

Effects of Spontaneous Gestures on Comprehension and Intelligibility of Dysarthric Speech: A Case Report

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Many speakers with dysarthria benefit from the use of strategies that provide additional contextual information to listeners, such as the use of hand gestures (gesticulations) while speaking. Less is known about the effect of spontaneous gestures on listeners' ability to understand severely dysarthric speech. In this study, a 12-year-old adolescent with a severe flaccid dysarthria from cranial nerve damage produced three different monologues (procedural and description discourse). The effect of the speaker's gesticulations was measured in relation to listeners' understanding of the monologues (comprehension) as well as their understanding of words within the monologues (intelligibility). The different listening conditions included full view (all cues available), face cues (only the speaker's face was visible), and audio-only signal (the video signal was eliminated). Results of 36 listeners showed that their comprehension of monologue information and word intelligibility of monologues was significantly better when all cues (including gesticulations) were available. The magnitude of this change ranged from 11.6% to 54.5% across listening conditions. The results are discussed in terms of their implications for understanding the benefits of hand gestures as an intervention strategy for dysarthric speech.

Many speakers with dysarthria benefit from the use of speech supplementation strategies that provide additional contextual information to listeners, such as the use of hand gestures (gesticulations) while speaking (Garcia, Cannito, & Dagenais, 2000). The nonverbal content of gesticulations pro-

vides an additional source of semantic information to help understand sentence productions for some speakers with dysarthria (Garcia & Cannito, 1996; Garcia & Dagenais, 1998; Hustad & Garcia, 2002). One limitation of the existing literature is that the gesticulations were scripted for predetermined sen-

tences. Less is known about the spontaneous gestures used by speakers with dysarthria in more natural speaking situations (e.g., describing an event), which has important implications for understanding the benefit of hand gestures as an intervention strategy. Additionally, studies of speech supplementation typically evaluate the effectiveness of an intervention using intelligibility measures (percent of words correctly transcribed), whereas a listener's ability to answer comprehension questions or summarize a main point might reflect a more accurate representation of message comprehension (Hustad & Beukelman, 2002). Research from nonverbal communication literature suggests that gesticulations can be used effectively to enhance story comprehension of typical speakers, especially in difficult listening situations (Riseborough, 1981). The present study examined the impact of gesticulations when listeners were presented a speaker with severe dysarthria producing monologues (procedural and description discourse). The effect of gesticulations was measured in two ways: the number of words that listeners were able to transcribe correctly (intelligibility) and their comprehension of monologue information.

METHOD

Speaker

The participant was a 12-year-old male who suffered cranial nerve damage following removal of a brainstem tumor. In addition to severe oropharyngeal dysphagia, he presented with severe flaccid dysarthria (hypernasality and imprecise articulation) and was 27% (142 wpm) intelligible on the Sentence Intelligibility Test (Yorkston, Beukelman, & Tice, 1996) at the time the monologues were elicited. He exhibited no cognitive, language, or other physical impairments.

Listeners

A total of 36 nondisabled listeners, 18–25 years of age, participated in the study. All listeners reported normal or near normal vision with correction; passed a pure-tone hearing screening at 25 dB HL for the frequencies of 1000, 2000, and 4000 Hz; and were "inexperienced" in listening to disordered speech.

Monologues

The monologues and gestures were self-generated by the case study participant (i.e., he determined the

topic, language, and gestural content) in the course of his intervention program for severe speech and swallowing deficits. He initially practiced increasing his use of content gestures to illustrate actions and descriptions within sentences and later progressed to discourse activities. His training spanned approximately 10 therapy sessions (twice weekly). The monologues were elicited during this period.

One monologue described a procedure and two were descriptions. The three monologues were similar in the following ways: length (46 to 51 words), speaking rate (produced at 105.6 to 109.8 wpm), and use of gesticulations (each contained 4–7 iconic gestures, depicting some aspect of the verbal content). Additionally, video recordings provided a similar view of the speaker's upper body (face and hands clearly visible).

Procedures

Video- and audiotapes were digitally edited with Final Cut Pro software to create three different conditions for each monologue: full view (all visual cues present, including gesticulations), face cues (videotape edited to eliminate gesticulations and only show the speaker's face while talking), and audio-only signal (video signal eliminated). Edited versions of the same monologue were then exported to VHS tapes. Listeners heard a different monologue in each of the three conditions, and each monologue was presented to the listener two separate times to assess both intelligibility and comprehension. Listeners wrote what the speaker said during an edited pause between sentences to determine *intelligibility*. The *comprehension* questions (randomized for each monologue and viewing condition) were:

- What phrase or sentence could you write to describe the main theme of this speaker's story?
- If you were having a conversation with this speaker and he told you this story, what question or comment would you use to add to the conversation?
- What actions were mentioned by the speaker in his story?
- What people and/or objects were mentioned by the speaker in his story?
- In what location would this speaker's story take place?

Monologues were counterbalanced for order of presentation in each condition (full, face, or audio-

only) and also with regard to the assessment format. That is, 18 listeners were randomly assigned to the comprehension/intelligibility order and the other 18 to the intelligibility/comprehension order of monologue presentation. Listeners were tested individually, and testing was completed in a quiet room with a signal level of approximately 65 dB SPL.

Scoring

The number of correctly transcribed words was summed for each condition and converted into percent intelligibility scores for each listener. Responses to comprehension questions were scored as (2) completely correct, (1) partially correct or correct but vague/nonspecific, or (0) incorrect. Two judges scored responses (exact scoring agreement of 91.1%); any differences were assigned a score based on consensus agreement. The listener's total score from the five questions was then converted to a percent comprehension score for each monologue and condition.

RESULTS

The means and standard deviations for intelligibility and comprehension scores are reported in Table 1. Paired *t*-tests were done to determine if the differences in percent scores from the audio-only, to face-cues, to full-view conditions were statistically significant. Intelligibility and comprehension scores were analyzed separately. Intelligibility scores for the full-view condition were significantly higher than both the audio-only ($t = 9.50, p < .01$) and face-cues conditions ($t = 2.29, p < .05$), and the face-cues condition was higher than audio-only ($t = 6.48, p < .01$). A similar pattern occurred for comprehension scores. The full-view condition reflected significantly higher comprehension than both the face-cues ($t = 2.93, p < .01$) and audio-only ($t = 7.29, p < .01$) conditions; the face-cues condition also was better than the audio-only ($t = 3.65, p < .01$). Scores for

specific questions were compared across conditions using nonparametric measures (Wilcoxon Signed Rank Test). Figure 1 illustrates the overall percent of comprehension for each question and condition. Both full-view and face-cues conditions were always better than the audio-only condition for each question type ($p < .05$). Of particular interest was the comparison of full-view scores to the face-cues condition; scores were significantly better for questions about the main theme, ability to add a comment, and identify actions ($p < .05$). The paired contrasts did not reach a level of statistical significance for objects and locations.

DISCUSSION

Results demonstrated that the speaker's use of gesticulations produced in a natural speaking situation aided intelligibility (word correctness) and comprehension of monologue information. Findings are consistent with previous reports (e.g., Hustad & Beukelman, 2002) showing that supplemental speech strategies assist in the comprehension of severely dysarthric speech (not just intelligibility). Analysis of question type showed that the full-view condition (including gesticulations) provided the greatest benefit to listeners' overall understanding of the monologue (i.e., identifying the main theme and adding a comment or question to the interaction) versus comprehension of specific details (i.e., identifying objects and location). This result supports the contention that gesticulations are spontaneous and idiosyncratic (without direct translation) (Garcia et al., 2000). Riseborough (1981) hypothesized that gesticulations evoke mental images that aid memory and performance. There also were significant differences between the face cues compared to audio-only condition, which may simply reflect that the speaker's use of gesticulation impacted other visual-facial cues that could not be eliminated fully from this condition. In summary, this study was the first of its type to consider the

TABLE 1. Intelligibility and comprehension mean scores (percent correct) and standard deviations for each listening condition.

Listening Condition	Intelligibility		Comprehension	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Audio-only	19.5%	(23.5)	20.8%	(37.7)
Face cues	57.6%	(25.8)	52.5%	(36.6)
Full view	69.2%	(22.2)	75.3%	(24.4)

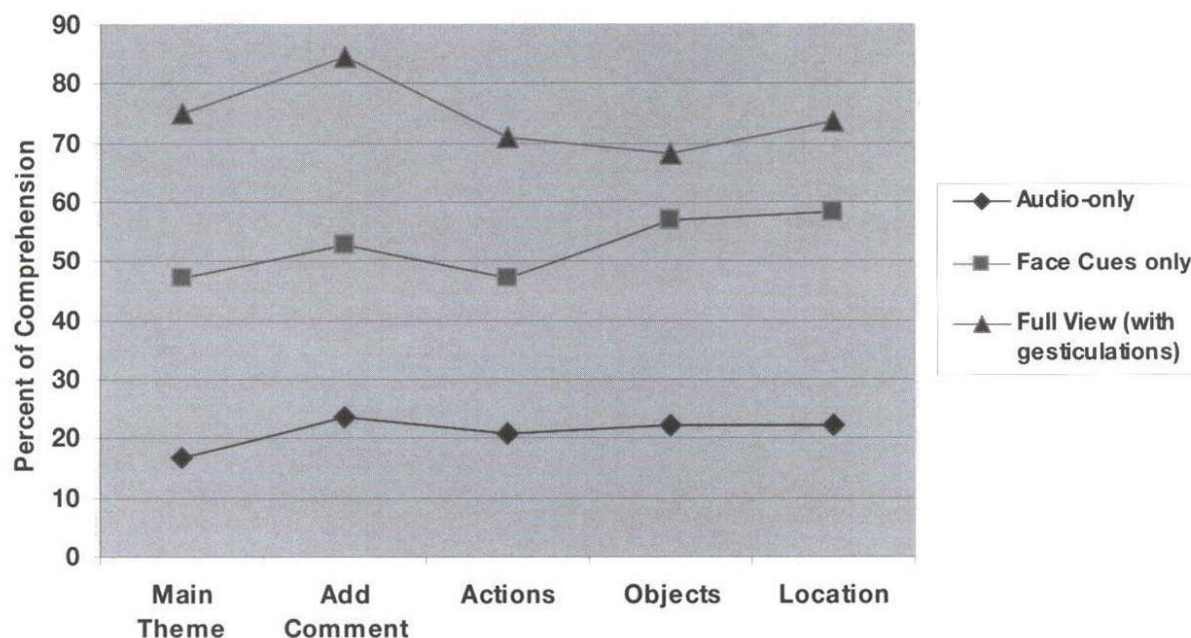


Figure 1. Percent of comprehension for each question across monologues.

impact of gesticulations to both intelligibility and comprehension. More important, the monologues and their gestures were self-generated by the case study participant. Results support the benefits of gesticulations to a speaker with severe dysarthria in natural speaking situations, which has important clinical implications for their use.

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