

Attentional resource allocation in children's subject-verb agreement production

An "agreement attraction" error, the use of the verb that erroneously agrees in number with the local noun rather than the head noun (e.g., "The key to the cabinets *are*..."[1]) has been studied extensively in adult speakers [e.g., 1-4], and is more common with singular (SP) than plural (PS) head nouns. But it has been suggested that children may use different agreement mechanisms. The existing reports on children's oral production have shown a strong bias towards producing the singular form regardless of the local noun, and have failed to find the predominance of SP attraction errors reported in adults [5]. However, these data were collected using a sentence completion task with preambles which may be unnatural and difficult for children, and in French language in which the singular and plural forms of many verbs sound identical. We explored the agreement production mechanism in English-speaking children using a more naturalistic task that involves all stages of sentence production from conceptualization to articulation, and tested if children still show a tendency to use the singular form (*singular-preference hypothesis*) or if they show the adult-like attraction pattern (*attraction hypothesis*). In addition, we examined whether agreement production requires attentional/inhibitory control and whether such control is shared with non-structural processes such as NP retrieval during sentence production.

Methods. In our novel referential communication paradigm, children (N = 46; Mean age = 6.5, range = 5.0-7.9 yrs.) helped the experimenter color in animals on her sheet (Figure 1). Children learned to give unambiguous instructions by describing the "target" animals (i.e., the animal to be colored) using "cue" animals (i.e., the animals next to them). We created four conditions by manipulating number marking on the head noun, as well as the number conflict between the two nouns (SS, SP, PP, PS; see Table 1). We also used a between-subjects manipulation of attentional demand. In the "Target-flash" condition, the "target" animal that corresponded to the head noun flashed on the screen. This aligned with the speakers' natural tendency to start the sentence with the visually-cued object [6], and thus required no attentional/inhibitory control. In the "Cue-flash" condition, the cue animal that corresponded to the attractor noun flashed. Here, children had to apply inhibitory control to suppress the urge to assign the subject role to the flashing animal. If agreement production requires attentional/inhibitory resources, we expect more verb errors in the Cue-flash condition, where such resources have been consumed.

Results. Agreement errors and disfluencies right before verbs showed a similar pattern, and the combined data are shown in Figure 2. There were significantly more errors in PP than SS condition ($z = 3.41, p < 0.001$), providing support for the singular-preference hypothesis. But there was also a main effect of number conflict (i.e., attraction; $z = 7.26, p < 0.001$), as well as an interaction between number conflict and head noun number marking ($z = 4.56, p < 0.001$) consistent with SP>PS errors as in adults [1]. We also found a reliable effect of attentional demand with significantly more errors in Cue-flash than Target-flash ($z = 2.06, p = 0.039$), which did not interact with number conflict. Finally, analysis of NP (color and noun) errors showed a trade-off between agreement computation and lexical retrieval: reliably more verb problems were observed with correct NP production ($z = 4.89, p < 0.001$), and reliably more NP errors were observed when the correct verb form was produced ($z = 4.35, p < 0.001$; see Figure 3).

Conclusion: The data support both the singular-default and the attraction hypotheses as sources of agreement errors in English-speaking children. Moreover, agreement production in children requires attentional/inhibitory resources and such resources are shared between structural operations and lexical retrieval in sentence production.

Table 1. Sample stimuli and conditions

SS	Singular Head, No Conflict	The snake next to the purple elephant is green
SP	Singular Head, Number Conflict	The snake next to the purple elephants is green
PS	Plural Head, Number Conflict	The snakes next to the purple elephant are green
PP	Plural Head, No Conflict	The snakes next to the purple elephants are green

Figure 1. If this is a Target-flash trial, the snake flashes and the child says “The snake next to the purple elephants is green”. The same sentence is evoked in the Cue-flash condition by flashing the two purple elephants.

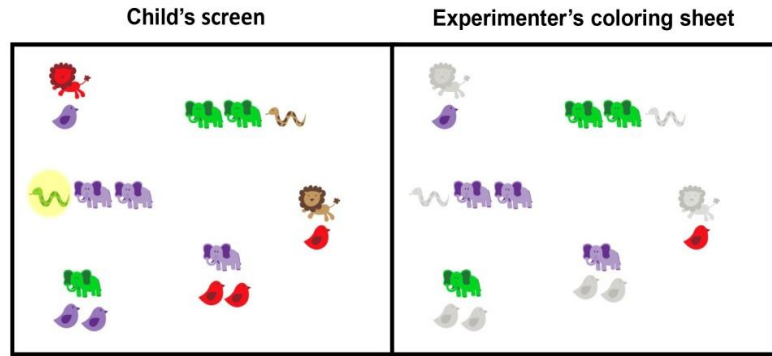


Figure 2. Proportion of errors + disfluencies on verbs in the Target-flash and Cue-flash conditions on the four trial types.

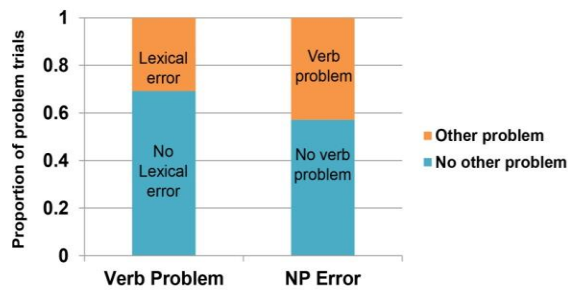
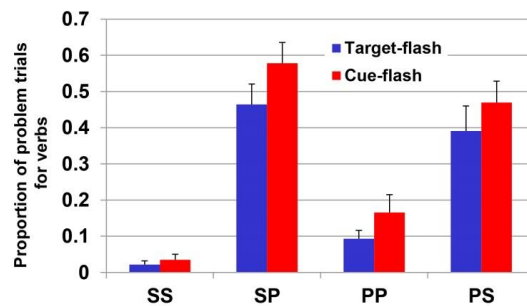


Figure 3. Proportion of trials with (orange) and without (blue) other problems in trials with verb problems (left column) and NP errors (right column). If agreement computation and NP retrieval share resources, we expect that spending more resources on NP retrieval (i.e., no lexical error trials) to lead to more agreement errors, because no resources are left for correct agreement computation, and vice versa.

References

- [1] Bock & Miller (1991). *Cognitive Psychology*, 23, 45–93. [2] Eberhard et al. (2005). *Psych. Review*, 112, 531-559. [3] Badecker & Kuminiak. (2007). *JML*, 56, 65-85. [4] Thornton & MacDonald. (2003). *JML*, 48, 740-759. [5] Franck et al. (2004). *J. of Neurolinguistics*, 17, 147-180. [6] Gleitman et al. (2007). *JML*, 57, 544-569.