Cognition 131 (2014) 139–146

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/COGNIT

Brief article

Infants use known verbs to learn novel nouns: Evidence from 15- and 19-month-olds

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ARTICLE INFO

Article history:
Received 28 May 2013
Revised 23 December 2013
Accepted 27 December 2013

Keywords:
Language development
Word learning
Infants
Nouns
Verbs
Selectional restrictions

ABSTRACT

Fluent speakers' representations of verbs include semantic knowledge about the nouns that can serve as their arguments. These "selectional restrictions" of a verb can in principle be recruited to learn the meaning of a novel noun. For example, the sentence *He ate the carambola* licenses the inference that *carambola* refers to something edible. We ask whether 15- and 19-month-old infants can recruit their nascent verb lexicon to identify the referents of novel nouns that appear as the verbs' subjects. We compared infants' interpretation of a novel noun (e.g., the *dax*) in two conditions: one in which *dax* is presented as the subject of animate-selecting construction (e.g., *The dax is crying*), and the other in which *dax* is the subject of an animacy-neutral construction (e.g., *The dax is right here*). Results indicate that by 19 months, infants use their representations of known verbs to inform the meaning of a novel noun that appears as its argument.

1. Introduction

Upon hearing the sentence *He ate the carambola*, fluent speakers of English would infer that *carambola* refers to something edible. And upon hearing the sentence *He ate his piano*, they would assume either that the sentence is nonsense or that an unconventional *eating* metaphor has been invoked. These inferences are guided by the verb *eating*'s "selectional restrictions" – the semantic requirements that this verb places on its arguments (Chomsky, 1965; Jackendoff, 1990; Katz & Fodor, 1963; Pinker, 1989; Resnik, 1996). In this paper, we ask whether infants can use their knowledge of verbs' selectional restrictions to inform the meaning of a novel noun that appears as its argument.

Although infants occasionally violate selectional restrictions in their spontaneous productions (Bowerman, 1978, 1982), they nonetheless appreciate the selectional restrictions of at least some verbs by their second birthday (Friedrich & Friederici, 2005; Naigles, Hoff, & Vear, 2009; Valian, Prasada, & Scarpa, 2006). For example, when 26- and 30-month-olds are presented with two images (e.g., a cookie and a book), they are faster to fixate on the cookie when they hear a sentence such as *Eat the cookie* than *Take the cookie* (Fernald, Zangl, Portillo, & Marchman, 2008; Mani & Huettig, 2012). By this age, they can also use known verbs to identify the referents of otherwise ambiguous pronouns (e.g., *Which one can you drive?*) and can rapidly acquire the selectional restrictions of a novel verb from the contexts in which it occurs (Yuan, Fisher, Kandhadai, & Fernald, 2011). Together, these accomplishments reveal that infants successfully use the selectional restrictions of known verbs in sentence processing.

What is less clear is whether infants can use a known verb's selectional restrictions to hone in on the meaning of a novel noun that appears as its argument. Only one study has addressed this directly, and its results are promising. Goodman, McDonough, and Brown (2008) introduced infants to a novel noun alongside a known verb (e.g., *Mommy feeds the ferret*). Next, they presented infants

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http://dx.doi.org/10.1016/j.cognition.2013.12.014

with images of four objects (e.g., one animal and three artefacts) and said, for example, *Show me the ferret*. Infants at 24 and 30 months successfully recruited the verbs' selectional restrictions, selecting the animate object as the referent of the novel noun. Despite some methodological limitations (e.g., using familiar English words, presenting an "oddball" animate target amongst 3 inanimate distractors), these data suggest that 2-year-olds may indeed use the selectional restrictions of a known verb to infer the meaning of a novel noun.

In the present study, we ask whether a known verb can inform infants of the animacy status of its subject. To address this, we compare infants' interpretation of a novel noun (e.g., *dax*) in an Informative condition, where *dax* was presented as the subject of an animate-selecting verb (e.g., *The dax is crying*) to their interpretation in a Neutral condition, where *dax* was presented in an animacy-neutral construction (e.g., *The dax is right here*). We designed a new eyetracking paradigm that permits us to advance previous work in several ways. First, it permits us to consider the capacities of younger infants (15- and 19-month-olds) who, by all estimates, have only a modest stock of verbs. Second, it permits us to ask whether infants' linguistic representations of these verbs are robust enough to guide their selection of a referent for a novel noun that appears later as its argument. Inspired by recent designs (e.g., Arunachalam & Waxman, 2010; Yuan & Fisher, 2009), we introduce known verbs in the absence of any candidate referents for the novel noun. Third, we control for infants' existing word knowledge by presenting nonce words, and minimize demand characteristics by offering only two candidate referents at test (cf., Goodman et al., 2008).

2. Methods

2.1. Participants

Fifty-nine infants were included in the final sample, 30 19-month-olds (M = 19.62 months, ranging 18.0–21.85; 16 F) and 29 15-month-olds (M = 15.60 months, ranging 14.20–17.82; 12 F). They were recruited from the greater Evanston, IL area and acquiring English as their first language, with no more than 25% exposure to another language. Caregivers completed the MacArthur Short Form Vocabulary Checklist: Level II (Form A) (Fenson et al., 1993) as well as a supplementary checklist that asked which of the familiar verbs used in this design were known by their infant (see Table 1). Another 24 participants were excluded and replaced due to fussiness (14), technical failure (8), or experimenter error (2). One 15-month-old (Informative condition) who was initially included in the analysis did not contribute data in any trials (due to track-loss); he was therefore excluded but not replaced.

2.2. Apparatus

A Tobii T60XL corneal-reflection eyetracker was used for stimulus presentation and data collection. The eyetracker has a sampling rate of 60 Hz, and a display size of 57.3 × 45 cm.

2.3. Materials (Fig. 1)

2.3.1. Visual stimuli

Each trial consisted of three phases: Preview, Dialogue and Test. In the Preview phase (6s), infants saw images of two objects (one animal, one artefact) presented side-by-side on the screen. In the Dialogue phase (9s), an abstract screensaver was displayed on the screen. In the Test phase (6s), the two images from the preview phase reappeared in the same left–right positions on the screen.

2.3.2. Auditory stimuli

Two native speakers of American English – one female and one male – produced the linguistic materials using child-directed speech.

2.3.3. Stimulus selection

We used vocabulary norms (Dale & Fenson, 1996) as a guide in selecting both the visual and linguistic materials. For the familiar trials, we selected target objects whose names are understood by at least 72% of 15-month-olds (nouns: *bird*, *bottle*, *cow*, *dog*, *horse*, *spoon*). For the unfamiliar trials, we selected objects whose names infants would not know (abstract sculptured artefacts and exotic animals). Finally, we introduced novel names for these objects in sentences containing familiar verbs that are understood by 66% of 15-month-olds (*cry*, *dance*, *drink*, *eat*, *look*, *sleep*).

2.4. Procedure (Fig. 1)

After completing the vocabulary checklists, caregivers accompanied their infants to a testing room. Infants were seated on the caregivers' lap approximately 60 cm from the monitor. Caregivers, who wore opaque glasses to prevent them from viewing the images on the screen, were instructed not to speak or point during the experiment. After a standard five-point eyetracking calibration routine, the

Table 1
Participant summary.

	Vocabulary		Looking times (s)			
			Familiar trials		Unfamiliar trials	
	MCDI	Known verbs	Mean (SD)	Min.	Mean (SD)	Min.
15 months	6.69	4.3	4.18 (1.39)	1.39	3.24 (1.78)	–
19 months	17.5	4.9	4.51 (1.17)	2.18	4.23 (1.46)	1.31

Note: MCDI represents the mean number of words (out of a total 89) that caregivers judged that their infants produced. Known Verbs represents the average number of verbs (out of the 6 included in this experiment) that caregivers of infants in the Informative condition judged that their infants comprehended.