t(19)=1.277, p=.217), circumlocutions and no responses (t(19)=.860, p=.400), and no responses and irrelevant responses (t(19)=1.670, p=.111). For TD children, circumlocutions were significantly more than phonological errors (t(19)=2.430, p=.025) and visual errors (t(19)=2.349, p=.030); also, semantic errors were marginally significantly more than phonological errors (t(19)=2.073, p=.052). No further significant differences were found between error categories for the control group.

DISCUSSION

The current study aimed to investigate expressive vocabulary performance in a group of children with High Functioning ASD, and further explore error patterns in the same group in comparison to a group of age- and IQ-matched TD children. The overall results point to an expressive vocabulary deficit in the children on the spectrum, as well as distinct patterns of errors relative to the TD group, which may suggest a different organization of ASD children's

mental lexicon or/and different processes through which words are retrieved in language production.

More specifically, ASD children's overall accuracy score in the expressive vocabulary test was significantly lower than the TD group, thus, suggesting a vocabulary deficit for the children in the spectrum. Crucially, children in both groups were IQ-matched on a 1:1 basis and general IQ and PIQ scores were within normal range (I> 80), which implies that the expressive vocabulary deficit in the ASD group was not due to a global cognitive deficit. Though autism has been extensively explored with respect to children's language delay in several domains of language, including syntactic comprehension, narrative performance and pragmatic communication (e.g. Bishop, 2010; Peristeri, Andreou, & Tsimpli, 2017; Peristeri et al., 2020), expressive vocabulary has received relatively less attention.

The errors patterns that have emerged in the performance of children with ASD reveal subtle trends in naming that may be linked to the mechanisms underlying ASD children's lexical retrieval abilities. The highest proportions of erroneous responses were observed for the semantic error category, followed by visual errors, circumlocutions and phonological errors. These findings suggest that the regularities proposed to support lexical learning biases in TD children may not be present in the vocabularies of children with ASD. In typical development, vocabulary acquisition has been proposed to result from domain-general associative learning, which, together with statistics in the environment, predicts word learning patterns (McMurray, Horst, & Samuelson, 2012). 'Heavy' use of semantic, phonological and shape biases claimed to underlie the organization of TD children's mental lexicon rapidly declines with age (Perry & Samuelson, 2011). On the other hand, the group of children with ASD that has participated in the present study showed strong vulnerability to interference from non-target words that shared sematic, phonological and visual/perceptual properties with the target words. Such interferences resulted in the production of higher proportions of semantic and phonological paraphasias, as well as visual naming errors and circumlocutions compared to the TD group.

The deficit characterizing ASD children's confrontation naming abilities may be associated with impaired cognitive mechanisms or even an atypical organization of their mental lexicon. On the lexical level, interference is caused by competition for selection between the activated representations, and consequently lexical selection is achieved via competition (Bloem & La Heij, 2003). If autism causes a deficit in the inhibitory mechanisms responsible for suppressing irrelevant-to-task competitors at the lexical selection level, then this would give rise to strong interference effects and high proportions of paraphasias, since the buffer would not have been cleared of the representation of lexical competitors. Though ASD has been linked to executive function deficits, such impairment has been rarely liked to children's confrontation naming abilities. It is thus possible that children with ASD, rather than lacking the conceptual representations of vocabulary, are instead lacking the cognitive control processes by which lexical selection normally takes place. Alternatively, the processes of lexical naming may develop distinctly in children with ASD due to the ways in which regularities and lexical biases are organized and accessed in the mental lexicon.

A surprising finding of the study was the high proportion of visual errors that stemmed from ASD children's over-attention to perceptual characteristics and details of the depicted stimuli. This pattern could be interpreted within the weak central coherence theory and ASD children's impaired contextual integration and enhanced perceptual functioning (Frith & Happé, 1994; Happé & Frith, 2006; Rogers & Ozonoff, 2005). Visual errors may have stemmed from ASD

children's persistent responses to discrete and narrow visual information, that was more locally-oriented.

CONCLUSIONS

Our findings demonstrate an expressive vocabulary deficit in children with High Functioning ASD. Though previous research has highlighted autism-related language deficits at the sentence- and discourse-level as the most disabling features in the disorder, it seems that more decontextualized, low-level language skills, including lexical naming, are also impaired. Error patters revealed ASD children's enhanced vulnerability to phonological, and semantic distractor-word interference, as well as children's difficulty to globally integrate visual characteristics of objects, which resulted in high levels of visual error production during naming performance. Overall this study extends expressive vocabulary skills in ASD to study cognitive processing in the same disorder. It also opens avenues to future research on autistic cognitive control processing and urges clinicians to address expressive vocabulary deficits in autism assessment.

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