Object *wh*-questions with unknown verbs are transitive for 20-month-olds

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Infants between 15- and 20-months show variable success at interpreting *wh*-questions [1-3], and may do so by using prior verb knowledge, without necessarily representing the dependency between the *wh*-phrase and verb [2-3]. [4-5] show that 18-19-month-olds, but not younger infants, represent fronted *wh*-phrases as arguments of known verbs. Here, we show that 20-month-olds use these representations when interpreting unknown verbs: they treat novel verbs in object *wh*-questions as transitive when assessing their fit to events.

We use a dialogue-based verb-learning task [6], adapting the Violation-of-Expectations paradigm [7]. Infants see dialogues with novel verbs in three between-subjects conditions: either object *wh*-questions (1), intransitive polar questions (2), or transitive polar questions (3). At test, we present videos of a single stimulus scene (e.g. a girl knocks over a tower) and ask infants whether they see *gorping* (Fig. 1). Piloting with adults confirmed that these scenes are robustly viewed as having two participants, and are a good fit for transitive descriptions, but not for intransitives of the form in (2).

    (1) What is the girl gonna *gorp*?
    (2) Is the girl gonna *gorp*?
    (3) Is the girl gonna *gorp* the toy?

Our dependent measure is total looking time at test. If infants recognize that *what* is a fronted object of *gorp* in (1), and therefore represent this sentence as transitive, we predict that they will attend similarly to the test event as infants who heard transitives with the object in canonical position (3). In both cases, *gorping* will be a good label for this 2-participant event [6]. Otherwise, they will represent (1) as intransitive, and exhibit looking behavior similar to (2): in both cases, *gorping* will not be a good label for this 2-participant event.

We tested 46 infants (19;0-22;0; target *n*=72) in a 2x3 design, with event (BREAK/KNOCK-OVER) within and dialogue syntax (*wh*-question/intransitive/transitive) between-subjects. A linear mixed-effects regression of looking time at test revealed a significant effect of condition ($F(2)=3.78$, $p<0.03$) and a condition-age interaction ($F(2)=3.78$, $p<0.03$). Post-hoc comparisons on the slopes of the age trends found that the *wh*-question condition differed significantly from the intransitive condition ($t(34)=2.58$, $p<0.04$), but not from the transitive condition ($t(34)=1.22$, $p<0.51$). Younger infants attended longer to these events after hearing *wh*-question and transitive dialogues, compared to intransitives; older infants attended longer after hearing intransitive dialogues compared to the others (Fig. 2).

Thus, younger vs. older infants appeared to respond differently to the inconsistency between intransitives and these 2-participant events: younger infants responded by disengaging, older infants by investigating. This pattern suggests differences in task difficulty for infants at different ages [8]. But crucially, infants across the age range differentiated *wh*-questions from intransitives, and treated them similarly to canonical transitives when assessing their fit to these scenes.

We find that 20-month-olds treat object *wh*-questions with a novel verb as transitive when relating them to 2-participant scenes. These results suggest that infants by 20-months (i) represent non-local dependencies, (ii) recognize them in *wh*-questions with unknown verbs, and therefore (iii) might use these representations to feed verb learning.
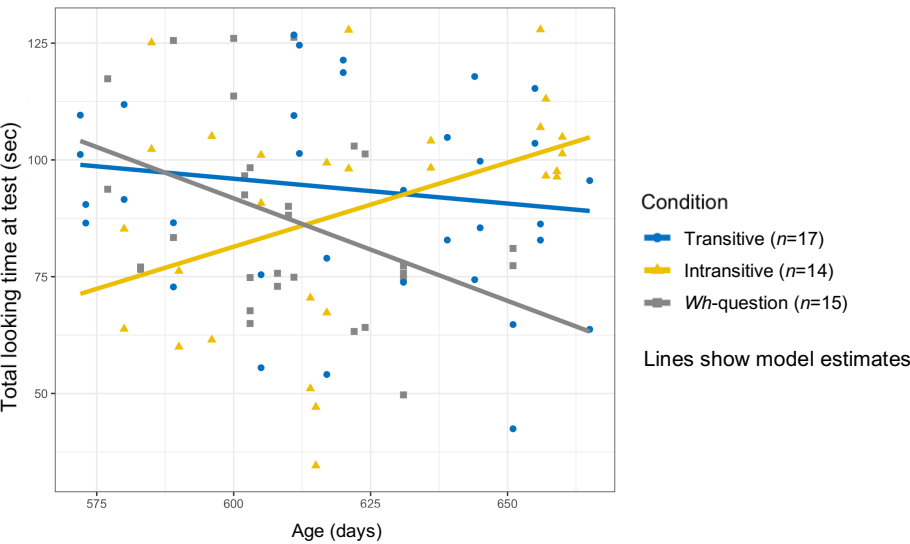
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Fig. 1 Experimental Method (1 of 2 Scenes)*

Dialogue (4 trials x 11 s)	

	Wh-question condition	Intransitive condition	Transitive condition
	- Ooh, what is the girl gonna gorp?	- Ooh, is the girl gonna gorp?	- Ooh, is the girl gonna gorp the toy?
	- Yeah, what IS she gonna gorp?	- Yeah, IS she gonna gorp?	- Yeah, IS she gonna gorp the toy?
	- Right, what is she gonna gorp?	- Right, is she gonna gorp?	- Right, is she gonna gorp it?
	- No idea! What is she gonna gorp?	- No idea! Is she gonna gorp?	- No idea! Is she gonna gorp it?

Test (4 trials x 32.4 s; video played on loop)	Ooh, look! … Did you see gorping? Hey, wow! … Did you see gorping?

*2 events tested within-participants (knocking over a tower, breaking a stick), paired with different novel verbs

Fig. 2 Total Looking Time at Test by Condition and Age in Days

Condition
- Transitive (*n*=17)
- Intransitive (*n*=14)
- *Wh*-question (*n*=15)

Lines show model estimates

Selected References
[1] Seidl, Hollich, & Jusczyk 2003. Early understanding of subject and object wh-questions. *Infancy*. [2] Gagliardi, Mease, & Lidz 2016. Discontinuous development in the acquisition of filler-gap dependencies. *Language Acquisition*. [3] Perkins & Lidz 2020. Filler-gap dependency comprehension at 15 month. *Language Acquisition.* [4] Perkins & Lidz, under review. Grammatical action at a distance. [5] Hirzel, Perkins, & Lidz 2020. 19-month-olds parse *wh*-questions incrementally. BUCLD 45. [6] Yuan & Fisher 2009. "Really? She blicked the baby?" *Psychological Science*. [7] Baillargeon, Spelke, & Wasserman 1985. Object permanence in five-month-old infants. *Cognition*. [8] Kidd, Piantadosi, & Aslin 2012. The Goldilocks Effect. *PloS One*.