

Handling noise: The influence of verbal working memory interference upon iconic gesture production

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Gesture production

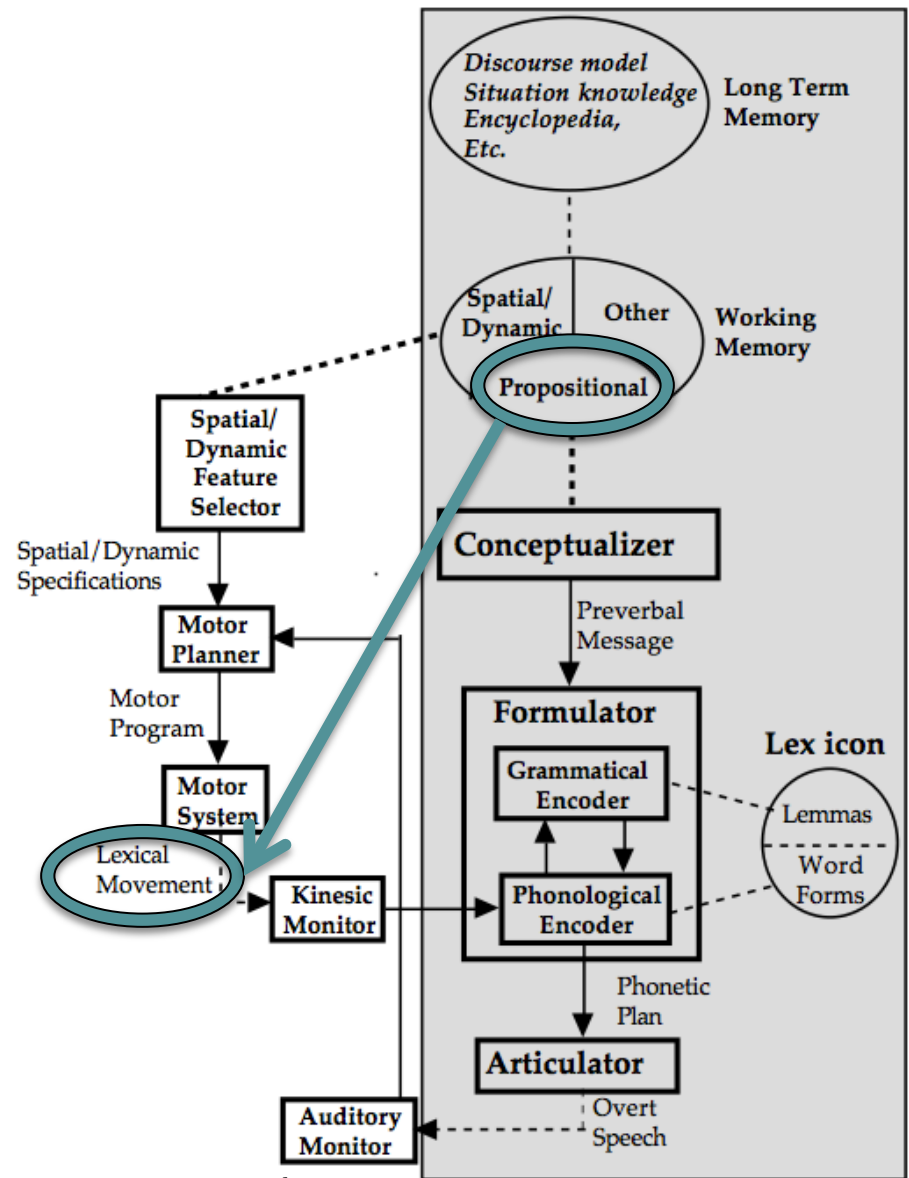
- “Although gestures are ubiquitous, they are not produced equally in all contexts or by all speakers” (Melinger & Kita, 2007, p. 473).



Verbal working memory and gesture production

Verbal working memory (VWM): responsible for the temporary storage and manipulation of language and sound information (Baddeley, 2000; 2003).

According to the *Lexical Gesture Process Model* proposed by Krauss et al. (2000), verbal working memory may be associated with iconic gesture production.



Verbal working memory

- **Two basic approaches have been used to examine the role of VWM in language processing** (Caplan & Waters, 1999):
 - 1) Examining the influence of individual differences in VWM **capacity**
 - 2) Examining the influence of VWM **load**

Verbal working memory **capacity** and **load** may be important predictors of iconic gesture production.



VWM capacity and gesture production

- In a study by Hostetter and Alibali (2007), participants with low levels of phonemic fluency (a measure of verbal skill) tended to produce more representational gestures than individuals with average levels of phonemic fluency.
- In a study by Smithson and Nicoladis (in press), iconic gesture rate in a narrative task was negatively associated with verbal working memory capacity.



VWM load and gesture production

- **Load on conceptualization:** Increasing the load on conceptualization is associated with an increase in gesture production (Melinger & Kita, 2007)
- **Speech rate:** Verbal working memory load may be increased when individuals speak quickly (Melinger & Kita, 2007).
- **Auditory interference:** Auditory interference may be used to increase the load on verbal working memory, since the concurrent audition of sound can interfere with information processing in verbal working memory (Smith, Wilson, & Reisberg, 1995).



This study

- The purpose of this study was to investigate whether verbal working memory **capacity** (as measured by verbal short-term memory and verbal working memory) and **load** (as measured by speech rate and auditory interference) are unique predictors of iconic gesture production.

Participants and method

Fifty-nine adult participants (20 males and 39 females):

- (1) Watched two short cartoon clips alone in a testing room
- (2) Relayed the stories in narrative form to an experimenter while being videotaped. Participants were randomly assigned to one of three conditions for this narrative task:
 - a) **Control group:** no auditory interference was used
 - b) **Simple Auditory (SA):** a simple beeping sound was played throughout the retelling
 - c) **Complex Auditory (CA):** a complex beeping sound was played throughout the retelling
- (3) Completed a standardized working memory assessment called the Automated Working Memory Assessment (Alloway, 2007)

Method continued

- Speech was transcribed and iconic gestures were coded.
 - **Iconic gesture rate:** # of iconic gestures/word tokens x 100
 - **Speech rate:** word tokens/seconds
- Participants did not differ significantly across groups with respect to verbal short-term or verbal working memory capacity.
- Participants rated the Complex Auditory distractor as significantly more complex than the Simple Auditory distractor.

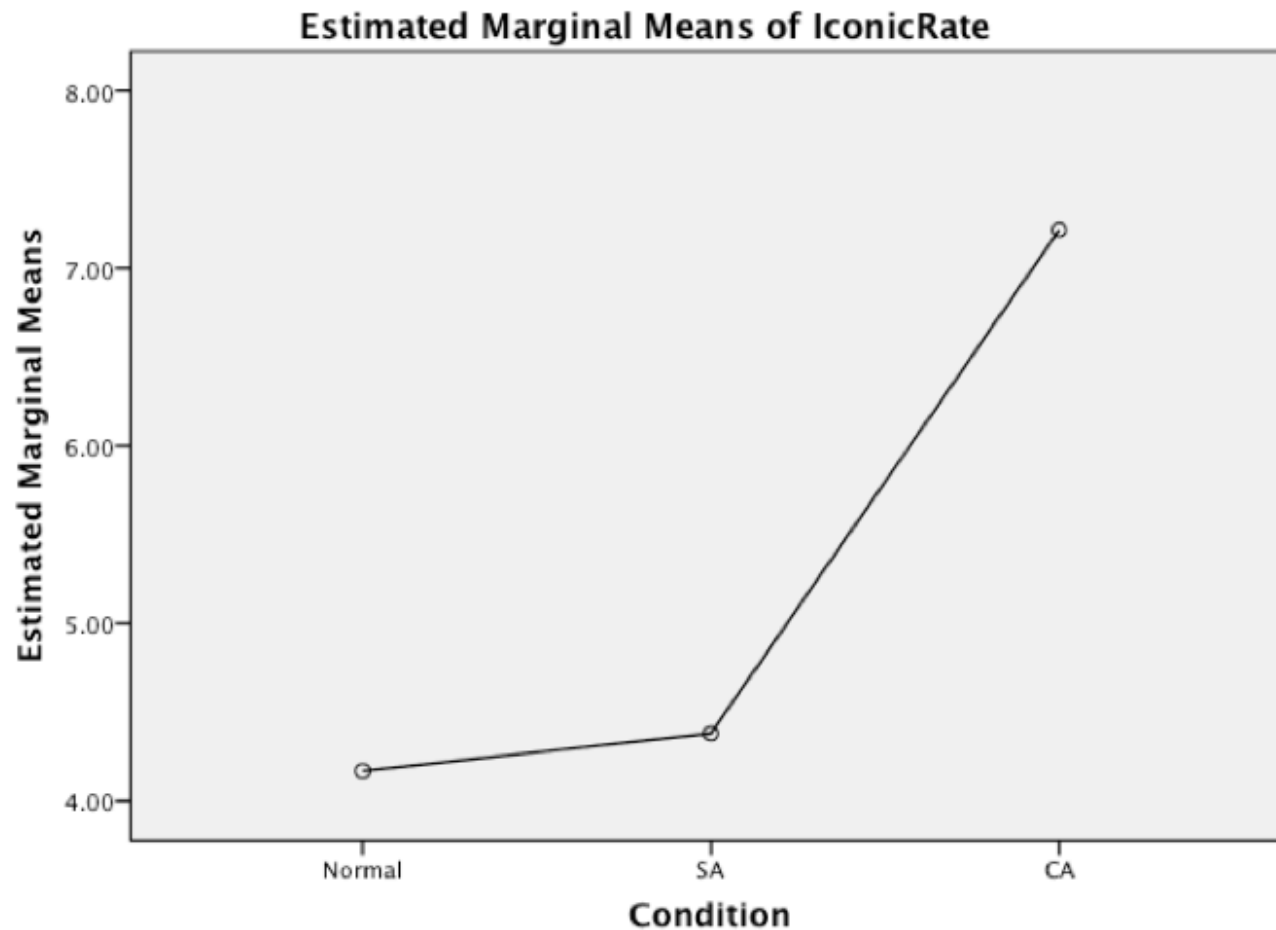
Results

- A forward multiple linear regression analysis included the following predictors of iconic gesture production:
 - verbal short-term memory
 - verbal working memory
 - speech rate
 - experimental condition
- Speech rate and experimental condition explained a significant amount of the variability in iconic gesture rate [Adjusted $R^2 = 0.243$, $F(2, 56) = 10.317$, $p < 0.001$].

Results

- It was also of interest to determine how iconic gesture rate differed across the conditions. An ANCOVA was conducted (using speech rate, verbal short-term memory and verbal working memory as the covariates).
- ANCOVA:
 - This analysis revealed significant differences, ($F(2, 53) = 4.467, p = 0.016, \eta_p^2 = 0.144$)

Results



Covariates appearing in the model are evaluated at the following values: SMEAN(SpeechRate) = 2.8360, SMEAN(VerbalWM) = 17.2414, SMEAN(VerbalST) = 36.3571



Discussion

- **Two measures of verbal working memory load predicted iconic gesture use:**
 - Speech rate:** a reflection of internally driven verbal working memory load.
 - Auditory interference:** a reflection of externally driven verbal working memory load.
- These results suggest that it is not verbal working memory capacity per se, but rather the load that is placed upon these resources (both internally and externally) that most strongly predicts individual differences in iconic gesture use.



Thank you for listening!