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Beat gestures improve word recall in 3- to 5-year-old children

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ABSTRACT

Although research has shown that adults can benefit from the presence of beat gestures in word recall tasks, studies have failed to conclusively generalize these findings to preschool children. This study investigated whether the presence of beat gestures helps children to recall information when these gestures have the function of singling out a linguistic element in its discourse context. A total of 106 3- to 5-year-old children were asked to recall a list of words within a pragmatically child-relevant context (i.e., a storytelling activity) in which the target word was or was not accompanied by a beat gesture. Results showed that children recalled the target word significantly better when it was accompanied by a beat gesture than when it was not, indicating a local recall effect. Moreover, the recall of adjacent non-target words did not differ depending on the condition, revealing that beat gestures seem to have a strictly local highlighting function (i.e., no global recall effect). These results demonstrate that preschoolers benefit from the pragmatic contribution offered by beat gestures when they function as multimodal markers of prominence.

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Introduction

In everyday communication, speakers use hand and body gestures to accompany speech. Beat gestures are a type of manual non-representational gesture that co-occurs with speech and functions as a visual highlighter of information. In contrast to a representation gesture, a beat gesture does not add propositional content to a given utterance (Kendon, 1995; McNeill, 1992, 2005) but rather is used to mark "the word or phrase it accompanies as being significant . . . for its discourse pragmatic content" (McNeill, 1992, p. 15). Beat gestures have been defined as rhythmical movements of the hands that are timed together with prosodic prominence in speech (Loehr, 2012; Shattuck-Hufnagel, Ren, Mathew, Yuen, & Demuth, 2016). Typically, the movements of hand gestures occur together with head and eyebrow movements, which together signal the privileged status of a given piece of discourse in a multimodal fashion (see, e.g., Cartmill, Demir, & Goldin-Meadow, 2012; McNeill, 1992). In our study, we investigated whether the use of beat gestures as a multimodal marker of prominence in a significant discourse context helps to improve language recall abilities during early childhood.

Research on gestures has extensively reported the beneficial results of representational gestures for various linguistic abilities such as the improvement of narrative skills between the ages of 5 and 6 years (Demir, Fisher, Goldin-Meadow, & Levine, 2014) and the comprehension of complex syntactic abilities by 3- and 4-year-olds (Theakston, Coates, & Holler, 2014). In parallel with this, the use of representational gestures has been shown to have cognitive benefits at different stages of children's cognitive development. For example, the benefits of representational gestures have been proven for 4- and 5-year-olds in recalling words in a first language (Church, Kelly, & Lynch, 2000; So, Chen-Hui, & Wei-Shan, 2012; Thompson, Driscoll, & Markson, 1998), for 5-year-olds in learning words in a second language (Tellier, 2008), and for 9-year-olds in solving arithmetic operations (Goldin-Meadow, Cook, & Mitchell, 2009). By contrast, the potential beneficial effects of beat gestures, which by definition do not carry semantic meaning, has not been investigated in depth, particularly in development.

Adults seem to benefit from observing beat gestures when asked to recall lexical information in a first language (Kushch & Prieto, 2016; So et al., 2012) or to learn novel words in a second language (Kushch, Igualada, & Prieto, 2015). These data suggest that beat gestures highlighting a specific target in the discourse benefit the recall and learning of that target, although less is known about the impact of this highlighting function of beat gestures on the processing of the co-occurring discourse information.

What underlies the possible cognitive advantage offered by beat gestures? Interestingly, several studies measuring event-related brain potentials (ERPs) in adults have shown neural evidence of the activation of language-related areas when beat gestures are perceived, suggesting that they have an attentional effect (Biau & Soto-Faraco, 2013; Holle et al., 2012; Wang & Chu, 2013). The functional neuroimaging study by Biau, Moris Fernandez, Holle, Avila, and Soto-Faraco (2015) showed that different brain areas were activated depending on whether speech was synchronized with beat gestures or with other non-gestural stimuli (i.e., disks/dots moving on a screen). Whereas beat gestures activated language-related areas of the brain, non-gesture stimuli activated visual perception areas. Hubbard, Wilson, Callan, and Dapretto (2009) found that beat gestures, and not nonsense movements or still images, enhanced auditory processing of speech. All these data support the idea that beat gestures can be distinguished from other potential visual highlighters because of their direct integration in the language system rather than a more general visual perceptual system.

Moreover, from a linguistic point of view, beat gestures have been shown to serve a focus-marking function (Jannedy & Mendoza-Denton, 2005; Loehr, 2012; Shattuck-Hufnagel et al., 2016; Yasinnik, Renwick, & Shattuck-Hufnagel, 2004). In addition, adult listeners have shown an increase in prominence perception when words are produced together with hand gestures (Krahmer & Swerts, 2007) and head/facial beat gestures (Moubayed, Beskow, & Granström, 2010). Apart from the above-mentioned physiological and linguistic evidence, the positive cognitive effects of beat gestures are consistent with the embodied cognition framework, which underlines the relevance of the body movements and multimodal supporting channels in cognition and in favoring memory traces (see Paivio, 1990; see also Barsalou, 2008; Barsalou, Simmons, Barbey, & Wilson, 2003).