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# Verb Learning from Syntax Alone at 21 Months

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To discover the meaning of a novel verb, toddlers are able to glean important information from the syntactic context in which it appears, including the number of participants expected to be involved in the event, and broad aspects of the relationship in which they will stand to each other (e.g., Fisher, 1996; Gleitman, 1990; Naigles, 1990). But verbs are often uttered in the absence of the events they describe (Tomasello & Kruger, 1992). To learn a new verb from such an encounter, when no visual scene is present, toddlers must be able to posit an initial representation for the verb from its linguistic context alone.

Recent evidence indicates that even if toddlers hear a novel verb in the absence of any accompanying event, syntactic information does support their acquisition of its meaning (Arunachalam & Waxman, 2010; Yuan & Fisher, 2009). For example, Arunachalam & Waxman introduced 27-month-olds to dialogues incorporating novel verbs either in transitive sentences (e.g., *John mooped the doggie*) or intransitive sentences (e.g., *John and the doggie mooped*), but absent any relevant referent scene. Next, toddlers viewed two candidate scenes: a) two participants performing synchronous actions (e.g., boy and girl each wave one arm), and b) two participants performing a causative action (e.g., boy spins girl). When asked to point to "mooping," toddlers who had heard transitive sentences chose the causative scene; those who had heard intransitive sentences did not.

Here, we advance this work in two ways. First, we ask whether toddlers as young as 21 months can also use syntactic context to assign verb meaning. We chose this age group because previous evidence suggests that toddlers under two years of age are sensitive to word order cues (Gertner et al., 2006), but not argument structure (Hirsh-Pasek & Golinkoff, 1996) when learning a novel verb's meaning. Second, we examine the time-course underlying toddlers' resolution of novel verb meaning. We measure toddlers' eye gaze as they hear the novel verbs during the test phase, and ask how long they require to shift their attention to the appropriate scene. NB: Although the time-course for lexical processing of *familiar* words has been well-studied in toddlers (e.g., Fernald et al., 2006), there is scant evidence on processing of *newly-learned* words.

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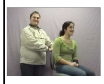
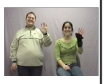
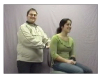
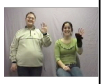
## 1. Participants.

40 typically-developing, monolingual English learning 21-month-olds participated, recruited from Evanston, IL, and surrounding areas.

## 2. Methods

Materials and procedure are identical to Arunachalam & Waxman (2010), except that we measure eye gaze instead of pointing as a dependent measure. See Table 1. Toddlers' eye gaze was recorded using a video camera centered above the screen. A trained coder, blind to condition assignment, coded the video recordings of toddlers' eye gaze, identifying, for each frame (30 frames per second) whether the eyes were oriented to the left scene, the right scene, or neither scene.

**Table 1. Representative trial. Toddlers viewed 4 such trials.**

| | DIALOGUE | TEST | |
|---|---|---|---|
| | | SALIENCE | RESPONSE |
| |  |   Causative Synchronous |   Causative Synchronous |
| **Transitive Condition** | A: Guess what? John *mooped* my brother.<br>B: Really? John *mooped* your brother?<br>A: And the man is going to *moop* the lady.<br>B: Oh yes, he is going to *moop* her. | Look! Wow! | Where's *mooping*? |
| **Intransitive Condition** | A: Guess what? John and my brother *mooped.*<br>B: Really? John and your brother *mooped*?<br>A: And the man and the lady are going to *moop.*<br>B: Oh yes, they are going to *moop.* | | |

## 3. Predictions

Recently, Booth and Waxman (2009) indicate that in a similar task, toddlers require at least 2.5 sec to respond to a novel *noun*. We therefore predicted that in our task, toddlers would require at least that length of time to respond to novel *verbs*. We defined two 2.5 sec windows for analysis: Window 1 (begins with onset of novel verb at test) and Window 2 (2.5 – 5 sec from novel verb onset) See Figure 1. If 21-month-olds can use the novel verb's argument structure to infer its meaning, then in Window 2, those in the Transitive condition should look more to the causative scene than those in the Intransitive condition.

## 4. Results

The results support this prediction. See Figure 2. In Window 2, at approximately 2.5 seconds after novel verb onset, looking behavior in the two conditions diverges. Toddlers in the Transitive condition significantly prefer the causative scene in Window 2 (Window 1, $t(38) = 0.16$; Window 2, $t(38) = 2.89$, $p < .01$). This is striking because it reveals that at their very first opportunity to hear the novel verb in the context of a candidate visual referent (the test phase), toddlers reliably mapped a transitive verb to a causative event, and did so despite the fact that when the candidate scenes were available, the verb appeared in a syntactic context that did not distinguish between the two candidate scenes.

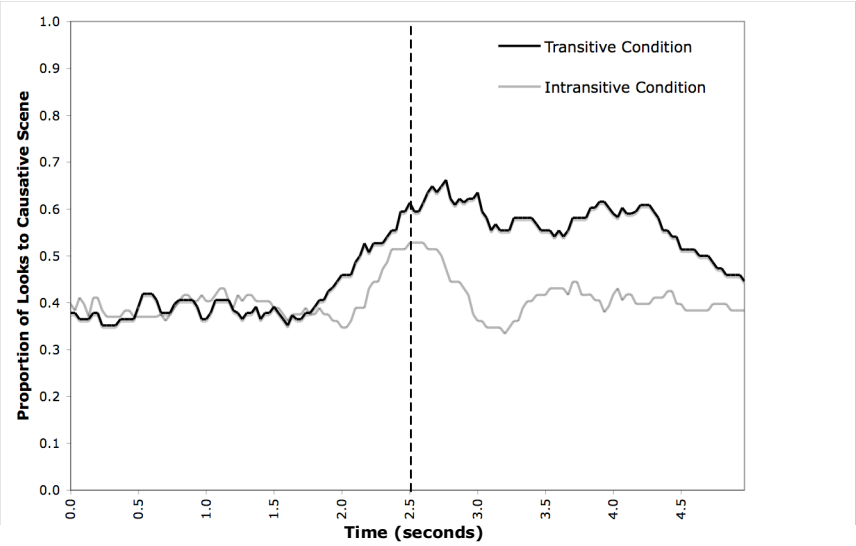



**Figure 1. Toddlers' looks to the causative scene in response to the test query (e.g., "Where's *mooping*?"), depicted here from the onset of the novel verb.**

## 5. Discussion

These results make three contributions. First, they provide the first evidence that 21-month-olds can use argument structure cues to establish an initial representation of a novel verb's meaning. Second, they document that like 27-month-olds, they can do so even when the syntactic information is presented *in the absence* of a relevant visual scene. Third, the time-course with which 21-month-olds are able to process *novel verbs* and attend to their visual referent is similar to that for *novel nouns*.

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