Pragmatic impairment is selective in autism: evidence from quantity implicatures

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Pragmatic deficits have long been recognised as one of the main nosological markers of Autism Spectrum Disorder (ASD). The latest edition of the DSM thus states that people with ASD tend to exhibit "[d]ifficulties understanding what is not explicitly stated (e.g., making inferences) and nonliteral or ambiguous meanings of language" (p. 48). In spite of this diagnostic criterion, a number of studies have found that people with ASD derive *scalar inferences* (e.g., the inference from "some" to "some not all") at the same rate as neurotypicals (e.g., Pijnacker et al., 2009).

One might conclude from this finding that people with and without ASD are equally adept when it comes to reasoning about the speaker's intentions for being underinformative. Such a generalisation would be in line with the social motivation theory of ASD, which holds that people with ASD are in fact capable pragmatic reasoners but often lack the motivation to engage in pragmatic reasoning (Chevallier et al., 2010). There are, however, compelling reasons to doubt that findings for scalar inferences can be generalised across the entire family of quantity implicatures.

In particular, scalar inferences have two features that are not shared by all varieties of quantity implicature. First, scalar infererences are closely connected to certain lexical expressions, to the extent that a number of theorists have argued that they are an aspect of lexical meaning rather than involving pragmatic inferencing (e.g., Levinson, 2000). Second, assuming that scalar inferences are bona fide inferences, their derivation is simple in that it can be reduced to constructing and negating alternatives, without considering the speaker's beliefs and intentions. In other words, scalar inferences are *lexicalisable* and their derivation is potentially *non-mentalistic* (LEX+ / MENT–).

In order to determine whether these two features shaped the observation that people with ASD derive scalar inferences at the same rate as neurotypicals, and more generally to what extent people with ASD are able to reason about the speaker's intentions for being underinformative, we extended the scope of investigation to four types of inferences that are often explained as quantity implicatures: scalar inferences, distributivity inferences, conditional inferences, and exhaustivity inferences.

Scalar inferences (LEX+ / MENT–)
Some of the shapes are red.
⇝ Not all of the shapes are red.

Distributivity inferences (LEX– / MENT+)
Each of the shapes is red or green.
⇝ There are both red and green shapes.

Conditional inferences (LEX– / MENT–)
Each of the shapes is red if it is a circle.
⇝ Not all of the shapes are red.

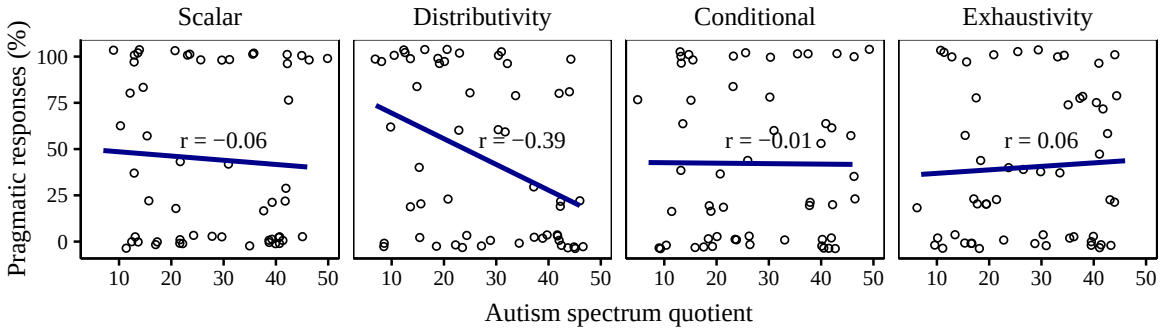
Exhaustivity inferences (LEX± / MENT–)
It is the circle that is red.
⇝ Only the circle is red.

Scalar inferences but not distributivity and conditional inferences are lexicalisable. Whether or not exhaustivity inferences can be encoded in the semantics of clefts is a matter of current debate. The derivation of scalar, conditional, and exhaustivity inferences is potentially non-mentalistic in that it can be reduced to constructing and negating alternatives. By contrast, the derivation of distributivity inferences also involves reasoning about what the speaker would have implicated had

she uttered one of the alternatives (or, in grammaticalist parlance, their derivation involves double exhaustification, cf. Crnič, Chemla, & Fox, 2016 for experimental evidence).

Following van Tiel and Schaeken (2017), we conducted a sentence-picture verification task. 62 participants with (28) and without (34) an official diagnosis of ASD (mean age: 34, range: 18–64, 32 females) read sentences that were followed by a picture and had to indicate if the sentence was true or false in that picture. Pictures showed either two (exhaustivity inferences) or five (the other three varieties of quantity implicature) coloured geometrical shapes. In target situations, sentences were true on their literal construal but false if the corresponding quantity implicature was derived. In control situations, sentences were unambiguously true or false. Example sentences, corresponding quantity implicatures, and target situations are provided in the figure above.

Participants also filled out the autism spectrum quotient (AQ) test (Baron-Cohen et al., 2001). The AQ test is a self-test consisting of 50 multiple choice questions and provides a measure of the extent to which one exhibits traits that are symptomatic of ASD. The figure below plots for each participant their AQ and the proportion of pragmatic (i.e., 'false') responses.



The results confirm previous observations that the rate of pragmatic responses for scalar inferences is independent of one's AQ. The same pattern was found for conditional and exhaustivity inferences (all Z's < 1). However, the proportion of pragmatic responses for distributivity inferences significantly decreased with one's AQ (β = -0.17, SE = 0.08, Z = -2.18, p = .03). Indeed, the effect of AQ on the rate of pragmatic responses for distributivity inferences significantly differed from its effect on the other varieties of quantity implicature (all p's $< .01$). These results were confirmed when participants were categorised based on whether they had been diagnosed with ASD.

These results indicate that the observation that people with ASD derive scalar inferences at the same rate as neurotypicals cannot be ascribed to these inferences being lexicalisable, since the same result was found for conditional and exhaustive inferences. However, people with ASD experience difficulties when the derivation of inferences involves more complex reasoning about the speaker's mental states, as was the case for distributivity inferences. Hence, structural differences in the derivation procedure affect the ease of computing pragmatic inferences for people with ASD. Interestingly, these difficulties were not reflected in the response times, which were equally high as for scalar inferences. The pragmatic deficits of people with ASD are thus selective, which speaks against the social motivation theory of ASD and a monolithic conception of pragmatics in general.

References: **[1]** Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). In: *J Autism Dev Disord*, *31* (1), 5–17. **[2]** Chevallier, C., Wilson, D., Happé, F., & Noveck, I. (2010). In: *J Autism Dev Disord*, *40* (9), 1104–1117. **[3]** Crnič, L., Chemla, E., & Fox, D. (2015). In: *Nat Lang Semant*, *23* (4), 271–305. **[4]** Levinson, S. (2000). *Presumptive meanings: the theory of generalized conversational implicature*. **[5]** Pijnacker, J., Hagoort, P., van Buitelaar, J., Teunisse, J.-P., & Geurts, B. (2009). In: *J Autism Dev Disord*, *39* (4), 607–618. **[6]** van Tiel, B. & Schaeken, W. (2016). Forthcoming in: *Cognitive Sci*.