

# Nonverbal Communication Analysis for Collaborative Environments

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## ABSTRACT

In many recent studies, researchers have found that technology supporting collaboration and interpersonal communication must feel or seem natural to the users in order to be successful. Many of the studies on natural collaborative tools are based on specific needs or contexts such as tabletop displays, walk-in displays, and virtual humans. We, however, are interested in building tools that are less context specific and could inform the creation of collaborative technologies across several contexts. We began this process by looking at different types of nonverbal behavior specifically used during interpersonal communication. Such behaviors are interpersonal space, body orientation, synchronous/mirroring movement, and matching/call-and-response movement. Using these behaviors, we are able to 1. Make specific collaborative tools that feel natural to users, and 2. Help guide users toward collaborative goals by analyzing their nonverbal behavior in real time and giving them audio/visual feedback on how close they are to reaching their goal.

The first system we developed to facilitate nonverbal communication is called *Handjabber*. *Handjabber* is an interactive audio/visual environment designed for two people. With the use of motion capture technology, we are able to analyze the two types of participants' nonverbal behaviors: interpersonal space and body orientation. By changing the way the participants use interpersonal space and body orientation, they can manipulate audio/visual feedback influenced by the semantic meaning of these behaviors in real time. The goal of this environment is to explore how audio and visual cues can effectively encourage certain behaviors and inform the participant's of their change in behavior.

With the information we gathered from *Handjabber* we began exploring how audio/visual feedback controlled by nonverbal behavior could guide participants toward specific collaborative actions. In another interactive environment called *SharedAction* we developed specific collaborative actions that the two participants could perform to trigger a large audio/visual response from the system. To guide the participants toward discovering these specific actions, we use the following

nonverbal behaviors: interpersonal space, body orientation, synchronous/mirroring movement, and matching/call-and-response movement. These behaviors control feedback that informs the users of how close they are to achieving the specific collaborative actions. We designed three specific actions for *SharedAction*: sawing a large imaginary object in half, lifting a large imaginary object, and hiding a small imaginary object between the two participants. We chose these three actions because they are naturally collaborative in the real world and are often performed by two people. While the actions we chose are made to fit three very specific contexts (sawing, lifting, and hiding), we were able to model these actions with the same nonverbal behaviors (interpersonal space, body orientation, mirroring, and matching) used to guide the participants toward the actions. We did this by constraining different combinations of the nonverbal behaviors. For example, in order to effectively perform a sawing action, the two participants must directly face each other, maintain a stable interpersonal distance, and perform synchronous, horizontal movements with their hands. By completing and maintaining all three of these constrained nonverbal behaviors, the two participants are considered to have performed a sawing motion.

We find that general nonverbal behaviors are very flexible. They can describe the general collaborative states of participants as well as define more context specific, collaborative actions. The understanding of nonverbal behavior used in interpersonal communication could be used to facilitate collaborative tools for more context specific technologies such as tabletop displays and walk-in displays. This poster will go into further detail about the two interactive environments, *Handjabber* and *SharedAction*. It will also discuss how meaning is constructed from the nonverbal behaviors used in these environments, both in real world situations and in the interactive environments.

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