Reduced sensitivity to context in language comprehension: A characteristic of Autism Spectrum Disorders or of poor structural language ability?

Melanie Eberhardt [a],*, Aparna Nadig [b]

[a] *Department of Special Education and Rehabilitation, University of Cologne, Cologne, Germany*
[b] *School of Communication Sciences and Disorders, McGill University, Montreal, QC, Canada*

ABSTRACT

We present two experiments examining the universality and uniqueness of reduced context sensitivity in language processing in Autism Spectrum Disorders (ASD), as proposed by the Weak Central Coherence account (Happé & Frith, 2006, *Journal of Autism and Developmental Disorders, 36*(1), 25). That is, do all children with ASD exhibit decreased context sensitivity, and is this characteristic specific to ASD versus other neurodevelopmental conditions? Experiment 1, conducted in English, was a comparison of children with ASD with normal language and their typically-developing peers on a picture selection task where interpretation of sentential context was required to identify homonyms. Contrary to the predictions of Weak Central Coherence, the ASD-normal language group exhibited no difficulty on this task. Experiment 2, conducted in German, compared children with ASD with variable language abilities, typically-developing children, and a second control group of children with Language Impairment (LI) on a sentence completion task where a context sentence had to be considered to produce the continuation of an ambiguous sentence fragment. Both ASD-variable language and LI groups exhibited reduced context sensitivity and did not differ from each other. Finally, to directly test which factors contribute to reduced context sensitivity, we conducted a regression analysis for each experiment, entering nonverbal IQ, structural language ability, and autism diagnosis as predictors. For both experiments structural language ability emerged as the only significant predictor. These convergent findings demonstrate that reduced sensitivity to context in language processing is linked to low structural language rather than ASD diagnosis.

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What this paper adds?

An influential view of cognition in ASD, the weak central coherence account (WCC), proposes a cognitive style focused on details. In the domain of language processing WCC predicts a reduced integration of linguistic and contextual information. This is a commonly held assumption in research as well as in clinical work, although findings are mixed and the possible influence of structural language ability on context sensitivity has been raised. The novel contribution of this paper is to directly test whether reduced sensitivity to context in language processing is universal and unique to children with ASD. This

* Corresponding author. Tel.: +492214703399.
   E-mail address: melanie.eberhardt2@uni-koeln.de (M. Eberhardt).

was done in two experiments using different methods of investigating the processing of ambiguous words (homonyms) by relying on sentence context, with distinct samples of participants tested in different languages. The results are remarkably consistent, showing that reduced context sensitivity is neither universal (children with ASD and normal language abilities do not exhibit this, Exp. 1) nor unique (children with Language Impairment do exhibit this characteristic) to children with ASD. Instead, regression models demonstrated that only structural language abilities predicted context sensitivity. These experiments are also novel in controlling for important aspects of stimuli to rule out alternative methods of arriving at context-sensitive responses. Taken together these findings add to growing evidence that reduced context sensitivity in language processing is linked to low structural language abilities across neurodevelopmental disorders, rather than being a universal feature of ASD.

1. Introduction

1.1. Autism, language and cognitive theories

Autism spectrum disorders (ASD) are neurodevelopmental disorders defined by impairments in social communication and interaction as well as restricted and repetitive behavior, interests or activities (APA, 2013). While structural language abilities, including vocabulary and grammar, are highly variable across the spectrum (Kjelgaard & Tager-Flusberg, 2001; Mawhood & Howlin, 2000), individuals with ASD are often reported to show difficulties in aspects of language comprehension (Hudry et al., 2010; Kjellmer et al., 2012; Kwok, Brown, Smyth, & Cardy, 2015), especially in understanding non-literal and ambiguous language (e.g., Happé, 1997).

Research on children with primary language impairment (LI), another neurodevelopmental disorder, shows that comprehension ability is a catalyst for further language growth and broader social development, as well as later academic achievement (e.g., Clegg, Hollis, Mawhood, & Rutter, 2005; Toppelberg & Shapiro, 2000). Thus, understanding the factors underlying language comprehension difficulties in neurodevelopmental disorders is an important objective.

There is a long tradition of searching for universal (shared by individuals across the spectrum), unique (to ASD and not to other disorders), and specific (domain-specific rather than general) cognitive markers of ASD, also called "core deficits" by Sigman and colleagues (e.g., Sigman, Dijamco, Gratier, & Rozga, 2004; see also Rajendran & Mitchell, 2007). The weak central coherence account of ASD (Frith, 1989; Happé & Frith, 2006) was proposed as such a marker and has become a popular explanation of communication challenges seen in this population. Frith (1989) first introduced the term "central coherence" referring to the drive to integrate pieces of information in order to achieve overall meaning in multiple domains (visual, non-speech auditory, and language processing). She applied the concepts of "local" to describe bottom-up processing of discrete information vs. "global" to describe top-down, meaning-based processing of information. *Weak* central coherence (WCC) therefore is an account that proposes a reduction of this drive in ASD.

Weak central coherence is an intuitively compelling explanation for some of the comprehension difficulties observed in ASD, since language comprehension involves the integration of literal language content with nonverbal communication and different types of contextual information. Happé and Frith (2006) proposed that WCC is a default cognitive style in ASD focused on detail or local processing, which can be overcome by providing explicit instructions to attend to context or global features (see also Happé & Booth, 2008). Models of language comprehension more generally also treat how different levels of linguistic and extra-linguistic information are integrated in the course of language processing (e.g., Bishop, 1997; Simpson, 1994).

1.2. Reduced sensitivity to context in language comprehension

Using ambiguous words or sentences is a classic way to test context sensitivity. Single ambiguous words can be homophones, like bank or fan, or homographs, which are words with the same spelling, but different pronunciations depending on the intended meaning, e.g. tear. Further, phrases or sentences can be ambiguous due to single words (lexical ambiguity, like "He goes to the bank.") or due to their syntactic structure, e.g. "The man hit the boy with a stick." In such cases, both global context and word frequency highly influence how we understand or disambiguate the sentence (Beveridge & Marsh, 1991; MacDonald, Pearlmutter, & Seidenberg, 1994; Swaab, Brown, & Hagoort, 2003). A particularly strong test of reliance on sentence context is afforded by the processing of rare versions of biased homonyms that have one much more frequent meaning than the other. Since the rare meaning of a homonym is disfavored based on lexical frequency, coming to the adequate interpretation could only follow from integrating global information offered by sentence context.

Frith and Snowling (1983) were the first to investigate how children with autism interpreted ambiguous sentences in a homograph reading task (e.g., "There was a big tear in her dress"). Unlike controls, children with autism made more errors and used the common pronunciation more often regardless of the sentence context, which was explained as a weaker use of sentence context or diminished global processing. This seminal WCC finding is well replicated (Happé, 1997; Jolliffe & Baron-Cohen, 1999; López & Leekam, 2003). Although often cited as evidence for weak global processing in ASD specifically, Snowling and Frith (1986) already questioned whether this was an autism-specific pattern or if it was instead related to underlying cognitive abilities.

However, more recent studies on language processing in ASD have yielded inconsistent results, calling into question the explanatory adequacy of the WCC account. For instance, Hoy, Hatton, and Hare (2004) found that children with autism made