

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

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Verbal working memory temporarily maintains and manipulates sound and language information (Baddeley, 2003). This component of working memory is thought to play an important role in speech formulation (Baddeley, 2003; Krauss, Chen, & Gottesman, 2000). Previous research has demonstrated that iconic gesture use is negatively associated with verbal working memory resources, suggesting that iconic gestures may facilitate the formulation of speech (Smithson & Nicoladis, under review). Gesture restriction is associated with a decrease in speech rate, providing further evidence for this claim (Morsella & Krauss, 2004). Whether or not verbal working memory *interference* influences iconic gesture production has yet to be investigated.

The purpose of this study was to investigate whether verbal working memory interference leads to an increase in iconic gesture production. The concurrent audition of sound and language information has previously been shown to interfere with information processing in verbal working memory (Smith, Wilson, & Reisberg, 1995). Sixty participants watched two short cartoon clips alone in a testing room and 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: (1) Control group: no auditory interference was used, (2) Simple Auditory (SA): a simple beeping sound was played throughout the retelling, (3) Complex Auditory (CA): a complex beeping sound was played throughout the retelling. On a complexity scale (1=very simple and 10=very complex), participants rated the CA distractor ($M=5.85$, $SD=1.77$) as more complex than the SA distractor ($M=3.65$, $SD=1.87$). After the narrative retelling, participants completed a standardized working memory assessment. Speech was transcribed and iconic gestures were coded. Values more than two standard deviations above or below the mean were considered to be outliers and were removed from the analyses. Participants did not differ significantly across groups with respect to their verbal short-term or verbal working memory capacities.

Results indicated that iconic gesture production was correlated with speech rate in the control, SA, and CA conditions ($r=0.587^*$, $r=0.538^*$, $r=0.450^+$, respectively) ($^*=p<0.05$, $^+=p<0.07$). An ANCOVA was therefore conducted (using speech rate as the covariate) in order to determine whether iconic gesture production differed across the experimental conditions while statistically controlling the effects of speech rate upon iconic gesture production. This analysis revealed significant differences, ($F(2, 47)=6.83$, $p=0.002$, $\eta^2=.225$). Pairwise comparisons revealed that participants in the CA condition ($M=7.14$, $SE=0.78$) had significantly higher iconic gesture rates than participants in the control condition ($M=2.97$, $SE=0.92$) and that participants in the CA condition ($M=7.14$, $SE=0.78$) had significantly higher iconic gesture rates than participants in the SA condition ($M=4.36$, $SE=0.77$).

The results from this study demonstrate that verbal working memory interference results in an increase in iconic gesture use. Additionally, the complexity of the auditory stimulus influences the strength of the verbal working memory interference effect. In combination with previous research demonstrating a negative association between verbal working memory capacity and iconic gesture production (Smithson & Nicoladis, under review), this study provides converging and suggestive evidence that iconic gestures enhance verbal working memory processing.

Keywords: iconic gestures, verbal working memory, speech rate, narratives, interference effects