Response Times as Negative Evidence in Grammar Learning

Anonymous CogSci submission

Abstract

Include no author information in the initial submission, to facilitate blind review. The abstract should be one paragraph, indented 1/8 inch on both sides, in 9˜point font with single spacing. The heading 'Abstract' should be 10˜point, bold, centered, with one line of space below it. This one-paragraph abstract section is required only for standard six page proceedings papers. Following the abstract should be a blank line, followed by the header 'Keywords' and a list of descriptive keywords separated by semicolons, all in 9˜point font, as shown below.

Keywords: Add your choice of indexing terms or keywords; kindly use a semi-colon; between each term.

Children rapidly learn to use language to successfully communicate with others, despite receiving little formal instruction about how to use language before attending school. How do children learn so much about language so quickly? Children are great at pulling linguistic information from others' speech and using those patterns to make predictions. Saffran, Aslin, and Newport (1996) showed that prelinguistic infants can follow statistical regularities in speech streams to detect word boundaries, and they can generate these patterns to novel sequences (Aslin & Newport, 2012). Therefore, children receive a large amount of positive evidence – information about what is correct to say – from their social partners. However, within the English language, there are a lot of exceptions to patterns and rules. Is listening to examples from adults enough information for children to master language?

Children are not only passive listeners of language, but they also become active participants in conversations. Through interacting with caregivers, they might learn from the corrections adults give to their mistakes. For example, if a child pointed to a horse and said "dog!", a parent might respond "that's not a dog, that's a horse!" However, adults are much less likely to correct syntactic errors (Newport, Gleitman, & Gleitman, 1977). For example, if a child said "I falled" instead of "I fell", a parent is much less likely to directly point out the error, because the content of their speech was correct. Nonetheless, children are able to learn and use accurate grammar. If children are not regularly told which utterances are ungrammatical, how do they quickly become proficient communicators?

One possibility is that parents give children implicit corrections when they speak ungrammatically. For example, parents are more likely to reformulate their child's utterance, in other words repeating it with corrected grammar, when their child makes an error (Hirsh-Pasek, Treiman, & Schneiderman, 1984, p. @chouinard2003). So, when their child says "I falled", parents might respond "you fell!" The child may be able to use the contrast between their own utterance and their parent's response as negative evidence – evidence their utterance was ungrammatical– and learn from their parent's example. Children are better at learning novel grammatical rules when they receive these reformulations than when they're only given correct examples unrelated to their speech (Saxton et al., 1998). Therefore, children do seem able to detect and use this implicit cue for learning in a controlled context.

However, parents do not consistently reformulate their children's errors. While parents are more likely to repeat an utterance when they are correcting their child, they do still often repeat correct utterances (Chouinard & Clark, 2003). Therefore, children may struggle to detect that the parent intended to correct rather than simply respond with a repetition (Marcus, 1993, p. @morgan1989). If children use repetition rates as evidence alone, Marcus (1993) argues that a child would need to make the same mistake over 80 times for them to notice a difference in how the parent responds. On the other hand, Saxton (2000) argues that the linguistic contrast between the parent and child's utterances is salient enough, without requiring the child to track repetition rates to use this cue. How do children learn from this unreliable signal?

We hypothesize that another, more implicit cue, might indicate to the child that the parent noticed an error. Adults are slower to process unpredictable utterances, therefore, timing may serve as a low-level cue that the child has made an error (Jurafsky, 1999; Fine & Jaeger, 2013). The longer pause combined with the linguistic contrast between the parent's and child's utterances may then serve as sufficient negative evidence against their mistakes. We investigate whether parents take longer to respond to their child's ungrammatical utterances, and explore processing demands as a possible explanation for why parents might be slower to respond.

Corpus Study 1

In this first study, we aimed to explore whether parents' response times after ungrammatical and grammatical utterances differ consistently during real interactions. Since the errors children make are highly variable, we specified our analysis to a specific and clear grammatical error: overregularizations.

Overregularizations are instances where a child incorrectly generalizes a grammatical rule, such as adding -s to the end of a noun to designate plurality, or adding -ed to the end of a verb to refer to past tense. For example, saying "mouses" instead of "mice" or "runned" instead of "ran" would be an overregularization. To detect whether there is difference in how long parents take to respond to their child's errors, we compared parent response times after overregularizations and grammatical utterances where the child produced a correct plural or past tense.

Methods

Child data. Analyses were performed using the Eleanor, Fraser, and Thomas corpora from the CHILDES database (MacWinney, 2000). Children are likely to produce overregularizations from age 2 up until ages 5 or 6 (Marcus et al., 1992). Therefore, these corpora were chosen because of their age range, high recording frequency, and the availability of timing data. Child utterances were selected that were responded to by the parent, and contained valid time codes for both the child utterance and parent response. These utterances also had to contain a past-tense or a plural. Data were extracted from the XML versions of the database using a Python script to parse the transcriptions. For both the Thomas and Fraser corpora, the father's responses were removed because the number of responses were negligible compared to that of the mother (0.23% and 5.75% of utterances, respectively). For the Eleanor corpus, both parents were included because they both contributed significantly, and their response patterns did not vary significantly.

Coding. We hand-coded whether utterances tagged with an error were an overregularization or an "other error." " Other error" refers to utterances in which the child made an error was not due to an overregularization of the past tense or plural. For example, the utterance "it did go elephants sleep" contains a plural ("elephants") and past tense, but the error is not an error of overregularization. Cases where the time of the utterance was longer than 5 seconds, less than 5 seconds, or utterance longer than 9 seconds were marked as suspicious timing. We verified whether these utterances were indeed marked with correct timings and whether the response was a contextual response to the child's utterance. If the utterance passed this criterion, it was included in the analysis.

One-column images

Single column is the default option, but if you want set it explicitly, set `fig.env` to `figure`. Notice that the `num.cols` option for the caption width is set to `1`.

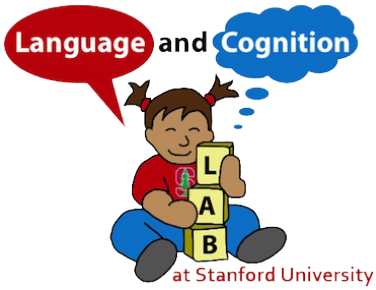

Figure 2: One column image.

R Plots

You can use R chunks directly to plot graphs. And you can use latex floats in the fig.pos chunk option to have more control over the location of your plot on the page. For more information on latex placement specifiers see **here**

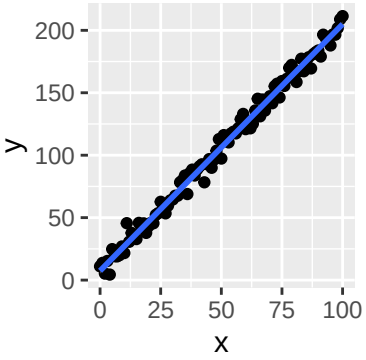

Figure 3: R plot

Tables

Number tables consecutively; place the table number and title (in 10 point) above the table with one line space above the caption and one line space below it, as in Table 1. You may float tables to the top or bottom of a column, set wide tables across both columns.

You can use the xtable function in the xtable package.

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.02	0.11	0.2	0.84
x	1.79	0.13	14.0	0.00

Table 1: This table prints across one column.

Acknowledgements

Place acknowledgments (including funding information) in a section at the end of the paper.

References

Chouinard, M. M., & Clark, E. V. (2003). Adult reformulations of child errors as negative evidence. *Journal of Child Language*, *30*(3), 637–670.

Figure 1: This image spans both columns. And the caption text is limited to 0.8 of the width of the document.

Hirsh-Pasek, K., Treiman, R., & Schneiderman, M. (1984). Brown & hanlon revisited: Mothers' sensitivity to ungrammatical forms. *Journal of Child Language*, *11*(1), 81–88.

Marcus, G. F. (1993). Negative evidence in language acquisition. *Cognition*, *46*(1), 53–85.

Morgan, J. L., & Travis, L. L. (1989). Limits on negative information in language input. *Journal of Child Language*, *16*(3), 531–552.

Newport, E., Gleitman, H., & Gleitman, L. R. (1977). Mother i'd rather do it myself: The contribution of selected child listener variables'.