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Getting to the elephants: Gesture and preschoolers' comprehension of route direction information

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ABSTRACT

During early childhood, children find spatial tasks such as following novel route directions challenging. Spatial tasks place demands on multiple cognitive processes, including language comprehension and memory, at a time in development when resources are limited. As such, gestures accompanying route directions may aid comprehension and facilitate task performance by scaffolding cognitive processes, including language and memory processing. This study examined the effect of presenting gesture during encoding on spatial task performance during early childhood. Three- to five-year-olds were presented with verbal route directions through a zoo-themed spatial array and, depending on assigned condition (no gesture, beat gesture, or iconic/deictic gesture), accompanying gestures. Children presented with verbal route directions accompanied by a combination of iconic (pantomime) and deictic (pointing) gestures verbally recalled more than children presented with beat gestures (rhythmic hand movements) or no gestures accompanying the route directions. The presence of gesture accompanying route directions similarly influenced physical route navigation, such that children presented with gesture (beat, pantomime, and pointing) navigated the route more accurately than children presented with no gestures. Across all gesture conditions, location information (e.g., the penguin pond) was recalled more than movement information (e.g., go around) and descriptive information (e.g., bright red). These findings suggest that speakers' gestures

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accompanying spatial task information influence listeners' recall and task performance.

Introduction

Nonverbal behaviors (i.e., gestures) offer a way for young children to convey and comprehend information beyond their current vocabulary (e.g., spatial information; McNeil, Alibali, & Evans, 2000; Morford & Goldin-Meadow, 1992; So, Sim Chen-Hui, & Low Wei-Shan, 2012; Thompson & Massaro, 1994). Although children differ in word learning abilities and language background (i.e., exposure to one or more languages on a regular basis), language and gesture proficiency typically increase throughout childhood to form a single integrated communication system (Adams, Bourke, & Willis, 1999; Capirci & Volterra, 2008; Goldin-Meadow, 1998; Menyuk, 1964; O'Reilly, 1995; Rowe, Silverman, & Mullan, 2013; Sekine, 2009). If gestures offer a way for young children to convey and comprehend spoken messages, then it is important to examine the influence of presenting different types of gesture accompanying a spoken message on task performance.

Types of gesture

Gestures can reflect real-world objects and communicate some aspects of thought more effectively than words (Cameron & Xu, 2011; Church, Garber, & Rogalski, 2007; Kendon, 1972; Kendon, 2004; McNeill, 1992; Tversky, 2011). For example, iconic gestures, such as pantomiming the way a dog runs, can convey complex movement characteristics through size and hand shape (Cassell, Kopp, Tepper, Ferriman, & Striegnitz, 2007). Pointing gestures, also called deictic gestures, convey position, movement, and directional information to listeners (Cassell et al., 2007). Iconic–deictic gestures combine aspects of both iconic and deictic gestures, such that hand shape and trajectory depict concrete referent characteristics as well as direction or movement information within the same gestures (Cassell et al., 2007). For example, pantomiming a steep downward sloping road that curves accompanying dialogue about travel conveys concrete path characteristics as well as movement information. Metaphoric gestures accompany explanations of abstract concepts. For example, pantomiming "give-and-take" accompanying dialogue about relationships conveys abstract concept characteristics (Allen, 2003; McNeill, 1992). Conversely, beat gestures are simple rhythmic hand movements that go along with the rhythm of speech and contain no apparent semantic content but may indicate other communicative aspects such as emphasis (Allen, 2003; McNeill, 1992). The integration of speech and gesture enriches communication and grounds language and thought processes in the environment (Goldin-Meadow, Nusbaum, Kelly, & Wagner, 2001; Hostetter & Alibali, 2008; Tversky, 2011).

The grounding of language in our sensory experience through gesture suggests two possible pathways whereby gesture might benefit listeners (Hostetter & Alibali, 2008). Gestures accompanying spoken messages provide young listeners with a scaffold for language learning during development by illustrating concepts, conveying additional information, and providing additional cues (Sauter, Uttal, Alman, Goldin-Meadow, & Levine, 2012). As such, speakers' gestures may make a greater contribution to listener comprehension for complex, ambiguous, or challenging spoken messages relative to listeners' language skills (Alibali & Hostetter, 2010; McNeil et al., 2000; Morford & Goldin-Meadow, 1992). Therefore, during language development, when vocabulary and adult-like language skills have not yet been achieved, the presence of gesture at encoding of spoken messages may act to disambiguate unfamiliar or novel terms used by speakers. Indirectly, these gestures may reduce the information processing demand of language comprehension, thereby increasing cognitive resources available for other processes, including memory (Cameron & Xu, 2011).

In addition, embodied cognition suggests that processing information conveyed in speech and gesture activates the same perceptual and motor states involved in gesture production, thereby creating a