

The interpretations of scalar implicatures, presuppositions, and implicated presupposition by Thai children with autism

Background Using the negated universal quantifier *not every*, we investigate the interpretations of scalar implicatures, lexical presuppositions, and implicated presuppositions by Thai children with autism spectrum disorders (ASDs), compared to their typically-developing (TD) peers and adults. It is expected that children with autism would be able to reject the literal meaning and base their judgement on scalar implicatures, which belong in the category of linguistically-informed inferences, to the same extent as their TD peers (Pijnacker et al., 2009; Chevallier et al., 2010; Hochstein et al., 2017). Yatsushiro (2008) predicted that the inferences derived by implicated presupposition and scalar implicature would yield similar results in typically-developing children. This study aims to compare how children in each group and adults perform with regards to scalar implicatures, lexical presuppositions, and implicated presuppositions.

Similar to the universal quantifier *every*, the negated quantifier *not every* also yields an EXISTENTIAL presupposition and an ANTI-UNIQUENESS implicated presupposition. Additionally, the literal *not all* meaning is also present. Given that if there is no intersection between restrictor and nuclear scope, cf. subject and predicate, other quantifiers, such as *no* or *none*, would have been used, the meaning that there has to be a restrictor-nuclear scope intersection is then derived from the use of *not every* through scalar implicature. The four types of meanings for ‘not every’, derived from different mechanisms, are provided with Example [1] below.

- [1] ‘Not every zebra is holding an ice cream.’
- \exists_{Ps} (DOM): There is a zebra
 - \exists_{Imp} (RESTR \cap SCOPE): There is a zebra holding an ice cream.
 - >1 IMPPS (DOM): There is more than one zebra.
 - $\neg\forall$: It is not true that every zebra is holding an ice cream.

Methods and design This study adapted the Covered Box paradigm (Huang et al., 2013). In each trial, a *context* picture was first shown on a screen, depicting a group of animals doing something, which corresponds with an auditory description of the scheme *In this group, every animal is doing y*. After the context, the screen was shifted to presenting two pictures, one visible and one hidden behind a black box. Another description was then auditorily presented with the scheme *but in this group, not every x is doing y*. The participants were instructed to choose either the visible picture or the covered box to map with the auditory description.

[...but in this group, not every zebra is holding an ice cream.] (audio)

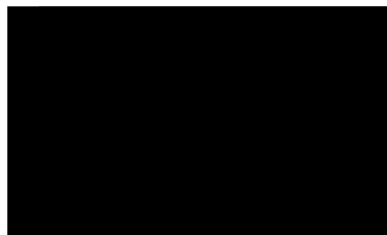


Figure 1: Example test screen.

Conditions and predictions The conditions were manipulated with regards to the compatibility between the visible picture and the readings under investigation. All of the critical experimental conditions are consistent with the literal *Not All* reading. They differ, however, in their consistency with the other three readings. (1) The *AllMet* condition is compatible with all of the readings,

with the visible picture showing 2 out of 3 target animals, i.e., ‘*not every*’ of them, doing the described action. (2) In the *AllViolated* condition, on the other hand, the visible picture showed no mentioned animal to begin with, making it incompatible with the three readings: the domain existential presupposition reading, the restrictor-nuclear scope intersection implicature, and the anti-uniqueness implicated presupposition readings. (3) The visible picture in the *ImpViolated* condition showed three of the target animals, auditorily described in the sentence, but none of them was doing the action that was mentioned. Therefore, the condition is consistent with all but one reading, which is the restrictor-nuclear scope intersection implicature reading. (4) In the *ImplmpPsViolated* condition, the visible picture showed only one target animal was depicted and it was not doing the described action. This condition is then not compatible with the restrictor-nuclear scope intersection implicature (target animal not doing described action) and the anti-uniqueness implicated presupposition (not more than one target animal depicted) readings.

Participants The child data were collected offline. An additional collection of adult data was done online using PennController (Zehr and Schwarz, 2018). A set of criteria was established to ensure objective measures on whether a participant was performing the task. Participants who failed to meet the criteria were removed from the statistical analyses. We recruited Thai native speakers, including 40 adults (3 excluded; *M* age for the included participants = 32.42), 60 typically developing children (28 excluded; *M* age for the included participants = 8;5), and 32 children with ASDs (13 excluded; *M* age for the included participants = 10).

Results Mixed effects logistic regression model were fitted to the covered box responses. We found a significant difference in the adults’ covered box response rates in the *AllViolated* and the *ImplmpPsViolated* conditions, providing empirical evidence for their access the derived meaning from EXISTENTIAL lexical presupposition. The adults’ difference between the performance in the *ImpViolated* condition and the *AllMet* condition also suggests their computation of scalar implicature. However, no significant additive effects were obtained from the ANTI-UNIQUENESS implicated presupposition in this experiment. While high proportions of children were excluded from the main statistical analyses, the included children display the same pattern as adults. The statistical analysis of the child data provides evidence for both children with ASD and TD children accessing the meaning derived from lexical presupposition and scalar implicature. The most indicative of group difference between children with ASD and TD children is their acceptance of literal meaning in the *AllViolated* condition, of which the visible picture conforms to only the literal meaning. The children with ASD significantly chose visible pictures more than the TD children, who mostly preferred covered boxes.

Implications The results of this study provide further empirical evidence to the literature (Chevalier et al., 2010; Hochstein et al., 2017; Pijnacker et al., 2009) that not only do adolescents with ASD perform on par with TD adolescents, *children* with ASD are also age-appropriate in their performance on deriving scalar implicatures. Additionally, this study adds that even though the children with ASD’s ability to compute scalar implicature is on par with TD children, they still tend to give more logical, literal responses, compared to their peers, as seen in their significantly lower covered box rates in the *AllViolated* condition. Additionally, the current results adds the observation to the literature (Yatsushiro, 2008; Legendre et al., 2011) that *types* of implicated presupposition matter in the acquisition pattern. This is evident from the fact that even though implicated presuppositions seem to affect the accuracy rates in comprehending certain personal reference terms, implicated presuppositions do not seem to have an additive effect on covered box response rates in any group of the participants in this study of the negated quantifier. The proposal that different types of implicated presuppositions may affect participants’ performance differently is a plausible proposal, considering that rates of deriving scalar implicatures were also previously observed to differ by scalar terms (Papafragou and Musolino, 2003).