

## **Number Word Interpretation is not Impaired in High-functioning Children and Adolescents with Autism Spectrum Disorders: Pragmatics or Semantics?**

The meaning of number words depends on the context: sometimes they mean “exactly X”, sometimes “at least X”, and sometimes “at most X” (Musolino, 2004). Gricean accounts propose that the interpretation of sentences containing number words or other scalar terms (e.g., “some”) involves pragmatic enrichment of more basic meanings by conversational implicatures (Grice, 1975; Horn, 1992). Recently, theorists have developed semantic or grammatical accounts of the meaning of number words (Kennedy, 2013) and other scalar expressions (Chierchia et al, 2012), arguing that scalar interpretation of these words follows from the compositional structure of the sentences in which they occur.

In this paper we examine the performance on a number word interpretation task of 32 individuals with autism spectrum disorder (ASD) (aged 9 to 17 years) and 28 typically-developing (TD) individuals matched for age and both non-verbal and verbal IQ. All participants scored in the normal range for both non-verbal and verbal IQ (>70) as well as on the core language domains of the CELF-4 language assessment. Individuals with ASD characteristically present with pragmatic language impairments even when they have normal-range vocabulary and syntax skills (Tager-Flusberg et al, 2005); and their pragmatic difficulties have been related to their problems in understanding minds (Tager-Flusberg, 2000). The performance of the subjects on the number word interpretation task is compared with their performance on two other tasks involving the interpretation of utterance meanings from the communicative context -- interpreting non-literal ironic meaning, and explaining relevance implicatures. The subjects were given brief picture-supported narrative scenarios and had to judge or explain what a speaker meant by key utterances involving either irony, relevance implicatures, or number words. Many

studies have shown that individuals with ASD are impaired in their understanding of ironic or sarcastic utterances (Tager-Flusberg et al, 2005). De Villiers & de Villiers (2009) reported that children with ASD also experienced considerable difficulty understanding and explaining relevance implicatures. However, both Pijnaker et al (2009) and Chevallier et al (2010) reported that adults with Asperger Syndrome were not impaired in interpreting scalar implicatures with “some” and “or”.

Controlling for differences in language scores on the CELF-4, the group with ASD were significantly worse than the TD group on both the irony task and the relevance implicatures task. However, they showed no impairment on the number word interpretation task (Table 1). Furthermore, level of performance on the irony and the relevance implicatures tasks was significantly correlated with the participants’ skills on a false belief reasoning task (theory of mind). However, there was no correlation between theory of mind and performance on the number word interpretation task (Table 2).

The results are discussed in terms of two possible explanations: 1) scalar interpretations of number words do not involve pragmatic enrichment and are part of the semantic or syntactic knowledge of the children with ASD, so they are not impaired; or 2) number word interpretation involves pragmatic enrichment, but it does not require the computation of shared knowledge or communicative intent as in other conversational implicatures.

**Table 1. Children with ASD vs TD Controls -- Pragmatics Tasks Percent Correct on Each Task and Group Effect in an ANCOVA with CELF-4 Core Language Score as a Covariate.**

	ASD	TD Control	F	df	p
<b>IRONY CELF-4 GROUP</b>	87.2%	98.4%	3.65 6.24	1,57 1,57	.060+ .015*
<b>RELEVANCE CELF-4 GROUP</b>	57.7%	78.6%	11.89 19.11	1,57 1,57	.001** .000***
<b>NUMBER CELF-4 GROUP</b>	88%	93.9%	0.83 2.28	1,57 1,57	.367 .137

**Table 2. Partial Correlations between Theory of Mind and Pragmatics Task Scores Controlling for Age, NVIQ, VIQ and CELF-4 Core Language Score (df = 53)**

	Irony	Relevance	Number
<b>Theory of Mind</b>	.53***	.31*	.07

**Key References:**

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