# Right Hemisphere Pica Percentiles: Some Speculations About Aphasia

Jon L. Deal, Leslie Deal, Robert T. Wertz,
Kurt Kitselman, and Cynthia Dwyer

Veterans Administration Medical Center, Martinez, California

## Introduction

Conventionally, language is considered to reside in the left hemisphere, and we expect patients with left hemisphere lesions to demonstrate aphasia. Conversely, we do not expect patients with right hemisphere lesions to be aphasic, and, we are surprised when aphasia does exist following right hemisphere brain injury. However, no one expects patients with right hemisphere lesions to be totally free of speech and language deficits (Eisenson, 1962; Joynt and Goldstein, 1975). We are not certain whether these deficits represent aphasia, but some patients have been diagnosed as presenting aphasia following right hemisphere injury, and Archibald and Wepman (1968) have reported "aphasic-like" responses by right hemisphere patients (N = 8) on the *Language Modalities Test for Aphasia* (Wepman and Jones, 1961).

Based on what we know, Myers' suggestion (1978), that patients with right hemisphere lesions who present speech and language abnormalities require the attention of a speech pathologist, is a good one. Unfortunately, when attention is given, the clinician finds sparse normative data on the communicative abilities of right hemisphere patients. Thus, the dilemma is doubled. Not only do we have difficulty in labeling right hemisphere speech and language deficits, we also find it hard to rate their severity.

The purpose of this paper is twofold. First, we will present normative data, in the form of percentiles, for right hemisphere performance on the *Porch Index of Communicative Ability* (Porch, 1967). And, second, we will discuss the results of a discriminant function analysis used to determine whether right hemisphere deficits resemble aphasia.

## Method

The PICA was administered to 111 patients who had suffered unilateral right hemisphere brain injury. The entire sample was used to compute Overall, Gestural, Verbal, and Graphic percentiles to represent a range of communicative performance in patients who have sustained a right hemisphere lesion. In addition, PICA performance from 96 patients in our sample was used to compute percentiles for each of the 18 subtests.

To determine whether PICA performance following a right hemisphere lesion resembles aphasia, we employed weights determined by Porch, Friden, and Porec (1976) in their discriminant function analysis that differentiated aphasic patients from non-brain-injured persons. Theoretically, normal performance on the PICA should yield a straight line at the 99th percentile when plotted on the PICA Ranked Response Summary. Aphasia, depending on its severity, resembles a negative function curve (Porch, 1967) where performance is better on easier subtests than it is on more difficult subtests.

Deviations from these two profiles, normal or aphasic, are believed to have diagnostic significance, for example, bilateral brain injury, apraxia of speech, illiteracy, malingering, etc. At times, however, individual patient differences result in profiles that make diagnosis difficult. The discriminant function analysis reported by Porch _et al._ (1976) improves precision in classifying PICA performance.

Briefly, discriminant function analysis of PICA performance is a statistical technique that estimates a weight for each subtest. These are multiplied by the appropriate PICA subtest percentile and summed to obtain a discriminant score. The weights are selected to insure that the discriminant score will differentiate among "types" of performance on the PICA and therefore, classify individuals in appropriate groups. Porch _et al._ found performance on 14 of the 18 subtests, when multiplied by the appropriate weight, yielded a range of discriminant scores that permitted classification into three groups: _aphasia_, _nonaphasia_, and _aphasia undetermined_.

Using the weights provided by Porch _et al._ (1976), we computed a discriminant function analysis for 86 patients in our right hemisphere sample. Once computed, the discriminant scores were classified according to the criteria provided by Porch _et al._ Scores larger than -.211 are considered to represent aphasia; scores less than -.279 are considered nonaphasic; and scores between these two values are unclassifiable. The number of patients classified into each category permitted us to determine whether speech and language deficits following a right hemisphere lesion resemble aphasia.

## Results

Table 1 shows Overall, Gestural, Verbal, and Graphic percentiles on the PICA computed from the performance of 111 patients who had suffered a lesion in the right hemisphere. Table 2 shows percentiles for the 18 PICA subtests. The data come from PICA performance by 86 right hemisphere brain injured patients.

Table 3 shows the results of the discriminant function analysis. Over half of our sample met the criteria established by Porch _et al._ (1976) for aphasia. Approximately one-third were classified as nonaphasic. Seven percent could not be classified as either.

Table 3. Discriminant function analysis classification of 86 patients with right hemisphere brain injury.

| Classification | N | Percent of Sample |
|---|---|---|
| Aphasia | 53 | 62 |
| Nonaphasia | 27 | 31 |
| Undetermined | 6 | 7 |

Representative Ranked Response Summary profiles for the three classifications are shown in Figures 1, 3, and 4. Figure 1 represents performance by a patient with a right hemisphere lesion. Even though there are obvious depressions on two copying tasks and three verbal subtests, his profile is similar to the negative function curve described by Porch (1967), and his

Table 1. Right Hemisphere Overall, Gestural, Verbal, and Graphic PICA Percentiles (N = 111).

| Percentile | Overall | Gestural | Verbal | Graphic |
|---|---|---|---|---|
| 99 | 14.90 | 14.85 | 15.00 | 14.90 |
| 95 | 14.72 | 14.72 | 14.98 | 14.67 |
| 90 | 14.53 | 14.66 | 14.85 | 14.40 |
| 85 | 14.32 | 14.64 | 14.80 | 13.93 |
| 80 | 14.14 | 14.59 | 14.77 | 13.68 |
| 75 | 14.00 | 14.48 | 14.57 | 13.52 |
| 70 | 13.84 | 14.42 | 14.45 | 13.05 |
| 65 | 13.71 | 14.31 | 14.40 | 12.82 |
| 60 | 13.66 | 14.24 | 14.20 | 12.68 |
| 55 | 13.60 | 14.12 | 14.05 | 12.50 |
| 50 | 13.31 | 14.07 | 13.90 | 12.32 |
| 45 | 13.18 | 14.00 | 13.88 | 11.95 |
| 40 | 13.10 | 13.91 | 13.78 | 11.28 |
| 35 | 12.80 | 13.87 | 13.70 | 10.83 |
| 30 | 12.52 | 13.66 | 13.60 | 10.27 |
| 25 | 12.23 | 13.56 | 13.55 | 10.10 |
| 20 | 12.03 | 13.40 | 13.32 | 9.52 |
| 15 | 11.72 | 13.31 | 12.98 | 8.61 |
| 10 | 11.34 | 12.75 | 12.63 | 7.50 |
| 5 | 10.63 | 12.61 | 11.85 | 5.95 |
| 1 | 6.48 | 7.11 | 7.97 | 4.37 |

Table 2. Right Hemisphere PICA Subtest Percentiles (N = 86).

| Percentile | Subtests | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | A | B | C | D | E | F |
| 99 | 15.4 | 14.1 | 15.1 | 15.3 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 14.5 | 15.0 | 14.8 | 15.0 | 15.0 | 15.0 |
| 95 | 14.8 | 14.1 | 14.5 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 12.6 | 14.9 | 14.5 | 14.9 | 14.7 | 14.8 |
| 90 | 14.4 | 13.8 | 14.4 | 15.0 | 14.8 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 11.9 | 14.6 | 14.2 | 14.7 | 14.5 | 14.5 |
| 85 | 13.8 | 13.4 | 14.2 | 15.0 | 14.7 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | 11.0 | 14.1 | 13.9 | 14.7 | 14.4 | 14.5 |
| 80 | 13.2 | 13.2 | 13.8 | 14.8 | 14.6 | 15.0 | 15.0 | 15.0 | 14.9 | 15.0 | 15.0 | 15.0 | 10.2 | 13.7 | 13.5 | 14.2 | 14.3 | 14.4 |
| 75 | 13.1 | 13.1 | 13.7 | 14.8 | 14.6 | 15.0 | 15.0 | 15.0 | 14.8 | 15.0 | 15.0 | 15.0 | 10.1 | 13.3 | 13.3 | 13.6 | 14.0 | 14.1 |
| 70 | 12.8 | 12.8 | 13.5 | 14.7 | 14.4 | 15.0 | 15.0 | 15.0 | 14.8 | 15.0 | 15.0 | 15.0 | 9.8 | 12.8 | 12.9 | 13.5 | 13.6 | 14.0 |
| 65 | 12.4 | 12.6 | 13.4 | 14.6 | 14.3 | 15.0 | 14.8 | 15.0 | 14.7 | 15.0 | 15.0 | 15.0 | 9.1 | 12.3 | 12.8 | 13.4 | 13.3 | 13.9 |
| 60 | 12.3 | 12.5 | 13.2 | 14.5 | 14.2 | 15.0 | 14.8 | 15.0 | 14.7 | 15.0 | 15.0 | 15.0 | 8.7 | 12.1 | 12.3 | 13.1 | 12.9 | 13.7 |
| 55 | 12.0 | 12.3 | 13.1 | 14.4 | 13.7 | 15.0 | 14.8 | 15.0 | 14.6 | 15.0 | 15.0 | 15.0 | 8.5 | 11.5 | 11.7 | 12.9 | 12.7 | 13.6 |
| 50 | 11.8 | 11.8 | 13.0 | 14.3 | 13.6 | 15.0 | 14.7 | 15.0 | 14.4 | 15.0 | 15.0 | 15.0 | 8.1 | 11.2 | 11.3 | 12.5 | 12.4 | 13.3 |
| 45 | 11.6 | 11.7 | 12.6 | 14.2 | 13.3 | 15.0 | 14.6 | 15.0 | 14.3 | 15.0 | 15.0 | 15.0 | 7.6 | 10.8 | 10.8 | 12.2 | 12.0 | 13.1 |
| 40 | 11.5 | 11.4 | 12.5 | 14.1 | 13.2 | 14.8 | 14.1 | 15.0 | 14.2 | 15.0 | 15.0 | 14.9 | 7.3 | 10.5 | 10.1 | 11.8 | 11.4 | 13.1 |
| 35 | 11.4 | 11.3 | 12.4 | 13.9 | 12.9 | 14.8 | 14.0 | 15.0 | 14.1 | 14.8 | 15.0 | 14.8 | 7.2 | 9.3 | 9.8 | 10.9 | 11.0 | 12.9 |
| 30 | 11.3 | 11.1 | 12.2 | 13.6 | 12.8 | 14.6 | 13.7 | 14.8 | 14.0 | 14.8 | 15.0 | 14.7 | 7.0 | 9.0 | 9.1 | 10.7 | 10.6 | 12.7 |
| 25 | 11.2 | 10.7 | 11.9 | 13.4 | 12.2 | 14.4 | 13.3 | 14.8 | 13.9 | 14.8 | 15.0 | 14.6 | 6.2 | 7.7 | 8.8 | 10.0 | 9.7 | 12.3 |
| 20 | 10.8 | 10.2 | 11.7 | 13.1 | 12.0 | 14.2 | 13.0 | 14.6 | 13.6 | 14.6 | 15.0 | 14.3 | 5.4 | 6.6 | 6.9 | 9.6 | 8.7 | 11.4 |
| 15 | 10.6 | 8.6 | 11.3 | 13.0 | 11.6 | 14.2 | 12.6 | 14.4 | 13.4 | 14.6 | 15.0 | 14.1 | 5.0 | 6.0 | 5.5 | 8.4 | 7.2 | 8.8 |
| 10 | 10.5 | 8.4 | 10.5 | 12.9 | 11.0 | 14.0 | 12.1 | 13.9 | 13.1 | 14.4 | 14.8 | 14.0 | 5.0 | 5.0 | 5.0 | 5.0 | 6.0 | 8.5 |
| 5 | 10.4 | 7.5 | 10.4 | 11.0 | 8.8 | 13.0 | 11.8 | 13.6 | 10.0 | 13.6 | 14.0 | 12.6 | 4.6 | 5.0 | 4.8 | 4.8 | 5.0 | 6.1 |
| 1 | 5.3 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.6 | 5.9 | 8.8 | 10.2 | 12.1 | 10.4 | 4.0 | 4.0 | 4.0 | 4.0 | 4.4 | 4.5 |

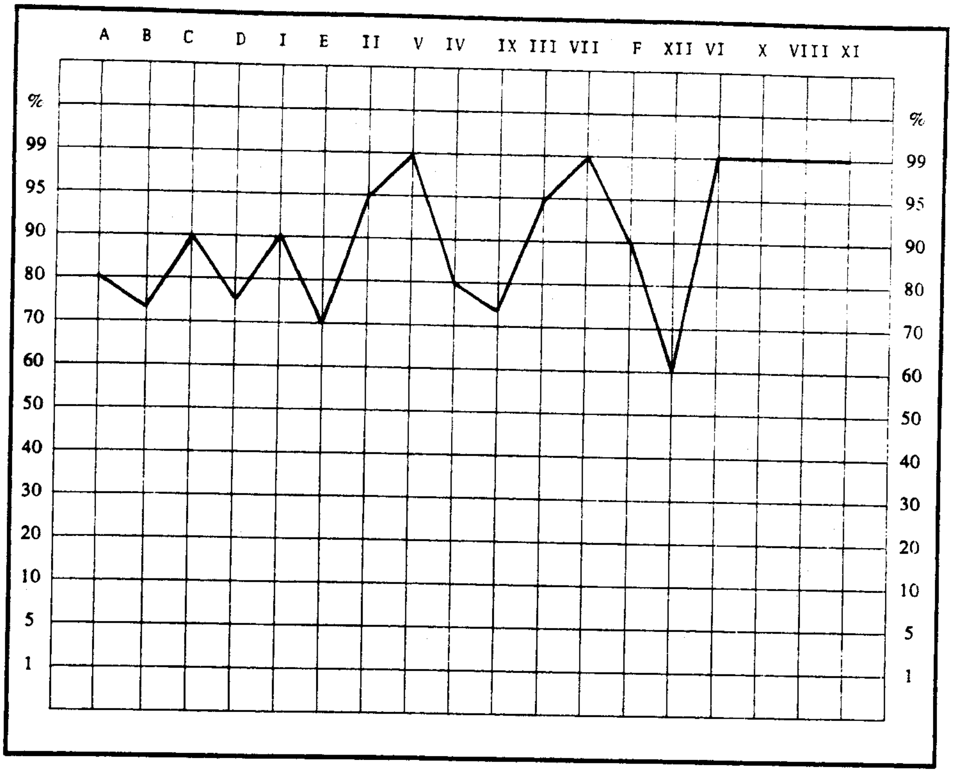


Figure 1. PICA Ranked Response Summary for a patient with a right hemisphere lesion whose discriminant function analysis score classified him aphasic.

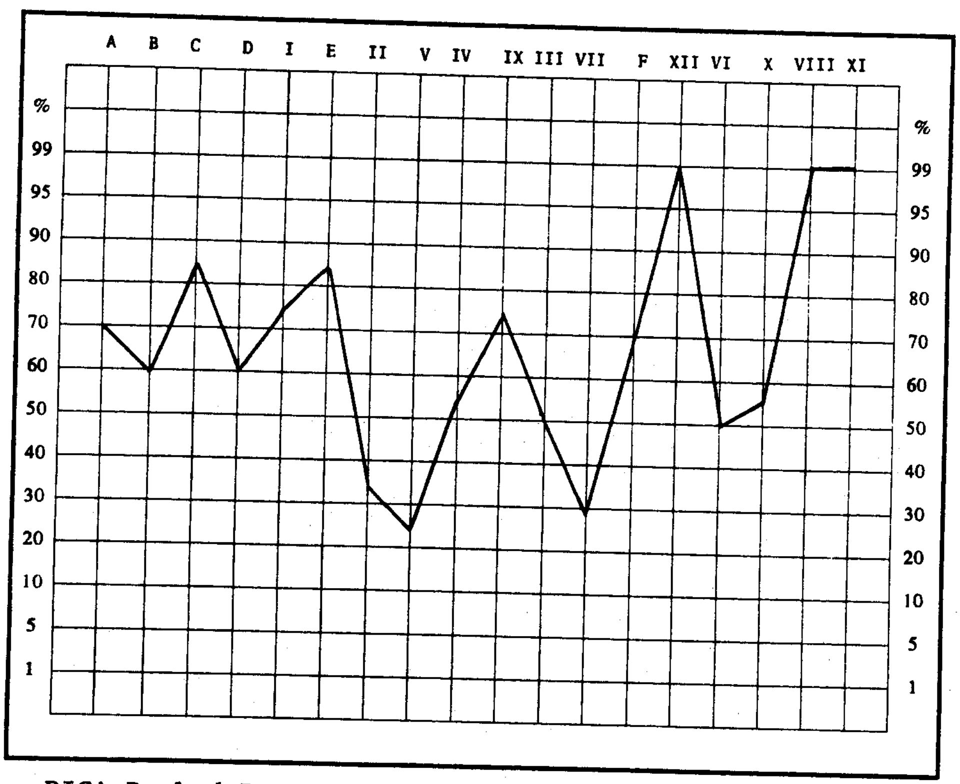


Figure 2. PICA Ranked Response Summary for an aphasic patient with a left hemisphere lesion.

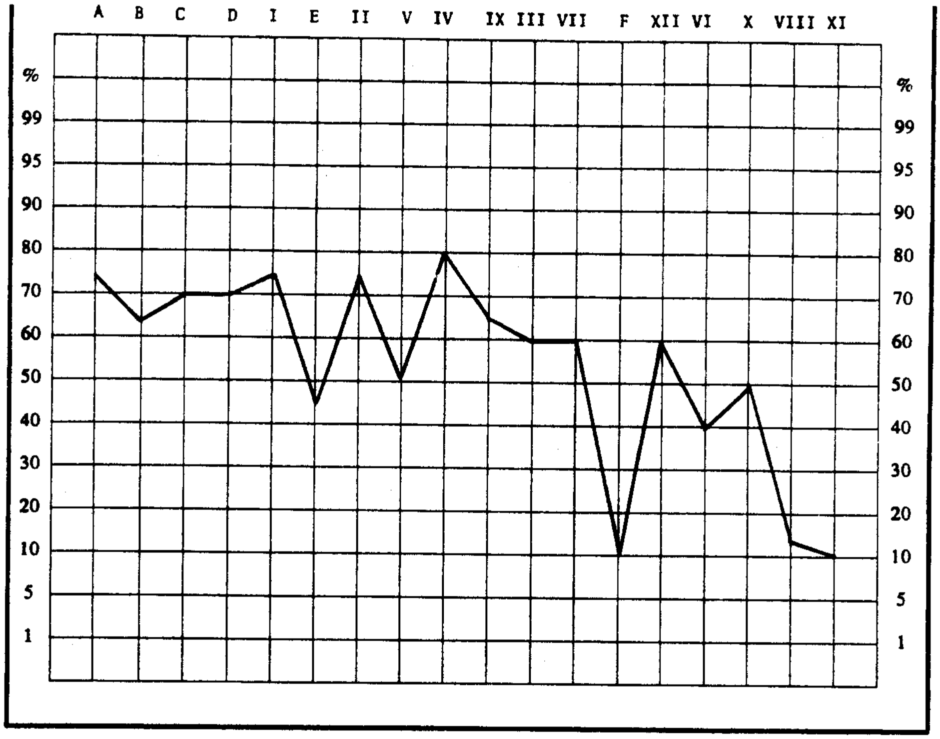


Figure 3. PICA Ranked Response Summary for a patient with a right hemisphere lesion whose discriminant function analysis classified him nonaphasic.

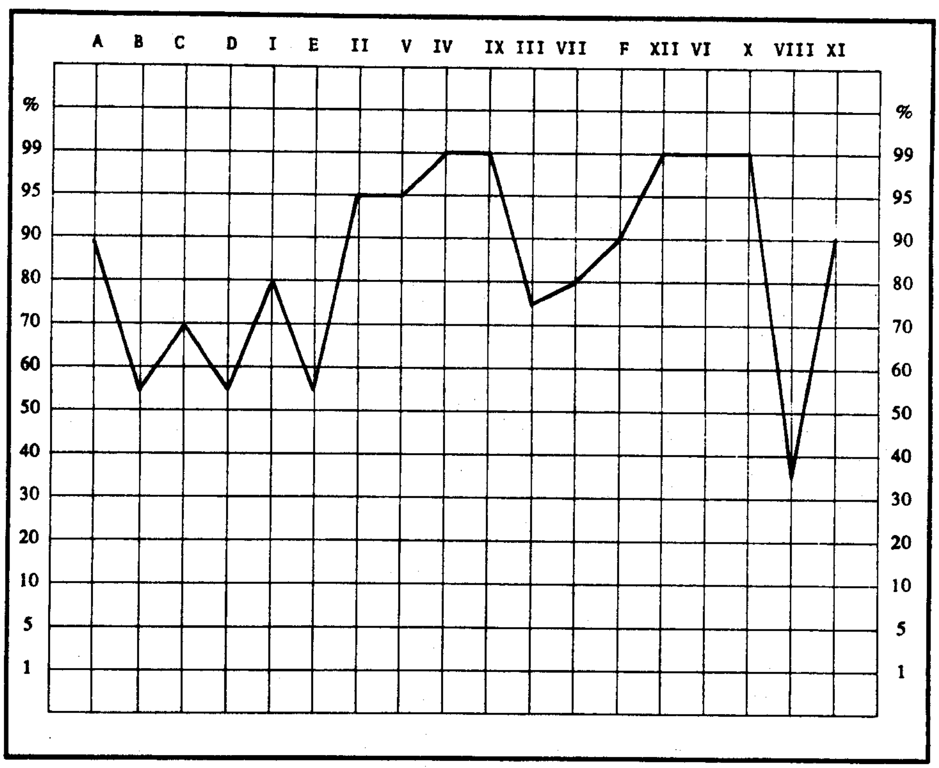


Figure 4. PICA Ranked Response Summary for a patient with a right hemisphere lesion whose discriminant function analysis classified him undetermined.

discriminant function score classified him as representing aphasia. This performance can be contrasted with that of an aphasic patient with a left hemisphere lesion shown in Figure 2. Again, depressions are obvious--on reading and auditory comprehension tasks--but the general profile and discriminant function score represents aphasia.

Figure 3 shows a profile for a right hemisphere patient whose discriminant function score is nonaphasic. The Ranked Response Summary shows more difficulty on subtests that are easier for aphasic patients and less difficulty on subtests that are harder for aphasic patients.

Finally, Figure 4 shows a profile for a right hemisphere patient whose discriminant function score places him in the undetermined group. Except for performance on subtests VIII and XI, and possibly A, the profile resembles aphasia. However, these three deviations result in an undetermined classification.

## Discussion

There is little to say about the PICA percentiles for right hemisphere patients. They represent a range of severity, and they indicate that right hemisphere brain injury results in speech and language deficits on this measure. They are offered for clinical use, but their validity is questionable without replication using a larger sample. Few norms exist for right hemisphere patients. These represent a beginning.

The results of the discriminant function analysis are equivocal. They do not approach the clarity reported by Porch et al. (1976) on their groups of acute and chronic aphasic patients, malingerers, and normals with no history of brain injury. Less than two-thirds of our right hemisphere patients were classified aphasic. Two of several possible explanations seem likely. First, right hemisphere brain injury may result in "aphasic-like" symptoms (Archibald and Wepman, 1968); however coexisting deficits (e.g., visual-spatial impairment) may mask aphasic deficits, at least in some patients. Second, the PICA may not be the best instrument to detect the presence or absence of aphasia in right hemisphere patients. Descriptions of speech and language impairment in right hemisphere patients--aphasic or nonaphasic--may have to come from other measures. Which of these two speculations or, more probably, which of other alternative explanations are correct may come from an investigation that transcends the one reported here.

## References

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## Discussion

Q: Jon, have you compared your data with the norms generated by Duffy, Keith, Shane and Podraza, "Performance of Normal Adults on the Porch Index of Communicative Ability?" (C.A.C. 1976)

A: We have not done that. And, I don't think it would show anything except that on the discriminant function the normals would look aphasic. Because, if they are going to miss anything it would be on the more difficult subtests. You would not expect them to make errors on the easier ones. Therefore, they should have the same kind of slope and same kind of profile, although at a much higher level. So I don't expect there would be any difference, but we would like to do that with normals data.

Q: Since the Porch test doesn't really define aphasia per se and you said maybe this isn't the test for it, could you give an example?

A: The question is, is it a test of communication? I think if you look at the PICA from the point of view that if it is a test of communicative abilities that's what it shows. It does not necessarily show aphasia. We see aphasia as a consequence after we administer it because we expect those patients to be aphasic. When we get the same kind of profile from a right hemisphere patient we don't call that aphasia, or if we see that same kind of profile from a normal person who doesn't have any known history we don't call that aphasia.

Q: I'd like to ask a question of Jon. The one profile that you showed us representing the right group seemed to be a very high-level aphasic patient. What kind of knowledge do you have of the premorbid language characteristics of these people?

A: I have none that is of any value.

Q: Jon, is the bottom line that we shouldn't use these profiles lightly and go around talking about being able to differentiate between aphasics and other types of patients based on profiles?

A: I think if you are going to differentiate or if you are going to attempt to differentiate the patients on the basis of a PICA profile...I think you'd best be very careful.

Q: Second question: How about your experience with psychiatric patients? Any at all?

A: We have not really done any of this with any psychiatric patients, but that's something for the future to see if there is any differentiation on the basis of a psychiatric disorder.