Preschoolers' use of verb and event knowledge in online reference comprehension

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Adults use word meanings [1] and event knowledge [2] to predict upcoming words, and they integrate these two information sources in online comprehension. For example, adult listeners used the semantics of the verb '*return*' in '*return the chair to area 3*' to guide their attention (measured by anticipatory visual fixations) to objects that had previously been moved, and, in a referential communication task, to objects that the speaker had witnessed being moved [3]. These findings show that adults can quickly use verb meanings to direct their use of previously acquired event knowledge during online comprehension. Prior evidence suggests that children can independently use word meanings and event knowledge in online language processing [4,5]. We explore for the first time whether children can flexibly combine these two information sources during anticipatory reference comprehension. To do so, we ask whether preschoolers' use of story-provided event information in online reference comprehension is influenced by the presuppositions of the verb used in the target sentence.

Methods. In an eye-tracking comprehension task, 38 4- and 5-year-old English-speaking children (Target *N*=48; *M* age=61.9 months) and 48 adults listened to stories modeled after recent studies [3,5]. Each story was 3 sentences long (see Table 1). The first sentence introduced Maisy and two animal characters. The animal characters were of the same species, distinguishable by a post-nominal modifier (e.g., *"the butterfly with the purse"* and *"the butterfly with the bow"*). The second sentence set up our experimental comparison. In the second sentence, the <u>target animal</u> gave an object to Maisy (e.g., "*the butterfly with the purse gives the birthday cake to Maisy*"). In the final, target sentence, Maisy transferred the object to one of the two animals. Maisy returned the object to the target animal in 16 experimental trials and gave it to the competitor animal in 16 filler trials. The key manipulation in experimental trials involved the verb in the final sentence. Half of the trials used the phrase "<u>*give the [OBJECT] back to*</u>", while the other half used the phrase "<u>*give the [OBJECT] to.*</u>" The phrase "*give back*" implies that the recipient of Maisy's transfer action had prior possession of the object, whereas "*give*" alone does not.

While they listened, participants viewed static images of the story participants (see Fig-1): Maisy, the target and competitor animals, and the object. We measured participants' eye gaze to these pictures during the final sentence. Crucially, the final sentence contained a temporarily ambiguous noun phrase (e.g., "*the butterfly with the …*"), which could refer to either of the two animals. We analyzed and compared participants' anticipatory visual fixations toward the target and the competitor animals during this ambiguous region across trial types. In "*give back*" (but not "*give*") trials, it is possible to anticipate which animal will receive the object if participants integrate their knowledge of the verb (i.e., that "*give back*" implies prior possession) with their knowledge of the event (i.e., who had prior possession of the object). We predicted that participants would look more toward the target than the competitor animal before hearing the disambiguating modifier in "*give back*", but not "*give*", trials.

Results. As depicted in Fig-2, during the ambiguous NP in the final sentence, both children and adults looked more toward the target animal in the "*give back*" trials than in the "*give*" trials. This effect was significant for both groups in mixed-effects regression analyses (adults: b=3.31, SE=0.37, p<.001; children: b=1.72, SE=0.45, p<.001). This demonstrates that participants not only constructed a mental model of the ongoing story to track changes in object ownership, but also rapidly used the semantic features of the verb to flexibly use story-provided event knowledge to predict an upcoming referent.

This finding provides evidence that preschoolers, like adults, can use lexical semantic information and event-related information jointly and in real time as sentences unfold. Our finding yields new evidence that real-time language comprehension involves the rapid use and integration of multiple sources of information, and this ability emerges early in development.

Figure 1. Example Trial Screen

Table 1. Example Stories in Experimental Trials

	Sentences
Introduction	*Maisy is playing with her friends, the butterfly with the bow and the butterfly with the purse. The butterfly with the purse gives the birthday cake to Maisy.*
Critical Sentence	*And Maisy gives the birthday cake* **to/back to** *the butterfly with the purse.*

Figure 2. Log-adjusted target advantage score for adults and children during the critical sentence by trial type (give vs. give back).
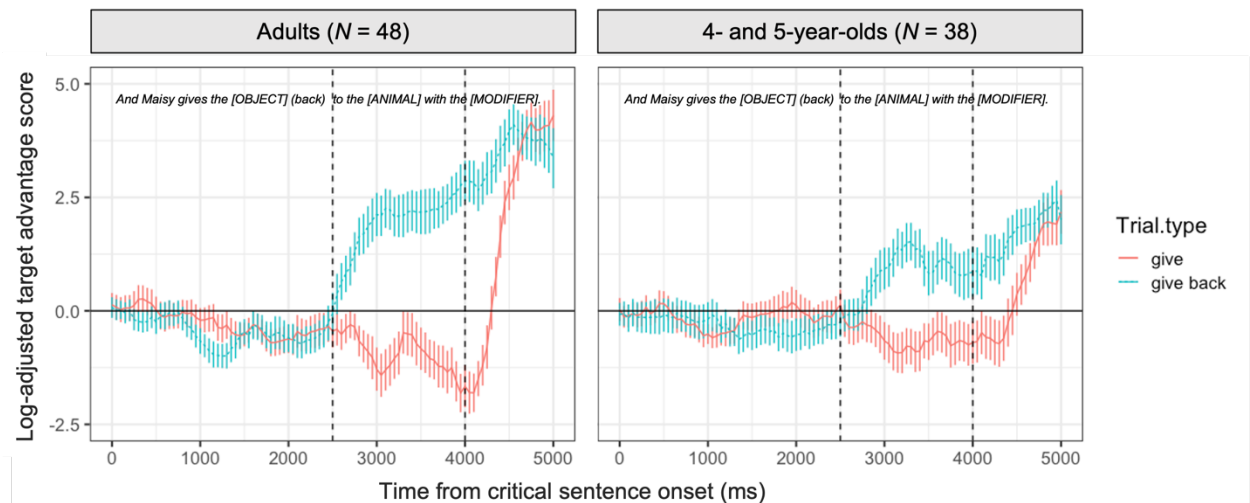
Note. 1) The target advantage score represents the ratio of looks toward the target animal to looks toward the competitor animal. We applied a log transformation to this score to make it a continuous variable not limited to values between 0 and 1. Positive values indicate a preference for the target animal, while negative values indicate a preference for the competitor animal. 2) Between 2500ms and 4000ms after the onset of the critical sentence (as denoted by the vertical dashed lines), participants heard the ambiguous noun phrase (*"to the [ANIMAL] with the"*). At 4000ms, they heard a disambiguating modifier that matched the target animal. To account for the response time for initiating eye movements, the measurement time interval was offset by 200ms for adults and 300ms for children. The error bars represent by participant standard errors.

References
[1] Altmann & Kamide, 1999. *Cognition*.
[2] Nieuwland et al., 2007. *Journal of Cognitive Neuroscience.*
[3] Chamber & San Juan, 2008. *Cognition.*
[4] Mani & Huettig, 2012. *Journal of Experimental Psychology.*
[5] Yuile & Fisher, 2021. *Proceedings of the 45th Annual Boston University Conference on Language Development.*