Nonverbal Behaviors in the Hemispheres: A Continuum of Disabilities

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Reports on the effects of left or right hemisphere lesions on nonverbal communicative abilities reveal conflicting results (Bear, 1983; Buck and Duffy, 1980; Duffy and Buck, 1979; Duffy and Duffy, 1981; Duffy, Duffy, and Mercaitis, 1984; Seron, van der Kaa, Remitz, and van der Linden, 1979; Ross, 1981; Tompkins and Flowers, 1985). Although the traditional model has been to assign prosodic and paraverbal abilities to the right hemisphere (Monrad-Khron, 1963; Ross, 1981) recent evidence (Roberts and Walker-Batson, 1984; Seron, van der Kaa, van der Linden, and Remitz, 1982; Tompkins and Flowers, 1985) suggests a continuum of disorders of nonverbal communication. That is, there appears to be quantitative and qualitative differentiation of nonverbal abilities between and within the hemispheres.

Discrepancies and conflict in research reports regarding nonverbal deficits in brain-damaged subjects probably result from poor neurological as well as behavioral subject definition, task complexity, and the ways in which the nonverbal behaviors were defined. Duffy and Buck (1979) used Critchley's (1939) notions of intentionality for nonverbal communication, taking into account the communicative intent of the sender. Kendon (1983) proposed similar distinctions for nonverbal abilities separating actions that are intentional and communicative from those that are not. In an attempt to clarify terminology we have extended Duffy's and Buck's (1979) definitions (Table 1) because we feel that, when comparing among studies, it is important to define nonverbal communicative behaviors and to consider the communicative intent of the communicator.

Ross (1981) evaluated a number of right hemisphere damaged (RHD) patients and postulated that both verbal and nonverbal affective components of language are affected with right hemisphere infarcts. He suggested the term aprosodia for the various disorders of affective language, which include inability to use and comprehend spontaneous prosody and gesturing. Ross proposed eight aprosodias, each paralleling one of the eight aphasic subtypes for homologous regions in the right hemisphere. Ross did not compare his RHD patients to comparably lesioned left hemisphere damaged (LHD) subjects or normals, nor did he clinically demonstrate all of the aprosodic subtypes.

Buck and Duffy (1979, 1980) compared LHD and RHD individuals in terms of propositional (pantomime) and subpropositional (facial expression)

communicative abilities. Their results indicated that verbal and nonverbal propositional language appeared to be equally deficient in LHD (aphasic) patients but subpropositional behavior remained relatively intact.

Table 1. Definitions for verbal and nonverbal communication clarification.

Verbal: To convey a message through the spoken medium.

Nonverbal: A message conveyed or enhanced through pantomime or gesture respectively.

Pantomime or propositional nonverbal behavior: The purposeful use of body or manual movements to convey a message in the absence of speech.

Gesture or subpropositional nonverbal behavior: Nonpurposeful limb, body, and facial movements which accompany speech and serve to enhance the spoken message.

Propositional language: The use of words or pantomime for deliberate and intentional communication.

Subpropositional language: The use of prosody and gesture for nonspecific utterances of automatic-social communication or emotional expression.

Note. Adapted from Duffy and Buck, 1979.

The present study attempted to elaborate on relationships between comprehension and expression of propositional and subpropositional nonverbal behaviors and site of lesion by assessing the pantomimic and gestural abilities of brain damaged adults. The purposes of this investigation were to determine whether tests of propositional and subpropositional nonverbal abilities would differentiate among well-defined LHD patients, RHD patients and normal adults, and whether certain nonverbal behaviors were deficient in LHD and RHD patients depending on lesion location (anterior or posterior to the Rolandic fissure).

METHOD

Subjects. Three groups--nine LHD patients, nine RHD patients, and nine normal controls--participated in this study. All subjects were native English speakers and were right-handed (Oldfield, 1971). Brain-damaged subjects were matched with normal controls for age, education, and sex. All subjects were administered the Raven's Standard Progressive Matrices (1960). Data for the three groups are summarized in Table 2.

All LHD and RHD patients had suffered a single focal cerebral infarct verified by CT scan at least ten days post onset. Control subjects exhibited no history of neurological injury or disease. In the LHD group, four subjects had lesions primarily to the preRolandic regions of the left hemisphere; five subjects had primarily postRolandic lesions. In the RHD group, five subjects had lesions primarily to the preRolandic regions of the right

hemisphere; four subjects had primarily postRolandic lesions. Presence of aphasia was determined in the left hemisphere group by performance on the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1972). Aphasia subtypes based on the BDAE included four nonfluent, four fluent, and one anomic. The severity range on the BDAE was from 2 to 4. In general, the aphasic subjects had moderate comprehension deficits.

Table 2. Summary table of mean ages, sex distribution, mean educational level and Raven's mean scores for all subjects.

Group (n = 9)	Age	Sex Dist. M/F	Mean Years of Education	Raven's Mean Scores
1. LHD	60.16	8/1	11.8	18.15*
2. RHD	60.00	7/2	12.4	19.20*
3. Normal Controls	67.16	8/1	12.7	26.35**

*25th - 50th percentile for mean ages
**50th percentile for mean ages

Procedures. Screening procedures were used for subjects whose medical history indicated possible hearing loss, visual impairments, or limb apraxia. Because verbal instruction was not a significant factor in the majority of the testing, subjects exhibiting mild hearing losses were included if they were able to attend to the task, attend to the examiner, and respond appropriately during informal conversation and subsequent training procedures. A visual matching test was administered to subjects suspected of having visual impairments. Each subject was required to match a picture to one of four pictures presented in five consecutive trials. In addition, all subjects were required to perform simple hand postures and limb movements through imitation to screen for significant limb apraxia.

Testing sessions consisted of a one-hour session for the experimental and control subjects to receive the Raven's test and the four nonverbal measures. The aphasic subjects received the BDAE in a separate testing session. Expressive pantomime and gestural tasks were videorecorded for later evaluation.

Nonverbal Test Battery

Pantomime Recognition Test--Revised (Duffy and Duffy, 1981). Ss responded by pointing to the picture of the objects pantomimed from a choice of four. Pantomime Expression Test (Duffy and Duffy, 1981). Ss pantomimed the functional uses of the object presented. Responses were scored on-line by an examiner using the 16-point system of the Porch Index of Communicative Ability (Porch, 1967). Comprehension of Emotional Gesturing Test. A visual comprehension task adapted from Ross (1981). Five affective states were presented--surprise, anger, disinterest, sadness, and elation. Ss responded by pointing to one of five photographs which most appropriately depicted the

emotion projected by the examiner. Expression of Emotional Gesturing Test. Developed for this study as a counterpart to the gestural comprehension test. The examiner instructed the S to use his face and limbs to express the same emotions presented in the previous test. The PICA 16-point scale was used to score this task.

Reliability. The videotaped expression tasks for pantomimic and gestural abilities were rated by three judges simultaneously and 100% agreement was obtained on an item-by-item basis. These scores were used for data analyses. The videotaped analyses agreed with the on-line scoring in a range from 80% to 88%.

RESULTS

Comparison of mean scores indicated that LHD patients with anterior lesions had as much difficulty on the propositional comprehension task as those with posterior lesions (Table 3).

Table 3. Comparison of mean nonverbal scores of anterior and posterior lesioned subjects.

	Pantomime Expression	Pantomime Recognition	Gestural Expression	Gestural Recognition
Group 1				
Ant	275	170.2	57.0	17.5
Post	274	171.4	48.4	18.2
Group 2				
Ant	332	178.6	58.6	18.8
Post	290	174.5	44.2	18.7

LHD patients, regardless of lesion site, had difficulty with the subpropositional task. RHD patients, regardless of lesion site, had difficulty with the expression subpropositional task but did not have difficulty on the comprehension subpropositional task. For further data analyses a Total Propositional Score was calculated by combining scores for the pantomime expression and comprehension tests. Additional analyses compared differences between LHD and RHD subjects on Total Propositional and Total Subpropositional Scores. As shown in Table 4 the Kruskal-Wallis one-way test of variance by ranks (Siegal, 1956) indicated that LHD and RHD subjects were significantly different from one another and from normals on the Total Propositional Score. LHD and RHD Ss were different from normals and significantly different from one another on the Total Subpropositional Score.

Table 4. Comparison of performances on nonverbal tests total scores.

Group	Mean Ranks TPS	TSS
Left Hemisphere (LHD)	7.11	10.33
Right Hemisphere (RHD)	13.72	9.16
Normals	17.83	22.50

Note. TPS = Total Propositional Score
TSS = Total Subpropositional Score
Significant differences among all groups ($p < .001$)

DISCUSSION

Our results suggest that intentional nonverbal communicative behavior as defined in this study is differentially disrupted in LHD and RHD patients. Our analysis yielded significant differences between LHD, RHD and normal Ss on the Total Propositional Score. In this small sample of four anterior and five posterior LHD subjects there were no significant differences in total mean scores when comparing expressive and comprehension abilities to lesion location. We are in the process of analyzing our data for relationships between the verbal and nonverbal abilities.

Comparison of LHD and RHD patients on nonverbal subpropositional abilities revealed significant differences between RHD and LHD and normals but the differences between the two brain-damaged groups in mean rank scores was small (see Table 4). Benton (1980) suggested that the left hemisphere might play a role in perception of facial messages, which our task called for. Benton argued that both right and left hemispheres participate in processing of facial messages and that perception of emotion may be partly dependent on facility with language. Seron (1982) suggested that processing of facial signals was not independent of linguistic comprehension. The results of the present study would appear to support this concept. In the area of verbal prosody, Tompkins and Flowers (1985) recently reported that as task complexity or levels of processing increased there were no differences between LHD and RHD patients on tasks involving spoken prosody. Our tasks were similar in complexity to those employed by Tompkins and Flowers.

The presence of an anterior or posterior right hemisphere lesion in this study did not determine the presence of an aprosodia subtype. Only two of the anterior RHD Ss exhibited motor aprosodia. None of the posterior RHD Ss exhibited a sensory aprosodia. This is not to say that the aprosodias do not exist, but perhaps the association areas for the aprosodias are more specified in some individuals than in others. This syndrome does not appear to be clinically as robust as the aphasias. It may be that the aprosodias can be identified in the very early phase after brain injury and then quickly resolve. (Our subjects ranged from acute to chronic stages.)

In summary, our results add support to findings reported by several other investigators which suggest a continuum of disabilities in nonverbal communication in LHD and RHD subjects. Further, lesion location (that is anterior or posterior to the Rolandic fissure) does not appear to give any more information than behavioral descriptions concerning nonverbal abilities.

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REFERENCES

Bear, D.M. Hemispheric specialization and the neurology of emotion. Archives of Neurology, 40, 195-202, 1983.

Benton, A.L. The neuropsychology of facial recognition. American Psychologist, 35, 176-186, 1980.

Critchley, M. The Language of Gesture. London: Arnold, 1939.

Buck, R. and Duffy, R.J. Nonverbal communication of affect in brain-damaged patients. Cortex, 16, 351-362, 1980.

Duffy, R.J. and Buck, R. A study of the relationship between propositional (pantomime) and subpropositional (facial expression) extraverbal behaviors in aphasics. Folia Phoniatrica, 31, 129-136, 1979.

Duffy, R.J. and Duffy, J.R. Three studies of deficits in pantomimic expression and pantomimic recognition in aphasia. Journal of Speech and Hearing Research, 24, 70-84, 1981.

Duffy, R., Duffy, J. and Mercaitis, P. Comparison of the performances of a fluent and a nonfluent aphasic on a pantomimic referential task. Brain and Language, 21, 260-273, 1984.

Goodglass, H. and Kaplan, E. The Assessment of Aphasia and Related Disorders. Philadelphia: Lea and Febiger, 1972.

Kendon, A. Some recent work on gesture with special reference to its relationship with speech. In J. Weiman and R. Harrison (Eds.), Nonverbal Communication. Beverly Hills: Sage, 1983.

Monrad-Khron, G. The third element of speech: Prosody and its disorders. In L. Halpern (Ed.), Problems of Dynamic Neurology. Jerusalem: Hebrew University Press, 101-117, 1963.

Oldfield, R.C. The assessment and analysis of handedness: The Edinburgh Inventory. Neuropsychologia, 9, 97-113, 1971.

Porch, B. Porch Index of Communicative Ability. Palo Alto: Consulting Psychologists Press, 1967.

Raven, J.C. Guide to the Standard Progressive Matrices. London: H.R. Lewis, 1960.

Roberts, J. and Walker-Batson, D. A pragmatic profile of left and right brain-injured subjects. Paper presented at the American Speech-Language and Hearing Association, San Francisco, California, November 1984.

Ross, E. The aprosodias: Functional anatomic organization of the affective components of language in the right hemisphere. Archives of Neurology, 38, 561-569.

Seron, X., van der Kaa, M., Remitz, A. and van der Linden, M. Pantomime interpretation and aphasia. Neuropsychologia, 17, 661-668, 1979.

Seron, X., van der Kaa, M.A., van der Linden, M. and Remitz, A. Decoding paralinguistic signals: Effect of semantic and prosodic cues on aphasics' comprehension. Journal of Communication Disorders, 15, 223-231, 1982.

Siegal, S. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill, Inc., 1956.

Tompkins, C.A. and Flowers, C.R. Recognizing moods through prosody following hemispheric brain injury. Paper presented at the Academic of Aphasia. Pittsburgh, PA, 1985.

DISCUSSION

Q: Can you tell us a little bit more about the gestural expression test, not the pantomime but the gestural test?

A: The gestural expression task followed the recognition task, so they had pointed to pictures of those five emotions; and then on the expression task they demonstrated those five emotions.

Q: And how was that elicited?

A: That was elicited depending on the patient. With the right-hemisphere patients there was a verbal instruction--Show me you are angry, etc. In the left-hemisphere group the instructions were dependent on the comprehension level of the patient. It was not a visual matching task from the recognition aspect. The experimenter might have to demonstrate a different emotional state from the one being elicited--then ask, Show me you are angry, etc. Then we viewed them on the videotapes. We obviously developed a metanonverbal task to look at this problem. Informally when we viewed the videotapes, we had two judges who did not know what we were looking for and we looked at the affect as it came across in a conversational sequence, not on the task, and the same things held up in the spontaneous situations as on the experimental task.

Q: What are your findings again regarding sensory versus motor aprosodia? Did you find those two problems?

A: We found two motor aprosodias in the nine right-hemisphere damaged patients. There was one sensory aprosodia that was noted on the medical chart, 10 days post infarct but when we interviewed the patient three weeks post infarct this had cleared. We did the same verbal tasks that Ross (1981) used, not because they were part of the study but because we wanted to document on the video tape.

C: I think we need to be very cautious about the use of those constructs--sensory and motor aprosodia.

A: That is really why we did the study because we did not believe in it. Clinically, we would see patients and they did not fit (into this dichotomy). So in many ways we really set up this study to refute Ross' claim that there was such a thing as sensory and motor aprosodia. I think it is very fragile.

C: Yes. I think there is a lot in the history of aphasia that we should keep in mind when we examine these deficits in right hemisphere patients. I think what you have done is a lesson in that for us. You have got some data that tells us to be cautious.

A: You know, these tasks are difficult. We had much difficulty finding discrete lesioned patients, anterior/posterior in right-hemisphere subjects. We set out to test Ross' model and to compare to normals and left hemisphere injured patients. We questioned Ross' model.

Q: I'm mostly interested in the emotional gestures compared LHD patients with normals. You have to be careful, I think, in measuring emotional gestures. When you tell the patient "Show me a happy face," etc., you are making the gesture an emblem, which is a linguistic gesture. It is a difficult thing to test. How did you measure the emotional gestures of the patients?

A: We viewed videotapes.

Q: How did you elicit them? Did you ask them to?

A: Yes.

C: I'm saying that might be a linguistic activity. That's not the way they would respond spontaneously.

A: I agree with you. I think there is some relationship to language. Again, can you say something is primarily left or primarily right in function? I think there is much overlap.

C: We videotaped aphasic patients during conversation and measured the occurrence and duration of the behaviors. When we did that we did not find any difference between the groups.

A: We did have two naive judges view some of the subjects during a spontaneous interaction. We asked the judges to rate how they were communicating in terms of affect. This particular group of LHD patients seemed to be deficient to normals. This was not handled statistically, only clinical impressions.

Q: Was this then analyzed behaviorally or was it an overall impression?

A: This was an overall impression.

Q: Was there sound on the videotapes when they were watching the nonverbal behavior?

A: Yes.

C: I think that might have an effect on it too.

A: I take that back. You mean when they were judging the nonverbal behaviors? We were interested to see if naive judges would see any difference. I think we used maybe five of the nine subjects. This then was viewed with the sound turned down. They (naive judges) did rate differences between normals and the left hemisphere and right hemisphere patients.

Q: Many people have postulated that there is depression after stroke in LHD patients, and a few people have postulated that RHD patients don't feel the emotions. Do you think that their emotions are any different from normals?

A: Their emotional state? Well, there has been a large study by Robinson finding more depression in LHD patients. We thought that was a limitation of our study that we did not use a measure of depression. Another thing that we know is that brain damage itself can cause flattening of

emotion, sleep disorders, etc. Had we given a depression scale we might not be able to get at the depression. Several people (Elliott Ross and John Rush) are trying to determine what part depression plays. I don't think we really know that.

Q: Do you think that's the cause of differences in subpropositional communication?

A: I don't think I can say.