# Perception of Facial Affect in Aphasia

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Nonverbal communication is essential to normal, daily interpersonal interaction. Facial expressions make up a major part of that interaction. Mehrabian (1968) estimated only 7% of a message's affect is carried by the words, while 38% is carried vocally, and 55% communicated by facial cues. Aphasic individuals' dependency on nonverbal cues from other people in the environment is believed by many to explain at least in part how aphasic people function so well in "natural" communicative settings (Egolf, 1975; Egolf and Chester, 1973). A person who sustained a stroke and became unable to communicate efficiently in a normal manner should presumably make the most of all remaining communicative abilities, both verbal and nonverbal. Clinically, aphasic patients appear to comprehend "other" channels of communication well by looking at the speaker and engaging in reciprocal movements such as nodding their heads, smiling, and other kinesic behaviors that indicate synchrony between speaker and listener (Katz, LaPointe, and Markel, 1978). Assuming that these nonverbal communicative behaviors are elicited by these patients implies that the aphasic person's ability to perceive commonly used nonverbal cues, such as facial expressions, posture and position, is intact or at least minimally impaired.

Hughlings-Jackson (1879) was among the first to suggest that the processing of "affective speech" occurred in the right hemisphere. Since that time, many studies have demonstrated right hemisphere superiority for comprehension of emotion (e.g., Safer and Leventhal, 1977). However, the contributions of the right hemisphere may not be independent of the influences of the left hemisphere when dealing with nonverbal messages.

Studies by various researchers suggested that aphasic subjects may be unable to comprehend nonverbal vocal cues, to recognize familiar faces, or to match unfamiliar, nonemotional faces (Heilman, Scholes and Watson, 1975; Benton and Van Allen, 1968). In a comprehensive review of the literature, Benton (1980) concluded that mechanisms of the left hemisphere are involved in mediating the discrimination of faces and that perception of facial emotion appeared to be language dependent. Recently, Dekosky and his associates reported that subjects with either unilateral left or right hemisphere dysfunction performed less accurately than a normal control group when asked to name the facial emotion displayed, or to choose the picture of the facial emotion named by the examiner. They concluded that while the right hemisphere appears responsible for processing emotional faces, "lesions of the left hemisphere not only may interfere with verbal function but also may disconnect the right-hemisphere 'emotional areas' from the left-hemisphere language areas that are important in denoting" emotional faces (Dekosky, Heilman, Bowers and Valenstein, 1980; p.214). However, the dependency of the study on verbal stimuli and responses may have influenced the results.

An increasingly complex view of hemispheric specialization for nonverbal processing has continued to develop. Tachistoscopic studies of non brain damaged normal subjects have lead to the suggestion that the cerebral hemispheres are differentially specialized for the perception of emotional faces. On a facial recognition task, Reuter-Lorenz and Davidson (1980) found that happy faces were processed faster and more accurately by the left hemisphere than the right hemisphere, while sad faces were associated with the opposite pattern.

Therefore, it appears that an aphasic person, having sustained left hemisphere injury, may be unable to enhance his residual language ability simply by attending more fully to commonly used nonverbal cues. It would be important to treat or compensate for the nonverbal impairment if such a deficit were found. However, if the ability to perceive facial affect is functional for aphasic patients, then it would be beneficial to encourage these patients, and their families, to maximize use of these cues to much the same purpose as when we counsel and train hard-of-hearing and deaf adults to attend to nonverbal cues to improve understanding. In addition, facial expressions and other affective kinesic behaviors might then be incorporated into Amerind (Skelly, Schinsky, Donaldson, and Smith, 1973) and other gestural treatment programs to facilitate production and to add greater scope to this modality.

Many previous attempts to measure the ability of aphasic subjects to recognize emotion from nonverbal cues have suffered from potential problems. Factors that may have inadvertently influenced some studies include; selection of emotions such as "embarrassment" or "love," stimuli delivered verbally instead of visually, verbal responses required instead of gestural, and use of drawings instead of photographs of faces. Finally, there are no reports in the literature of the ability of aphasic subjects to perceive emotions differentially. The present study attempted to avoid these problems by using emotions that have been supported by accepted theories of facial expression and affect and by using emotions that have generated consistent judgments of emotion in various normal populations (Ekman, and Friesen, 1975). Response items represented familiar activities commonly associated with the various emotions presented in this study so that the salient features of each response item were situational (requiring understanding of the emotion) rather than visually isomorphic.

The purpose of this study was to determine whether or not aphasic adults have difficulty comprehending emotions from facial expressions. Specifically, these questions were asked:

1. Do aphasic subjects differ from normal speaking, non brain damaged subjects in the ability to associate facial expressions with emotions?
2. Does the degree of language impairment vary predictably with aphasic subjects' ability to associate facial expressions with emotions?
3. Does nonverbal, visual problem solving ability vary predictably with aphasic subjects' ability to associate facial expressions with emotions?

## METHOD

Subjects were adult male outpatients from two VA facilities, divided into two groups, matched for age, educational level and vocational status (Table 1). The experimental group consisted of 20 predominantly expressive aphasic subjects, each of whom suffered a single thromboembolic left CVA of at least five months duration. Right hemiparesis was present in 18 of these subjects and had resolved in the remaining two subjects. Aphasic subjects were premorbidly right-handed. Overall performance on the PICA for this group ranged from the 24th to the 88th percentile with the mean value at the

52nd percentile. The control group consisted of 20 normal speaking non brain damaged right handed subjects. All subjects had normal or corrected visual acuity, normal hearing in at least one ear, and no history of mental disorder.

Table 1. Subject information: age, education and time post onset.

| SUBJECT GROUP | AGE (yr.) | | | EDUCATION (yr.) | | | TIME POST ONSET (yr.) | | |
|---|---|---|---|---|---|---|---|---|---|
| | $\overline{X}$ | SD | Range | $\overline{X}$ | SD | Range | $\overline{X}$ | SD | Range |
| Aphasic | 61.5 | 6.5 | 48-72 | 13.4 | 3.1 | 8-20 | 4.5 | 4.9 | 0.6-19.4 |
| Control | 59.9 | 8.2 | 40-75 | 12.8 | 2.9 | 7-20 | --- | --- | ------ |

Stimuli consisted of 20 sepia-toned slides depicting four different posers (two males and two females) each displaying five different emotions (happy, sad, fear, anger, surprise). These slides were taken from a larger set of slides designed by Ekman and Friesen (1976), who have studied relationships between facial expressions and emotions. These slides have been demonstrated to yield highly consistent judgments of emotions. Stimuli were presented using a rear projection slide viewer. All subjects passed two visual matching tasks using six geometric shapes and four neutral faces to rule out potential visual problems and to familiarize subjects with task requirements.

Subjects responded to each stimulus by pointing to one of two response items. In all, five different response items were used. Each item represented one of the five emotions studied. Four of these response items were adapted from the Peabody Picture Vocabulary Test (Dunn, 1965) and a fifth was composed from other treatment sources. Facial expressions in these pictures were touched up so as to minimize their presence. The critical cues for the response items, therefore, were the posture and position of the characters and the setting. Voice and gesture were used to supplement verbal instruction to strengthen comprehension of each response item before the stimuli were presented.

Each subject's ability to associate facial expressions with emotions was reflected in the number of stimuli correctly identified, both overall and by each emotion. The Porch Index of Communicative Ability (PICA) (Porch, 1967) was administered to all aphasic subjects to determine the presence and severity of aphasia and to provide language information for the study of the relation between recognition of emotion and language ability. The Ravens Coloured Progressive Matrices (Raven, 1975) was also administered to all aphasic subjects to assess visual-spatial ability.

## RESULTS

When the overall affect score was calculated for each group of subjects, it was found that the aphasic group's performance was slightly less accurate and more variable than that of the control group (Table 2). A multivariate analysis of variance, which measured the degree of difference between the two groups along each of the five emotions simultaneously, was applied and found to be not significant ($F=1.33$; $p=.28$) (Table 3). It appears, then,

Table 2. Overall facial affect scores for aphasic and control groups.

| GROUP | $\overline{X}$ | SD | Range |
|---|---|---|---|
| Aphasic | 17.55 | 2.39 | 11-20 |
| Control | 18.80 | 0.87 | 17-20 |

from the results of this statistical measure and from other examination of the data, that aphasic subjects as a group do not differ significantly from non brain damaged controls in the ability to associate facial expressions with emotions.

Table 3. Facial affect: average performance (percent accurate) for aphasic and control groups of subjects.

| GROUP | HAPPY | SAD | FEAR | ANGER | SURPRISE | TOTAL |
|---|---|---|---|---|---|---|
| Aphasic | 96.3 | 91.3 | 76.3 | 88.8 | 86.3 | 87.8 |
| Control | 100.0 | 93.8 | 90.0 | 92.5 | 93.8 | 94.0 |

Figure 1 displays the overall accuracy of the two groups on the facial affect task. Note that the greater variance of the aphasic group was primarily due to the five aphasic subjects who performed below the level of the other aphasic subjects. Their performance, as can be seen, was also below the normal range established by the control group. Performance of these five subjects was examined with special interest. At first glance, it might seem that their poor performance might be due to impairment of perception of facial expressions, but experimental results, like facial expressions themselves can be deceptive.

The actual performance of these five aphasic subjects revealed impairment on a task requiring the matching of unfamiliar emotional static faces with empathic response pictures. Whether these error patterns represented the responses of subjects unable to comprehend facial expressions or simply subjects unable to perform efficiently on the experimental task is less clear. For some subjects, the errors could possibly reflect such systematic factors as difficulty understanding the task requirements, confusion of the intended emotion for various response items, and processing problems that may be a function of the task itself, such as fatigue. The strongest support for these interpretations is the fact that each of these five subjects performed poorly on only one or two different emotions, but performed well or without any error at all on the remaining three or four emotions. It would be expected that impairment of perception of facial affect would influence pereption of all emotions simultaneously, or at least the same pattern of emotions for these aphasic subjects. However, while the fundamental cause of the errors may be unclear, what can be said with certainty is that most predominantly expressive aphasic subjects do not suffer a concurrent deficit in perception of facial affect.

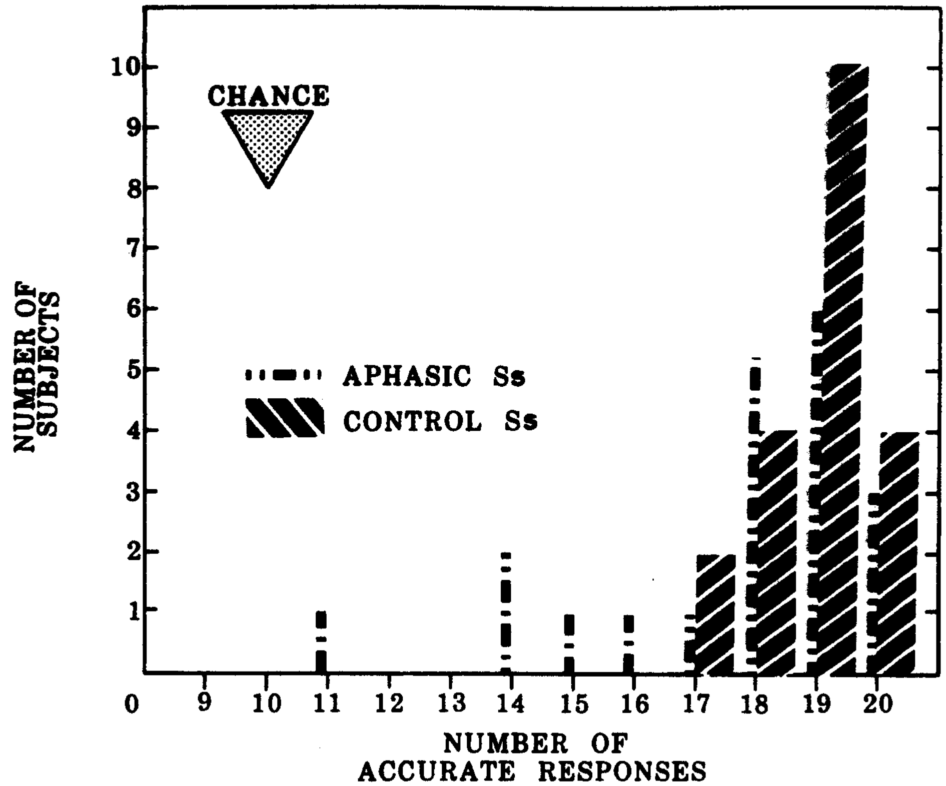


Figure 1. Perception of facial affect. Number of accurate responses (out of 20) for aphasic and control subjects. (N = 20 per group)

The second and third questions pertained to the relation between language ability, visual-spatial ability, and perception of facial affect for the aphasic subjects. Visual-spatial ability, as measured by the Ravens CPM, correlated negligibly (r=.17) with perception of facial affect for the aphasic group. The lack of interaction between these two variables indicated that a problem in perception of facial expression is not the result of an impairment of visual-spatial ability. As for language ability, four statistically significant correlations were found to exist between language ability and perception of facial affect for the 20 aphasic subjects (Table 4).

Table 4. Correlation coefficients between language performance and overall facial affect scores.

| PICA MEASURE | CORRELATION COEFFICIENT | LEVEL OF SIGNIFICANCE |
|---|---|---|
| OA | +0.60 | $p < 0.01$ |
| GST | +0.58 | $p < 0.01$ |
| VRB | +0.62 | $p < 0.01$ |
| GPH | +0.33 | NS |
| AC (VI,X) | +0.63 | $p < 0.01$ |
| VIS (VIII,XI) | +0.36 | NS |

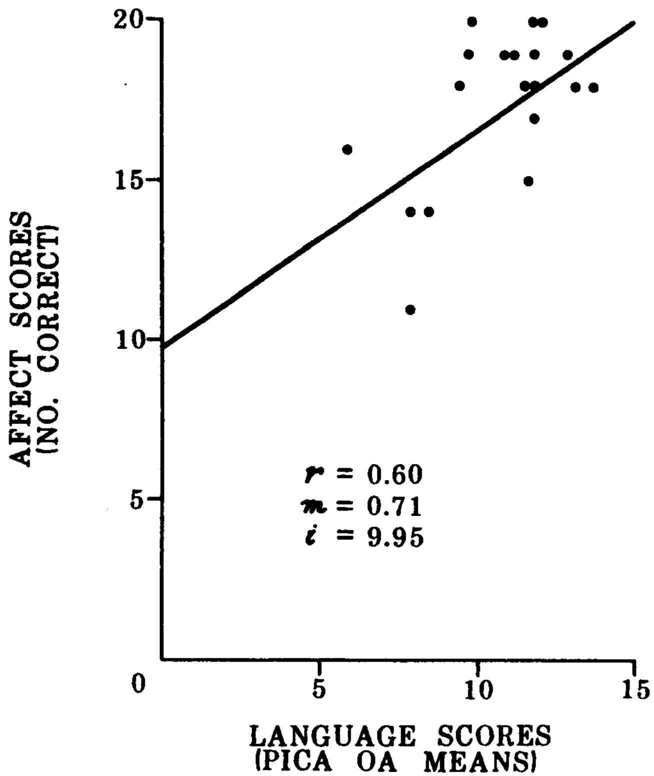


Figure 2. Correlation between facial affect scores and overall language performance for aphasic subjects ($p. < .01$).

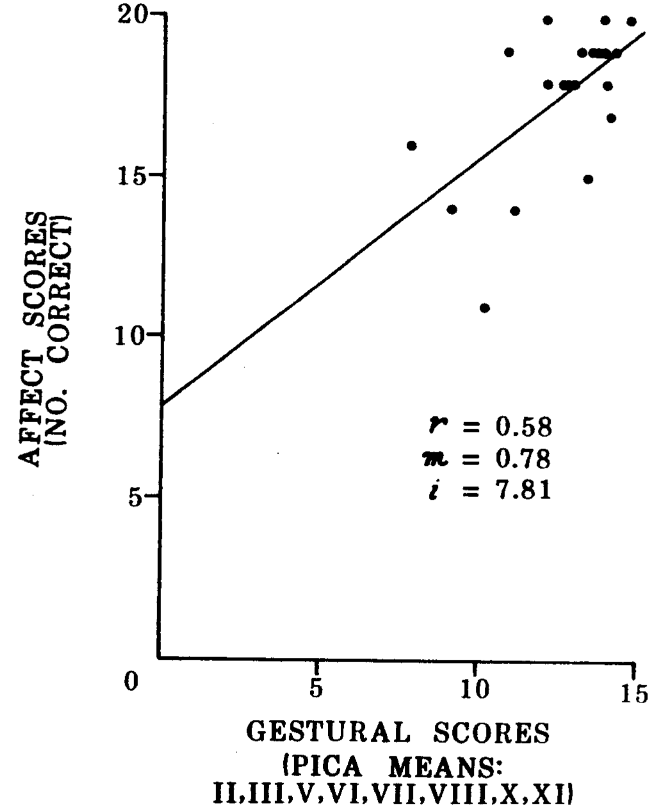


Figure 3. Correlation between facial affect scores and gestural output performance for aphasic subjects ($p. < .01$).

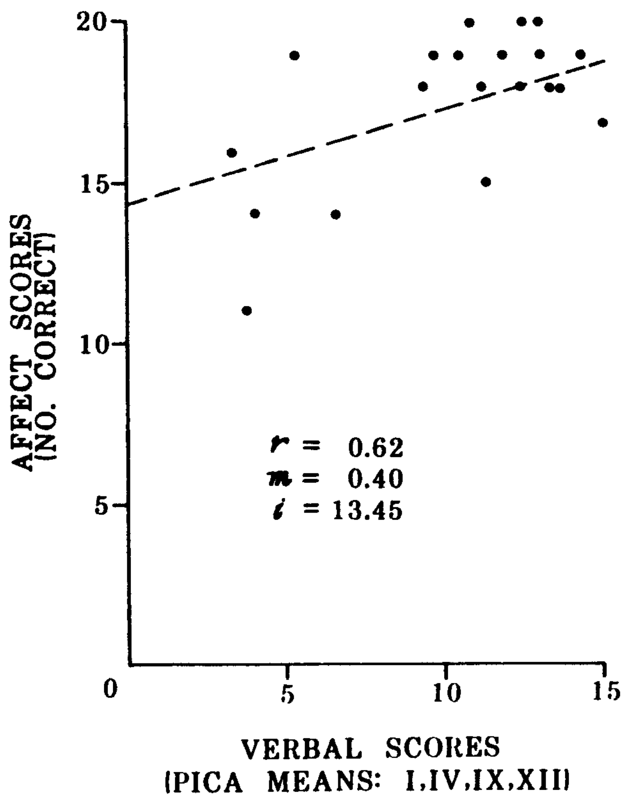


Figure 4. Correlation between facial affect scores and verbal output performance for aphasic subjects (p. < .01).

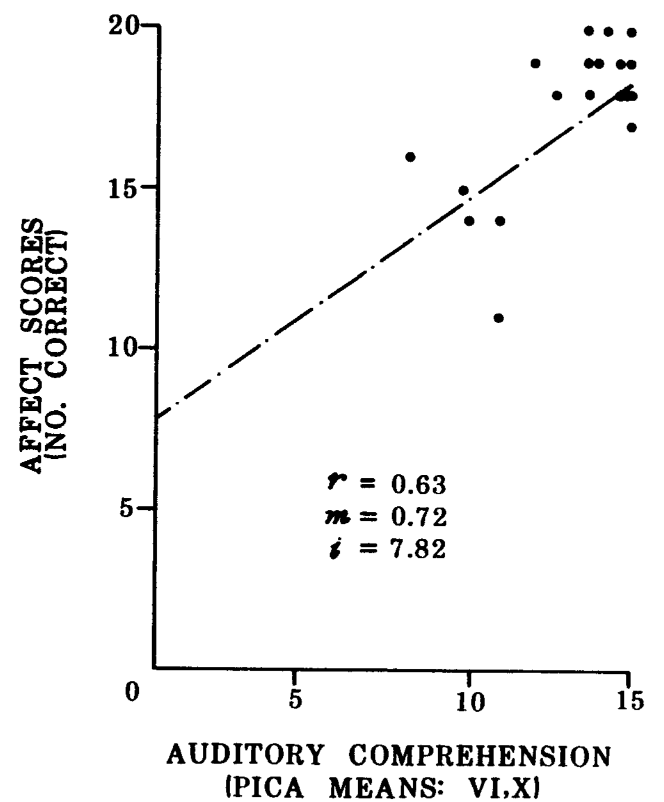


Figure 5. Correlation between facial affect scores and auditory comprehension performance for aphasic subjects (p. < .01).

Figures 2, 3, 4, and 5 illustrate the significant correlation results. However, as can be seen, the depressed affect scores of the five aphasic subjects mentioned earlier accounted for much of the strength of these correlations. As previously described, their lower scores on the affect task possibly resulted from processing problems and other factors related to task requirements rather than inability to comprehend facial expressions. Also, within the two subgroups of aphasic subjects, no interaction between affect and language scores was found, as would be suggested by the substantial correlations obtained. If this interpretation is accurate, then in actual communicative situations, an aphasic person would not be expected to have significant difficulty comprehending the dynamic and redundant nonverbal movements displayed in facial expressions.

Therefore, the results of this study indicate that most aphasic patients do not suffer a concurrent impairment in perception of facial affect. Ability to associate facial expressions with emotions appeared to be unrelated to visual-spatial ability. While perception of facial affect for the majority of aphasic patients is unrelated to language ability, the exact relation between marked language impairment and perception of facial affect is still unclear. Further attempts to assess perception of facial expressions might incorporate more objective measures such as electroencephalography and visually evoked responses to avoid the possibility of language involvement in the task itself.

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## DISCUSSION

Q: Could you describe the methodology of presenting the stimulus and the way in which the choice of stimuli were displayed?

A: The stimuli were slides of people's faces projected on a self-contained rear projection slide viewer. The response choices were line drawings placed under the viewer screen and presented side-by-side, two at a time per stimulus.

Q: Did you ever have an occasion to stack the two response choices on top of one another as opposed to right and left?

A: No, I did not. I later realized that displaying the response items vertically instead of horizontally would probably reduce the effects of a hemianopsia or field neglect. However, during the instructions, I carefully indicated and gestured to both response items. I also looked for signs of visual problems during the screening and the administration.

Q: In the more severely affected cases, did you notice any tendency for a right hemineglect in responses when the correct choice should have been on the right side versus when the correct choice should have been on the left?

A: I did not find any trend favoring either side.

Q: Did you observe any of your subjects attempting to verbally encode the emotions they saw?

A: Yes. Occasionally some aphasic and control subjects would try to name the emotion before pointing to the response item. Several times one aphasic subject said the wrong name, but pointed to the correct response, but this did not happen frequently with other subjects. Also, some aphasic subjects described verbally what they saw. For example, when a stimulus facial expression was surprise (the slide of a face with the eyelids and mouth open), one aphasic subject pointed to the response item of happy (the girl eating an ice cream cone) and said "mouth open." So sometimes the verbal encoding worked and other times it did not.

Q: What features discriminated those five aphasic subjects who did not do so well?

A: The major distinction was that their language ability was more severely impaired, but how this interacted with the ability to perceive the facial expressions can only be speculated upon.

Q: It seems to me it would be very difficult to eliminate language from a test like this. My feeling is that in looking at the Peabody pictures there is a further rehearsal of the label of the emotion. I think a patient unable to do that would have an inadequate response.

A: I agree that normal subjects probably use verbal labeling to some degree. On the other hand, much of the task is accomplished nonverbally. Many nonverbal cues were available to the subjects, such as gesture and vocal cues during the instructions and posture, position, objects and settings within each response item.

Q: I would expect an aphasic patient to do much better in a real life situation, to respond more appropriately to emotions, to recognize facial expressions and emotions, as opposed to having to match, in which they might use verbal mediation.

A: Yes. I would expect both aphasic and control subjects to perform more accurately in the nonverbally redundant, real life situations to which they are accustomed than in the experimental task. However, among other things, the task allowed a more accurate comparison of the performance of the two groups than could be obtained from an uncontrolled, spontaneous setting.

Q: Could these stimuli be used for therapeutic purposes in that they can get the patient talking perhaps more than static pictures?

A: Yes. We now use them ourselves. In addition to individual treatment, we use them and other emotionally weighted materials in our PACE groups and gesture group.

Q: When you say 55% of the message is nonverbal, how did they ever come up with that figure?

A: Mehrabian (1968) actually stated of the amount of affect communicated, 55% is communicated by facial expressions, and so on. I am not sure how he obtained those values, but the different figures could have been acquired by using conflicting messages for each channel.

Q: I think we are a bit premature in drawing firm conclusions on this research for two reasons: First, you say you suspect that you really did not have a good measurement. If you have not measured things accurately, the drawing of conclusions from what you have measured is suspect. In the second place, you applied an analysis of variance to two groups which are very widely different in their standard deviaitons. Homogeneity of variance is one of the preconditions that you have to have for applying analysis of variance to the data. So you have already violated two mathematical assumptions for drawing strong conclusions from what you said.

A: Let me address the first point. I am confident that the results of this experiment are valid in showing that the majority of aphasic patients respond as accurately as normal subjects do on a task requiring the perception of facial affect. The experimental design and measurement system demonstrated this clearly. Where the design fell short was in not explaining why the five aphasic subjects who performed poorly did so, but this was not the intention of the experiment. However, the design allowed for the examination of each subject's response pattern and, as reported, this information has provided several possible explanations. As for the application of a multivariate analysis of variance to the results, I feel this also was valid. In looking at the data points, we all saw that the 15 aphasic subjects who performed normally had the same distribution of scores as the 20 normal controls. It was the poor performance of those five aphasic subjects that created the greater variance. This is reflected in the statement that mild-to-moderately impaired aphasic patients demonstrated normal ability while the ability of markedly impaired aphasic subjects is still uncertain.

Q: I would like to add to your response to this question. All the weaknesses that have been identified in this study would tend to work to the disadvantage of the aphasic group and you found no differences between the groups. The second point relevant to the difference in variance: Most people accept the statement that analysis of variance is very robust to differences in variance as well as departures from normality in the distribution.

Q: I would just like to endorse that comment. Speech pathologists seem to be a lot more worried about using analysis of variance than biostatisticians and other statisticians who tell me that analysis of variance is extremely appropriate for use with aphasic folks.

Q: Have you tried a delayed match-to-sample, with the disappearance of the test stimulus before the response items are presented? Sometimes that has brought out a high error pattern for us.

A: No. That is a good suggestion, but I was afraid that problems in memory would interfere with the results.

Q: With what emotions did the aphasic subjects have most difficulty?

A: Subjects who had difficulty with emotions had difficulty with different emotions or different sets of emotions. These results were not expected. Assuming the errors were perceptual, some consistency was predicted based upon the results from the Reuter-Lorenz and Davidson (1980) tachistoscopic study reported earlier. However, the aphasic subjects in my study saw the stimulus faces with both hemispheres simultaneously, albeit an impaired left hemisphere, so it may not be directly compatible with the tachistoscopic literature.