A perceptual advantage for onomatopoeia in early word learning: Evidence from eye-tracking

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A B S T R A C T

A perceptual advantage for iconic forms in infant language learning has been widely reported in the literature, termed the "sound symbolism bootstrapping hypothesis" by Imai and Kita (2014). However, empirical research in this area is limited mainly to sound symbolic forms, which are very common in languages such as Japanese but less so in Indo-European languages such as English. In this study, we extended this body of research to onomatopoeia—words that are thought to be present across most of the world's languages and that are known to be dominant in infants' early lexicons. In a picture-mapping task, 10- and 11-month-old infants showed a processing advantage for onomatopoeia (e.g., *woof woof*) over their conventional counterparts (e.g., *doggie*). However, further analysis suggests that the input may play a key role in infants' experience and processing of these forms.

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Introduction

A large body of recent evidence has consistently shown an advantage for iconicity—that is, forms that are symbolically linked to their meanings through seemingly non-arbitrary verbal or gestural cues—in language learning (Asano et al., 2015; Imai, Kita, Nagumo, & Okada, 2008; Lockwood, Dingemanse, & Hagoort, 2016). This is consistent across a range of populations using a wide spectrum of experimental designs. However, in infant research in particular, the stimuli used in these various experiments are not typical of the real-world language-learning experience. Most often, participants

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are tested on their ability to pair non-words with novel objects (e.g., Asano et al., 2015; Ozturk, Krehm, & Vouloumanos, 2013) or their success in learning novel non-words that are perhaps atypical of the native language in question (Imai et al., 2008). Therefore, although results suggest an inherent sensitivity to iconic sound–meaning correspondences across populations, it is difficult to extend the validity of these findings to our understanding of language learning in reality. In this study, we addressed this gap in the literature by testing whether young infants show a learning preference toward iconic words that are present in their native language. Eye-tracking was used to analyze infants' processing of onomatopoeia—a form of iconicity that is present in most, if not all, languages of the world (Hinton, Nichols, & Ohala, 1994) and that is considered in some accounts to be an example of "true" sound symbolism (Lyons, 1968; Sapir, 1970).

Over the last decade, an increasing body of research has considered whether non-arbitrariness in language might facilitate learning. In contradiction with the Saussurean notion of "the arbitrariness of the sign" (de Saussure, 1962), it has been posited that language may be more easily acquired across forms that are somehow iconically connected to their meaning (Imai & Kita, 2014). This advantage has been demonstrated in signed languages (Vinson, Cormier, Denmark, Schembri, & Vigliocco, 2008), where signs rated as more iconic tend to be acquired earlier than less iconic signs. Furthermore, studies of both adults and toddlers have shown a learning advantage for sound symbolism in spoken language; non-Japanese speakers learn sound symbolic Japanese adjectives (Lockwood et al., 2016) and novel verbs (Imai et al., 2008) more successfully than non-sound symbolic words. The established evidence appears to support Imai and Kita's (2014) sound symbolism bootstrapping hypothesis given that learners do indeed appear to draw on iconicity to facilitate language learning. However, the extent to which different languages show iconic form–meaning correspondences is still unclear; thus, the broader relevance of these findings to language acquisition in general should not be taken for granted.

Certainly, non-arbitrariness is identifiable across many languages. Onomatopoeia (e.g., *woof woof, bang*) probably constitute the most obvious and common form of iconicity in language as a whole, but ideophones (e.g., *glisten, jingle*) and mimetics (found in Japanese, for example *gorogoro* 'movement of a heavy object' and *pika* 'a flash of light'; Kita, 1997) also contribute to iconicity in the linguistic system, albeit in varying proportions across languages. Typically, the research in this area has focused on sound symbolism, or what Ohala (1984) termed the "frequency code," that is, a symbolic relationship between the formant values and vocal tract size in the production of a specific segment and its corresponding meaning. Vowels and consonants with a smaller vocal tract size, and thus higher f0 such as /i/ and /k/, refer to small, sharp, or rapid referents, whereas those produced with a larger space in the vocal tract and lower f0, such as /u/ and /b/, relate to large, slow, or heavy referents (Hinton et al., 1994). Mimetics are also derived from these correspondences (Ivanova, 2006); Kita (1997) claimed that "in [the] realm of mimetic forms, phonemes seem to have meanings of their own" (p. 380).

A multitude of experiments have used these correspondences, known as the "bouba/kiki" effect (Köhler, 1970), to test effects of sound symbolism. In this paradigm, round and spiky shapes are presented with either congruent or incongruent "round" and "spiky" words corresponding to labels such as *bouba* and *kiki,* respectively. Evidence shows that sensitivity to these correspondences is consistent across speakers of different languages and age ranges (Davis, 1961) as well as with both novel and familiar objects (D'Onofrio, 2014). It has been suggested that this sensitivity to sound–symbol correspondences might be an innate aspect of primate cognition (Ozturk et al., 2013) given that infants as young as 4 months match congruent sound–shape correspondences. The suggestion that non-arbitrary form–meaning correspondences may be innately specified is supported by findings from Bohn, Call, and Tomasello (2016), who showed that even chimpanzees draw on iconic gestures when learning associations between form and meaning. However, the chimpanzees were much slower to learn than 4-year-old children, who were consistent in drawing on iconicity in their comprehension of novel gestures.

Although these studies may demonstrate important findings regarding the nature of our sensitivity to sound symbolic congruence between form and meaning, it is difficult to extend their conclusions to real-world situations of learning. To what extent do such form–meaning correspondences occur across languages in general, and are these correspondences ubiquitous in supporting learning regardless of the language being acquired? Recent literature has helped to broaden our understanding of these