

When is Recursion Easier for Children?

Ken Hale famously remarked that complex sentences held the key to learning a new grammar. Here we explore how recursion may make grammar clearer for a child. There is controversy over how children answer questions like 1)

1) Where did the girl think she caught the butterfly?

Several studies suggest that children readily allow "long distance" (LD) wh-readings like 1) from age 3, and sometimes even prefer them, but recent parsing results suggest that the default reading for children and adults is a "first resort" strategy in which they complete the wh-question at the first verb (Omaki et al, 2014).

Young children also provide a so-called 'reality' answer to question 5), in stories where the man said he ate one thing, but it was not what he ate. Their answer fails to integrate the two verbs, and answers only the last,

5) What did the man say he ate?

Such an interpretation does not include the opacity generated by the higher verb recursively subcategorizing the clause. One proposal (Lewis et al, 2012) is that with verbs such as *say*, the first clause might be seen as adjunct or parenthetical as in 6):

6) Mary, the man said, is in Boston.

More complexity could rule this out, as in 7) with two embeddings:

7) Where did the man say Bill thought Mary was?

because parentheticals do not seem to apply recursively:

8) * Mary, the man said Bill thought, is in Boston

With two such verbs, the potential analyses of 7) are: a) recursive embedding, or b) only the top verb is parenthetical, in which case the first resort answer would be the *second* verb, a fusion of the theories.

These considerations led us to an experiment to see how children respond to recursive embedding. We examined doubly embedded clauses such as:

9) When did Mom think Dad said Billy got his train? (Figure 1)

Would children answer the first, second, or third verbs, or integrate them? 29 children aged 3;5 to 5;7, and 23 monolingual English adults were tested on 6 stories followed by a two clause adjunct wh question like 2), and 6 stories followed by a recursive sentence like 9). The verbs were systematically varied across *think*, *say* and *tell*, and all answers, even illegitimate ones, were available in each story in different orders (see Figure 1)] Note that the stories contained mistakes, so that at each level one could differentiate the scope of the wh by the answer given.

Children were very prone to answer 2) with a reality response, but much less likely to do so with 9) (see figure 2). The difference is highly significant on a paired t-test ($p < 0.000002$). Figure 2 shows the different answers by age for the recursive type. No participant preferred a first resort answer, and the intermediate answers are strikingly absent from both children and adults. There is no evidence of a first resort strategy, nor of filling the first gap following a parenthetical interpretation of the top verb (i.e. a second verb answer).

The significance of these results is that Recursion leads to the loss of the middle-verb reading for all ages, not just children. Moreover it blocks the child's reality interpretation, that is, an analysis that closes the clause prematurely for interpretation (Roeper & deV). So recursion keeps the clauses "open" or unresolved in two senses-both satisfaction of the wh-word, and maintaining opacity for the adult by preventing premature shifting of contents to interpretation at the first phase. In sum, syntactic sentence recursion sharply narrows the point at which wh-insertion (gap-filling) applies. Recursion thus fundamentally alters the processing of sentences, justifying Hale's intuition.

Figure 1 Sample story and answers for type 9)



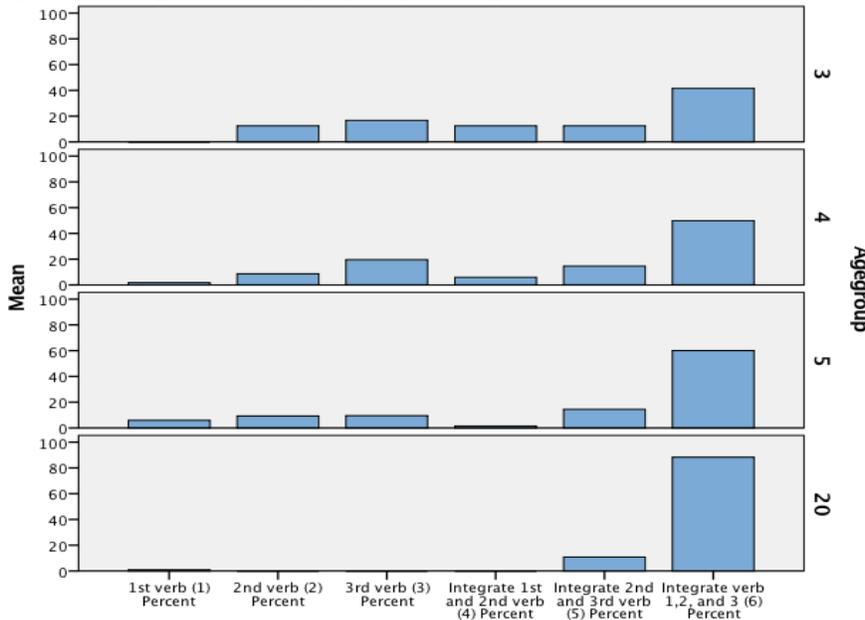
Example Story: Billy got a train set when he went to see his Grandma in the summer. One night, Dad said to Mom, "I really like that train Billy got on his first birthday." Mom was a bit sleepy, so she didn't listen very well. The next morning when she was taking a shower, she laughed about it. She thought Dad was talking in his sleep and said that Billy got the train when he was first born!

Question: When did Mom think Dad said Billy got his train?

Answers:

- 1 first verb (think)= in the shower
- 2 2nd verb (say)=in bed at night
- 3 3rd verb/reality (got)= in the summer
- 4 Integrate (think+say) = while sleeping
- 5 Integrate (say+ got) = at first birthday
- 6 Integrate (think+say+got)= when born

Figure 2: Responses by age group to Type 4



References

Omaki, A., Davidson White, I., Goro, T., Lidz, J., & C. Phillips. 2014. "No fear of commitment: Children's incremental interpretation in English and Japanese wh-questions". *Language Learning and Development*, 10(3), 206-233

Lewis, S., Lidz, J. & V. Hacquard. 2012. "The semantics and pragmatics of belief reports in preschoolers". *Semantics and Linguistic Theory* 22, 247-267

