Journal of Experimental Child Psychology 118 (2014) 27–40

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

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

Type of object motion facilitates word mapping by preverbal infants

Dalit J. Matatyaho-Bullaro [a,*], Lakshmi Gogate [b], Zachary Mason [a], Steven Cadavid [c], Mohammed Abdel-Mottaleb [c]

[a] Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY 10461, USA
[b] Department of Psychology, Florida Gulf Coast University, Fort Myers, FL 33965, USA
[c] Department of Computer Engineering, University of Miami, Coral Gables, FL 33124, USA

ARTICLE INFO

Article history:
Received 5 November 2012
Revised 19 September 2013
Available online 8 November 2013

Keywords:
Infant learning
Word learning
Word–object mapping
Lexical development
Intersensory perception
Synchrony detection

ABSTRACT

This study assessed whether specific types of object motion, which predominate in maternal naming to preverbal infants, facilitate word mapping by infants. A total of 60 full-term 8-month-old infants were habituated to two spoken words, /bæf/ and /wem/, synchronous with the handheld motions of a toy dragonfly and a fish or a lamb chop and a squiggly. They were presented in one of four experimental motion conditions—*shaking*, *looming*, *upward*, and *sideways*—and one *all-motion* control condition. Infants were then given a test that consisted of two mismatch (change) and two control (no-change) trials, counterbalanced for order. Results revealed that infants learned the word–object relations (i.e., looked longer on the mismatch trials relative to the control trials) in the shaking and looming motion conditions but not in the upward, sideways, and all-motion conditions. Infants learned the word–object relations in the looming and shaking conditions likely because these motions foreground the object for the infants. Thus, the type of gesture an adult uses matters during naming when preverbal infants are beginning to map words onto objects. The results suggest that preverbal infants learn word–object relations within an embodied system involving matches between infants' perception of motion and specific motion properties of caregivers' naming.

* Corresponding author. Address: Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY 10461, USA.
E-mail address: dalitjm@gmail.com (D.J. Matatyaho-Bullaro).

0022-0965/$ - see front matter
http://dx.doi.org/10.1016/j.jecp.2013.09.010

Introduction

The task of word learning is an arduous process for preverbal infants. Although by the end of the first year of life infants begin to assign meaning to words (Halliday, 1975) and say their first words (Benedict, 1979), word learning is by no means an easy task to accomplish. For infants to comprehend language, they must first learn to perceive the connection between the spoken word and the referent. This perceptual ability, also known as word mapping, is an essential building block for language comprehension and production (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Gogate, Walker-Andrews, & Bahrick, 2001; Golinkoff, Mervis, & Hirsh-Pasek, 1994; Huttenlocker, Haight, Bryk, Seltzer, & Lyons, 1991; Quine, 1960). But how exactly do infants come to learn that a word maps onto a specific referent? More specifically, when an adult names an object, how do infants disambiguate between the correct referent and different objects nearby?

For decades, it has been theorized that an infant maps words onto objects in spite of referential ambiguity within the communicative environment owing to innate constraints that humans are purportedly endowed with right from the start. As a case in point, Quine (1960) theorized that a novice speaker of any language (e.g., an infant) knows that a word refers to an object amid several other potential referents, despite referential ambiguity, because of innate constraints. More recently as well, researchers have theorized that innate constraints limit the number of possible referents that an infant will selectively attend to during word learning (Golinkoff et al., 1994; Markman, 1989). In these views, built-in constraints enable the infant to learn word–object relations despite referential ambiguity. For example, the poverty of stimulus argument predicts that it is only with a language acquisition device (LAD) that infants can learn word–object relations in an impoverished language environment (Pinker, 1995).

In contrast, in our view, similar to many others (Yoshida & Smith, 2007; Yu, Ballard, & Aslin, 2005), one way in which infants solve the word-mapping puzzle is by focusing on an adult's gestures with an object that the adult is naming. How infants disambiguate among potential and competing referents, therefore, can be addressed in part by focusing on research that delves into the gestural origins of word-mapping development (Gogate, Bahrick, & Watson, 2000; Gogate, Bolzani, & Betancourt, 2006; Gogate, Maganti, & Laing, 2013; Yoshida & Smith, 2007; Zukow-Goldring, 1997; Zukow-Goldring & Ferko, 1994). As a case in point, recent research suggests that mothers provide gestures, such as *shaking* and *looming* motions with a handheld object, more often than others when naming objects during play and that these motions predict preverbal infants' word-mapping success (Matatyaho & Gogate, 2008). To narrow in on this topic, in the current experimental study we examined whether an adult's use of these predominant motions during naming is causally related to word mapping by preverbal infants.

In the current article, the general hypothesis is that word-mapping development is an embodied process where "intelligence emerges in the interaction of an organism with an environment and as a result of sensory–motor activity" (Smith, 2005, p. 279). An important assumption underlying the embodied process is that word mapping emerges from perceptual development. The perception of visual, auditory, and intersensory properties from caregivers' naming can occur only when two systems interact—infants' perceptual mechanisms and caregivers' input during naming. More specifically, word-mapping development involves the infant's detection of invariant properties in caregivers' naming in the auditory and visual domains and across auditory–visual domains (Gogate & Hollich, 2010). Invariance detection is the process by which the perceptual system seeks to reduce uncertainty in the stimulus flux and seeks order amid change by attending selectively to stable patterns in the stimulus array (Gibson, 1969). In turn, by providing unimodal invariance (e.g., object motion or phonetic quality of utterance) and intermodal invariance (e.g., synchrony) and reducing uncertainty in the stimulus array for infants (Gibson, 1966), caregivers educate or scaffold infants' attention to salient aspects of verbal and gestural communication, including word–referent mappings (Matatyaho & Gogate, 2008; Zukow-Goldring, 1997). Thus, invariance detection is a mechanism by which infants attend to salient and relevant properties of caregivers' communication and serves as a perceptual gateway to the learning of word–object relations (Gogate & Hollich, 2010).