

Iconic gesture production during the conceptualization and formulation of speech

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“Gesture and speech are operations that have been connected *within*. This is the sense in which they are parts of a single process” (McNeill, 1992, p.33). If gestures and speech truly are parts of a single process, then gesture production may play a role in each of stages of speech production. According to Levelt (1989), three stages are involved in speech production: conceptualization, formulation, and articulation. One hypothesis that suggests an association between gesture production and two of these stages is the Information Packaging hypothesis. This hypothesis suggests that gestures play a functional role both in the conceptual planning and the formulation of speech (Alibali et al., 2000). Long-term memory resources are thought to be necessary for *conceptualization* and verbal working memory resources are thought to be necessary for *formulation*. The purpose of this study was to explore the role of iconic gestures in the conceptualization and formulation stages of speech production by assessing the relationship between iconic gesture production and memory using a narrative task.

Thirty adults participated in this study. Participants were asked to watch two short cartoons and to retell narratives from these videos as they were videotaped. Participants also completed a standardized working memory assessment designed to measure verbal short-term memory and verbal working memory capacity.

In order to investigate the relationship between iconic gesture production and the *conceptualization* stage of speech production, long-term memory was assessed. Narrative length is thought to be strongly reflective of memory encoding (Beaudreau, 2005). In the current study, participants were asked to watch cartoons and retell the stories, thus relying on visual information that was encoded in long-term memory. Narrative length was therefore used as a proxy measure of visuospatial long-term memory.

In order to investigate the relationship between iconic gesture production and the *formulation* stage of speech production, a Verbal Memory Manipulation Index (VMMI) was computed for each participant. The manipulation capacity of verbal working memory is thought to be responsible for the ordering and assembly of verbal information during the formulation stage of speech production. In order to isolate this manipulation capacity, a subtraction was conducted wherein verbal short-term memory scores were subtracted from verbal working memory scores. VMMI scores were computed for each participant.

Correlational analyses revealed that iconic gesture rate was significantly associated with narrative length ($r=0.563^{**}$) and VMMI ($r=0.424^{*}$).

Individuals relating longer narratives tended to use a higher rate of iconic gestures. Since narrative length was our proxy measure of visuospatial long-term memory, this finding was interpreted as lending support to the role of iconic gesture production in the conceptualization of speech. Individuals with stronger VMMIs tended to have higher gesture rates. This was interpreted as lending support to the role of iconic gesture production in the formulation of speech.

In conclusion, the results of this study lend support to the Information Packaging hypothesis and provide suggestive evidence that iconic gesture production plays a functional role in the conceptualization and the formulation of speech.