

## Neg-raising in child language

**Summary:** Sentences containing a matrix negation and a neg-raising (NR) predicate such as *want* (1) are generally interpreted as if negation were in the embedded clause. In contrast, non-NR predicates such as *tell* disallow this reading (2). A recent approach derives the neg-raising inference (NRI) in (1) as a scalar implicature (SI), unifying the two inferences. In this study, we look to child language to test this uniformity hypothesis. Our findings are that children (and adults) indeed pattern alike in their computation of NRIs and SIs, in line with the SI approach to NRIs.

- (1) Zebra didn't want Frog to pick the pears  $\rightsquigarrow$  *Zebra wanted Frog not to pick the pears*  
(2) Zebra didn't tell Frog to pick the pears  $\not\rightsquigarrow$  *Zebra told Frog not to pick the pears*

**Background:** There are a number of approaches to neg-raising, ranging from purely syntactic approaches (e.g., Collins & Postal 2012) to presuppositional ones (e.g., Gajewski 2005, 2007). In this study, we focus on the SI approach, recently put forth in Romoli (2012, 2013), because of its uniformity prediction regarding the relationship between NRIs and SIs. Let us assume that SIs arise via the negation of relevant alternatives that are stronger than the assertion. According to the SI approach to NRIs, the affirmative version of (1), *Zebra wanted Frog to pick the pears* (**want**( $z, p$ )), is associated with the set of alternatives in (3), namely the assertion itself and a corresponding excluded middle proposition. Given that the excluded middle is entailed by the assertion, nothing happens in the positive case. For the negative sentence in (1) ( $\neg$ **want**( $z, p$ )), however, the alternatives are those in (4). Since the negation of the excluded middle is now stronger than the assertion, the negated excluded middle is negated (5). Consequently, the neg-raising inference is derived, as (5) indeed entails that Zebra wanted Frog not to pick the pears.

- (3) { **want**( $z, p$ ), [**want**( $z, p$ )  $\vee$  **want**( $z, \neg p$ )] }  
(4) {  $\neg$ **want**( $z, p$ ),  $\neg$ [**want**( $z, p$ )  $\vee$  **want**( $z, \neg p$ )] }  
(5)  $\neg$ **want**( $z, p$ )  $\wedge$   $\neg$  $\neg$ [**want**( $z, p$ )  $\vee$  **want**( $z, \neg p$ )]  $\Rightarrow$  **want**( $z, \neg p$ )

As mentioned, by equating SIs and NRIs, the SI approach makes clear uniformity predictions. That is, everything being equal, children should perform uniformly on SIs and NRIs. Much previous developmental literature has shown that children differ from adults on SIs: unlike adults, children tend to accept underinformative sentences such as (6), in contexts where their scalar implicatures are false, i.e., when the dog ate all of the apples (Noveck 2001, Papafragou 2003, Katsos & Bishop 2011 a.o.). If NRIs are a kind of SI, we expect to observe similar differences between children and adults for both NRIs and SIs.

- (6) Lion carried some of the apples  $\rightsquigarrow$  *Lion did not carry all of the apples*

**Experiment:** We used a Truth Value Judgment Task (Crain & Thornton 1998, 2000) to investigate the interpretations assigned by children and adults to sentences like (1) as compared to sentences like (6). We tested 20 adults and 19 children (4;00 – 5;10,  $M = 4;06$ ). Each participant saw a series of short stories presented through images on Powerpoint slides. **(I) NRI condition:** Each participant was presented with 4 stories in the NRI condition. These stories involved two characters (e.g., Zebra and Frog) and two sets of items (e.g., apples and pears). One of the characters would tell the other to carry out some activity on one of the sets of items (e.g., Zebra tells Frog to put the apples in his basket). The second character (i.e., Frog) would then ask what he should do with the other set of items (e.g., pears), to which the first character would state that they didn't mind what happened to those items (Fig. 1-(i)). After the story, the puppet would be asked the question in (7-a), and would respond with the description in (7-b). If participants generated the

NRI, they were expected to reject (7-b), because it is false that Zebra wanted Frog not to pick the bananas; she just didn't care whether or not Frog did it. **(II) SI condition:** Each participant also saw 4 stories in the SI condition. These stories involved a character who was presented with two sets of four items, and carried out some action with all of the items in one of the sets (Fig. 1-(ii)). After the presentation of the story the puppet was prompted with (8-a), and uttered (8-b). If participants generated the SI, they were expected to reject the description, because Lion carried all of the apples. **(III) Controls:** In addition to these test conditions, participants were presented with a number of control conditions: 3 repetitions of a negated non-NR verb *tell*, 2 repetitions of positive *want*, 2 repetitions of positive *tell*, and 2 repetitions of bare negation sentences.

- (7) a. So Zebra wanted Frog to pick the apples, what about the pears?  
 b. Zebra didn't want Frog to pick the pears.  
 (8) a. So Lion didn't carry any of the oranges, what about the apples?  
 b. Lion carried some of the apples.

**Results:** All participants were included in the analysis. Fig. 2 shows the proportion of *yes*-responses in the test conditions. We ran a mixed model logistic regression analysis using the lme4 package in R (Bates 2007), with group and condition as fixed effects, and item and subject as random effects. We found a main effect of group ( $p < .001$ ), with children more likely to accept in both conditions than adults; no effect of condition and no interaction.

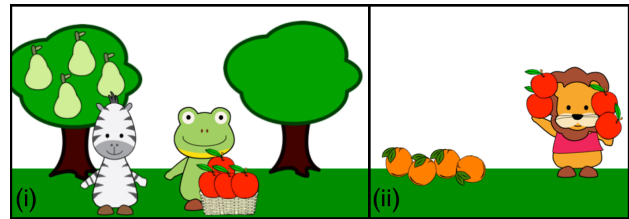


Figure 1: Examples of the final images of the NRI (i) and SI (ii) test conditions.

**Discussion:** As can be seen in Fig. 2, children were significantly less likely to derive the relevant inferences (SI or NRI) in both test conditions in the same way, while the adults were computing them on a par. This uniformity is very much in line with the predictions of the SI approach.

As a side note, we also observed unexpected responses to the negated *tell* control condition. Recall that *tell* is a non-NR verb. While we expected adults and children to accept (2) in a context where Zebra neither told Frog to pick the pears nor not pick them, we observed that roughly half of the adults and about 30% of the children rejected in this condition. These results may raise questions about how participants were engaging with the sentences.

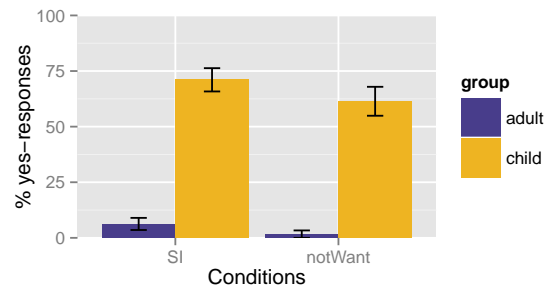


Figure 2: Results for SI and NRI test conditions

Since predicate was a within-subject factor though, we suspect participants may have been influenced by the *want* condition. We are currently running follow-up studies to investigate this further.

**Conclusion:** Our experimental findings reveal that both children and adults behave uniformly on NRIs and SIs: adults compute both at ceiling, while children generally compute fewer of both kinds of inferences than adults. Importantly, children and adults differ from each other in the same way on both inferences. Our findings provide support for the uniformity proposal that NRIs are a kind of SI.

**Selected References:** • Romoli, Jacopo. 2013. A scalar implicature-based approach to Neg-raising. *Linguistics & Philosophy*. • Gajewski, Jon. 2007. Neg-raising and polarity. *Linguistics & Philosophy*. • Noveck, Ira. 2001. When children are more logical than adults: Experimental investigations of scalar implicatures. *Cognition*.