

# Intersubjectivity as a Basis for Gesture Production

Mitchell J. Nathan (mnathan@wisc.edu), David A. Havas (dahavas@wisc.edu),  
and Chelsea V. Johnson (cvjohnson@wisc.edu)

University of Wisconsin  
Madison, WI 53706 USA

**Keywords:** Embodied cognition; gesture production.

## Motivation and Statement of the Problem

There is considerable debate about whether gestures index mental states (Goldin-Meadow, 2003), reflect processes of lexical access (Krauss, 1998), or are primarily used communicatively (Alibali, Heath & Myers, 2001). Recent advances in Social Neuroscience shed light on the mechanisms that determine social, affective, and cognitive behavior and development. These advances support an account of gesture production in which the processes that mediate gesture also help to maintain *intersubjectivity*, or common ground for social communication (Nathan, in press). Intersubjectivity (IS) is established through the use of shared objects, including perceptually simulated objects and reified signs. We argue this account also provides the basis for a unified theory of gesture production.

## Object Use and Gesture Production

Social understanding involves sensorimotor simulation of the meanings communicated between participants (Glenberg, 1997; Havas, Glenberg & Rinck, in press), and understanding is achieved when those simulations are coordinated (e.g., Pickering & Garrod). Coordination is facilitated by mutually available objects, events and language. Studies of learning through imitation as well as the comprehension of *observed* actions and emotions reveal that participants' (both primates and humans) motoric and emotional processes are activated by observing the actions and emotions of others (Rizzolati et al., 2001), by placing them in intersubjective relation to our own prior actions and feelings through empathetic responses.

## Empirical Predictions and Method

Math teachers (N=6) can alter their amount of gesture production when directed to enhance and inhibit its use,  $F(2,20)=107.60$ ,  $p<.001$  (Hostetter et al., 2006). A re-examination of these teacher gesture data, suggests an interrelation between gesture production and object directed (OD) behavior such that: (1) gestures will be in greater evidence when teachers' instructional speech during the baseline condition is OD; and that (2) OD speech will increase significantly when teachers are directed to enhance their gesturing, and will drop significantly when they are told to inhibit gesture use. The basis of these predictions is that the empathetic system that mediates gesture production during communication also mediates OD action and perception in service of establishing IS through empathetic reactions among interlocutors.

## Results

There was significantly more OD than non-OD speech, *paired-t*(10)=4.8,  $p<.001$ . As predicted, there was more

gesturing by teachers when their accompanying speech was OD,  $F(1,107)=82.2$ ,  $MS=1704.1$ ,  $p<.001$ . We also found the predicted Speech Type by Condition interaction. The OD advantage for gesture activity is reliably related to the gesture condition,  $F(2,107)=25.6$ ,  $MS=183.1$ ,  $p<.001$ . This suggests instructions to enhance or withhold gesture also mediate use of OD and non-OD speech.

A planned contrast analysis of utterance data was used to test the hypothesis that the pattern of results will show (1) an overall greater incidence of gesture during OD v. non-OD speech, and (2) that this effect will be greatest in the enhanced gesture condition and weakest in the inhibit condition. The planned contrast showed that the pattern of results reliably follows the pattern predicted by our two hypotheses about the incidence of gestures,  $t(12)=12.0$ ; with a very high degree of fit of the data to the hypothesized pattern,  $r_{contrast}=0.98$ .

## Conclusions and Discussion

We propose that both communicative and lexical functions of gesture can be explained within a common framework that focuses on IS. Gestures and OD speech help to establish shared states among interlocutors. Actions and OD behavior help people directly understand one another because witnessing or simulating actions evoke the internal states we would occupy were we to perform these actions ourselves. OD behaviors that succeed when interlocutors are present may be co-opted to fulfill the role of individual thinking such as lexical access and planning that may occur outside of the view of others. Behaviors that foster IS also assist in word choice and articulating private thoughts, appropriating *intersubjective* processes for *intrasubjective* purposes.

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