On Recovering from "Kindergarten Path" Errors: Referential Context and Executive Functioning Influence Children's Online Ambiguity Resolution

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Adults exploit multiple information-sources in online sentence interpretation, rapidly integrating linguistic and referential-context information [1,2]. In contrast, children may not incorporate referential-context information in an adult-like manner. Trueswell et al. (1999) compared 5-year-olds and adults' interpretations of sentences like (1). In (1), *on the napkin* is temporarily ambiguous; the underlined disambiguating phrase establishes that the ambiguous phrase was a modifier specifying which frog, not a destination for putting. Adults resolved this ambiguity more easily when the referential context contained two frogs, making the modifier interpretation felicitous. But children often failed to resolve the ambiguity at all, making action errors on more than 60% of ambiguous trials, regardless of referential context [see also 4, 5].

(1) Put the frog on the napkin into the box.

Such data have been interpreted as evidence that 5-year-olds cannot use referential context to guide interpretation, and that they have great difficulty revising initial misinterpretations of ambiguous phrases. Proposed explanations for children's difficulty with revision often appeal to the development of executive functioning [6].

In the current study we sought to obtain new evidence on both these points. We began with the intuition that children's high error rates in interpreting sentences like (1) might stem both from difficulty revising, and failure to activate multiple possible interpretations in the first place. Sentence (1) might make a modifier interpretation difficult to generate, due to the semantic unrelatedness of *frog* and *napkin*. A closer semantic relationship between objects and their locations, as in (2), might promote activation of the modifier interpretation [7, 8]. If so, this increase in the baseline activation of the modifier interpretation might make it possible to measure effects of referential context, and of individual differences in executive function, on ambiguity resolution.

(2) Put the frog on the pond into the tent.

5-year-olds followed spoken instructions including 6 ambiguous and 6 unambiguous (e.g., *…frog that's on the pond…*) target sentences (Fig-1) by moving cut-out felt animals on a display. A hidden camera monitored their eye movements. Referential context (1 vs. 2 referents) was manipulated between subjects. We used a Simon Says game to measure children's executive function.

Fig-1. Example of 1-referent (left) and 2-referent (right) display for the trial *Put the frog on the pond into the tent.* Experimental displays contained: a target animal and distractor animal both on named platforms (e.g., pond, leaf), a distractor destination (empty pond), and a target destination (tent).

Children made fewer action errors in the 2- than the 1-referent context (Fig-2), though this effect was not reliable. Strong evidence of a referential context effect was revealed by a reliable interaction of ambiguity and referential context in analyses of children's fixations to the distractor destination (e.g., the empty pond, Fig-4). After hearing *pond* (e.g.), children looked reliably more at the distractor destination in ambiguous than unambiguous trials in the 1- but not

in the 2-referent condition. Children with higher Simon-Says scores made fewer action errors in ambiguous trials (Fig-3).

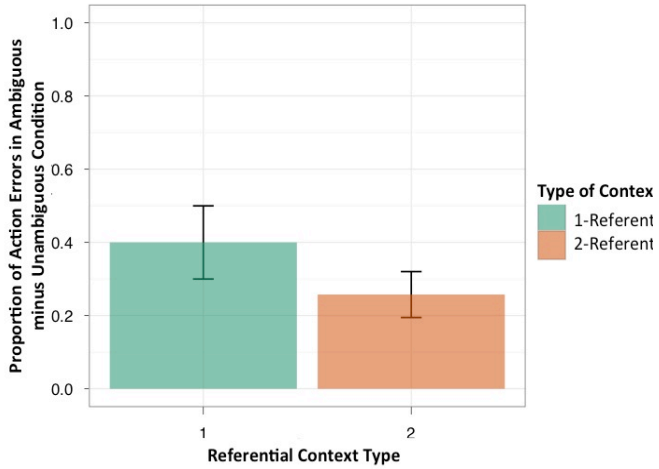

Fig-2. Proportion of errors in ambiguous relative to unambiguous trials in different referential contexts.

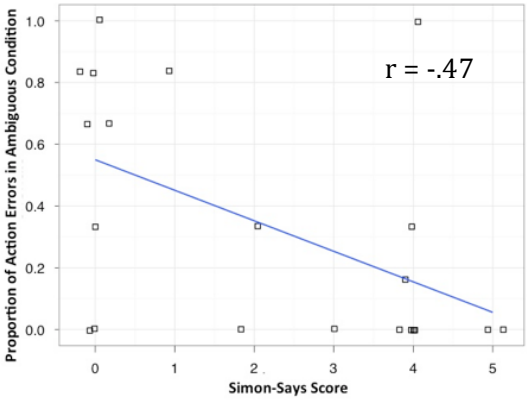

Fig-3. Correlation between Simon-Says performance and error rate in ambiguous trials. Children with higher Simon-Says scores made fewer action errors.

These data provide the first evidence that 5-year-olds use referential context in the resolution of syntactic ambiguity. Furthermore, the correlation between children's performance in an inhibitory-control task and their success in ambiguity resolution supports the hypothesis that the reanalysis of garden-path sentences recruits domain-general executive function mechanisms to resolve the conflict between an initial misinterpretation and disambiguating linguistic cues.

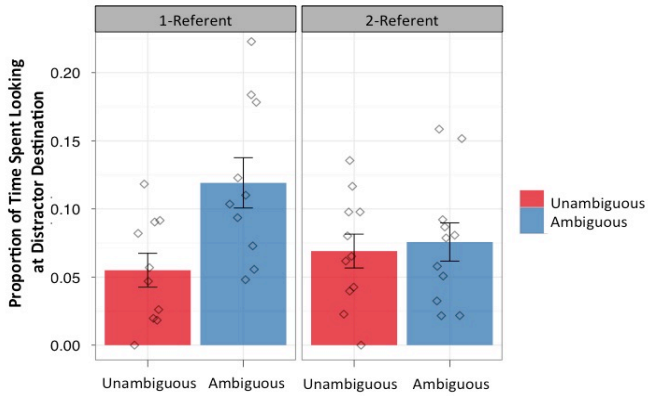

Fig-4. Proportion of time spent looking at the Distractor Destination after onset of the word (e.g., *pond*). Children looked reliably more at the distractor destination in ambiguous than in unambiguous trials in the 1-referent but not in the 2-referent condition.

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