



Brief article

Mothers modulate their gesture independently of their speech



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ABSTRACT

Do speakers alter their gestures independently of speech during communication? We addressed this question by examining how mothers modulate their speech and gestures when communicating about safety with their children. Mothers and their 8- or 10-year-old children viewed and discussed a series of images depicting another child engaged in a variety of physical activities with the goal of deciding on a joint safety rating for each image. When mothers perceived a situation as more unsafe than their child did, they conveyed more information in both speech and gesture. Importantly, as this disparity between mother and child ratings grew, mothers systematically increased their rate of gesturing when communicating dangerous information and decreased their rate of gesturing when communicating non-dangerous information. These findings show that speakers selectively alter their gestures for their listeners, demonstrating that speech and gesture need not be modulated in parallel.

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1. Introduction

Speech and gesture are a highly integrated system for communication (Kendon, 2004; McNeill, 2013). During language production, characteristics of speech affect the form of accompanying gesture (Kita & Özyürek, 2003) and characteristics of gesture affect the accompanying speech (Alibali & Kita, 2010; Bangerter, 2004; Graham & Heywood, 1975). Yet despite the tight coupling of speech and gesture, speakers' gestures are known to communicate unique information, including perceptual-motor and manner information not readily available in speech (Cassell, McNeill, & McCullough, 1998; Cook & Tanenhaus, 2009). If speakers' gestures can communicate information not present in speech, then speakers might selectively communicate information through each modality. At present, little is known about how speakers selectively alter their gesture for their listener.

Many prominent gesture production theories do not consider the communicative needs of the listener but instead posit that gesture emerges from imagistic characteristics of a speaker's message. For example, growth point theory (McNeill, 1992) claims that the core of an utterance (a growth point) contains both linear-symbolic and global-imagistic information that gets expressed in speech and in gesture, respectively. Similarly, the Sketch (De Ruiter, 2000) and Interface models (Kita & Özyürek, 2003) claim that speakers distribute information into each modality, with visuospatial information expressed through gesture. By these accounts speakers' gestures emerge as a result of characteristics of the speaker's message – messages with more imagistic content lead to increased gesture production. Despite their descriptive power, these theories do not explicitly predict that factors beyond the content of the message may affect communication in speech and gesture.

One recent theory specifically includes a mechanism for modulation of gesture production that is separate from the content of the message. The Gesture as Simulated Action

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(GSA) framework (Hostetter & Alibali, 2008) posits a gesture threshold that can be flexibly altered by a speaker's past experiences and the speaker's perception of the listener's needs. Motor activity exceeding a speaker's current gesture threshold necessarily leads to gesture production, whereas gestures are not produced when activation is below the threshold. The existence of a gesture threshold has been supported by evidence that gesture is modulated in response to the communicative context (e.g., Holler & Stevens, 2007).

Prior research has found that speakers gesture at a higher rate when communicative demands are higher for a given listener. When speakers believe their description is highly relevant to their listeners (listeners will act on the information), they produce three times as many representational gestures compared with when the description is less relevant (Kelly, Byrne, & Holler, 2011). Moreover, when speakers know that their listeners are uninformed about a topic, speakers gesture more (Holler & Wilkin, 2009) and produce gestures that are rated as more complex and informative (Gerwing & Bavelas, 2004). Thus, speakers alter the gestures produced based on their listener's needs. However, it has yet to be tested whether the threshold can be modulated dynamically *within* a communicative context.

Moreover, these findings cannot distinguish selective adjustment of gestures with relevant information from a general increase in one gesture type. To examine this, and to investigate the specificity of changes in gesture as a function of changes in listeners' perspective, requires a design in which the needs of the listener vary within a context, making specific types of information more or less relevant. If speakers specifically and dynamically adjust their gesture thresholds for their listener, and not as a general function of the communicative context or task demands, then speakers should increase gestures with information that is relevant for the listener, and should simultaneously decrease gestures that are less relevant for the listener.

We examined this possibility using a naturalistic design where the needs of the listener were constantly changing. This enabled a within-dyad analysis of gesture rate; prior research has only found evidence for changes in gesture rate between dyads (Galati & Brennan, 2013; Holler & Stevens, 2007; Holler & Wilkin, 2009; Kelly et al., 2011; Parrill, 2004). O'Neal and Plumert (2014) developed a task that allows for changing relevance of information within a single dyad in a study investigating parent–child conversations about safety. Mothers and their 8- or 10-year-old children viewed and rated images of another child engaged in physical activities that varied in safety (e.g., cooking on a hot stove, climbing up on a counter). Mothers and children first individually rated the safety of the images and then jointly discussed and rated the images. During the conversations, mothers and children justified their safety ratings with references to dangerous information (e.g., “That stove is very hot.”) and references to non-dangerous information (e.g., “His arm seems high enough above the stove.”). References were further broken down into *features* (observable aspects of the activity) and *outcomes* (potential results of the activity). Because

mothers and children agreed and disagreed across the images under consideration, communicative demands changed across trials. Moreover, when mothers and children disagreed about the safety rating, mothers frequently brought children around to their way of thinking – convincing children that some images were more dangerous and that others were less dangerous. Given this, we might expect to see trial-to-trial variation in references to dangerous and non-dangerous information in speech and gesture. Moreover, depending on the mother's perspective relative to her child's, we might expect different forms of information to be more or less relevant for communication on a given trial. Thus, this task was ideal for testing the hypothesis that speakers alter their gestures dynamically in response to specific informational needs of their listener.

We recoded and analyzed the video data from O'Neal and Plumert (2014) to test whether mothers selectively modulate their gestures for dangerous and non-dangerous types of safety information relative to their child's perspective. We predicted that when the child's rating deviated from their mother's, mothers would highlight relevant information in gesture. Thus, we expected mothers to selectively increase their gesture rate for some information and not for other information – highlighting danger when a child thinks a situation is more safe than the mother does, and highlighting safety when a child thinks a situation is more dangerous than the mother does. If mothers do differentially adjust their gestural communication depending on the perspective of the child and the type of information – and do so independently of changes in speech – this would provide strong evidence that gesture rate is not simply a function of the global communicative context. Instead, this would suggest that speakers can dynamically alter their gesture threshold in response to their listener's changing needs, and in turn can adjust the specific information that they communicate through gesture. Such evidence would require modification of existing theories of gesture production.

2. Method

2.1. Participants

The participants were 66 mother–child dyads from O'Neal and Plumert (2014). There were 30 eight-year-olds ($M = 8$ years, 10 months) and 36 10-year-olds ($M = 10$ years, 9 months).

2.2. Materials

The stimuli consisted of two matched sets of 12 test and two familiarization images. Each set contained images of either a male or female child actor (age 10) performing the same activities. Participants viewed the images on a 46-in (116.8 cm) NEC MultiSynch p461LCD touchscreen monitor. A four-point Likert scale just below the image included choices labeled “very safe,” “kind of safe,” “kind of unsafe,” and “very unsafe.” Participants sat facing the touchscreen and used a stylus to select the ratings. Two video cameras, one positioned behind the dyad and the other positioned to the side, recorded each session.

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