# Variability of Performance on the Porch Index of Communicative Ability

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## INTRODUCTION

As early as 1973, Porch suggested that the greater the variety of scores observed within a subtest on the Porch Index of Communicative Ability (PICA) (Porch, 1967), the greater the chance for improvement. Few clinicians would argue that the unique feature of the PICA--its multidimensional scoring system--is ideally suited to the task of describing performance variability by aphasic patients. This system allows us to quantify not only the adequacy of the responses, but also the number of response types available on any particular task; that is, the response repertoire.

Despite these advantages, quantitative changes in performance from test to retest do not always coincide with our clinical impression of change in the quality of performance; specifically, changes in intrasubtest variability.

This situation seems to stem from two problems. First, reduction of intrasubtest data to means, peak-mean difference values, percentiles and high-low gap values obscures the variety of intrasubtest performance. Second, the performance summary scores depend on the actual value of scores assigned, which in turn, leads to questions about the intervality and ordinality of the original multidimensional scale. These questions have been addressed by Porch (1974), Silverman (1974), McNeil, Prescott and Chang (1975), Duffy and Dale (1977), and Martin (1977).

A related problem is that of prediction, which has been studied extensively by Porch, Collins and Wertz (1974), Deal, Deal, Wertz, Kitselman and Dwyer (1979), Aten and Lyon (1978), Wertz, Deal and Deal (1981) and Porch and Callaghan (1981). If intersubtest variability is a predictor of eventual recovery, as Porch has suggested, it is unfortunate that variance and summary scores used to date have partially obscured this valuable dimension of patient performance.

The purpose of this study was to describe intrasubtest variability on the PICA in 10 aphasic patients tested in the 1 - 6 month post onset period. The specific questions were: What is the distribution of ISV values? What is the relative occurrence of positive and negative change in ISV scores for modalities showing improving mean scores? What is the relationship of ISV to the actual level of performance?

Subjects. PICA data from 10 aphasic patients were analyzed. All but one patient was male. Ages of subjects ranged from 23 to 68, with a mean age of 42.9 years, and formal education from 8 - 20 years, with a mean of 11.7 years. With regard to medical background, Subject 1 presented aphasia

following a right hemisphere lesion and Subject 8 following a left hemisphere frontal craniotomy for anterior communicating artery aneurysm repair. Subjects 3 and 8 underwent surgery for removal of hemorrhagic arteriovenous malformations. Neurologic deficits were thromboembolic in origin in Subject 2 and intracerebral hemorrhage in the remaining subjects. Subjects 1, 3 and 9 were left-handed, the remainder were right-handed. PICA performance for these 10 subjects at 1 month post onset ranged from 5.46 to 13.16, corresponding to a range in percentiles from the 8th to the 82nd. For the group, the overall mean was 9.26 (the 37th percentile). Most subjects fell in the 30th to the 60th percentile range of performance at 1 month post onset.

Definition. Intrasubtest variability (ISV) was defined as the number of different scores within a subtest, and provides an index of the size of a patient's response repertoire. It is important to note that the ISV is impartial to the actual numerical values assigned to specific behaviors from the multidimensional scale, but rather is a direct index of the number of different behaviors exhibited by the patient for any given subtest. ISV values for any subtest range from a minimum of 1 to a maximum of 10. Modality ISV's and overall ISV's are derived by averaging subtest ISV's.

## RESULTS

PICA data were analyzed as follows. Phase A refers to PICA's administered at 1 month post onset; Phase B, within the 2-3 month post onset period, and Phase C, within the 4-6 month post onset period. Cohort 1 refers to the 10 subjects for whom PICA's were administered in Phases A and B; Cohort 2 refers to the 4 subjects of the original group for whom PICA's were administered in Phases A, B and C.

Question 1 pertained to the distribution of subtest ISV values. For this analysis, the numbers of subtests represented by ISV values of 1 through 10 were tabulated, then converted to percent values based on the total number of subtests analyzed, 432. The analysis showed that 31% of all subtests had an ISV value of 1; 23.1%, an ISV value of 2; 18.3%, an ISV value of 3; 15.0%, an ISV of 4; 9.5%, an ISV of 5; 2.8%, an ISV of 6; .002, an ISV of 7. No subtests in the sample received an ISV of 8, 9 or 10.

Thus, though as many as 16 different responses as defined by the multidimensional scoring system are potentially available to the patient, it appears that most patients typically limit their selection to 1, 2 or 3 response types and occasionally exhibit 4, 5 or 6 different response types on any given subtest.

Question 2 was: "What is the relative occurrence of positive and negative change in intrasubtest variability scores for modalities showing improving mean scores?" For this analysis, not the amount of change but rather the direction of change in the ISV value from test to retest was analyzed. To simplify this analysis, subtest ISV values were converted to modality ISV values. Three sets of data were available. In Cohort 1, Phase A scores were subtracted from Phase B scores; in Cohort 2, Phase B from Phase C, and A from B. The first step involved a tabulation of the concurrent instances of change in ISV and change in subtest mean scores. The second step involved a tabulation of the concurrent instances and the direction (either positive or negative) of change in ISV and subtest mean scores.

The results for Cohort 2 are presented in Figure 1. The first set of change scores (Phase B minus Phase A) are shown on the left; the second set (Phase C minus Phase B), on the right. This figure shows that improving modality mean scores were associated with negative--i.e., decreasing--intrasubtest variability 54.5% of the time in the early test-retest period, and 63.6% of the time in the later test-retest period, respectively. Conversely, improving modality mean scores were associated with positive--i.e., increasing--intrasubtest variability 36.4% of the time in the early test-retest period and only 9.1% of the time in the later test-retest period. The remaining improving modality mean scores were associated with no change in intrasubtest variability.

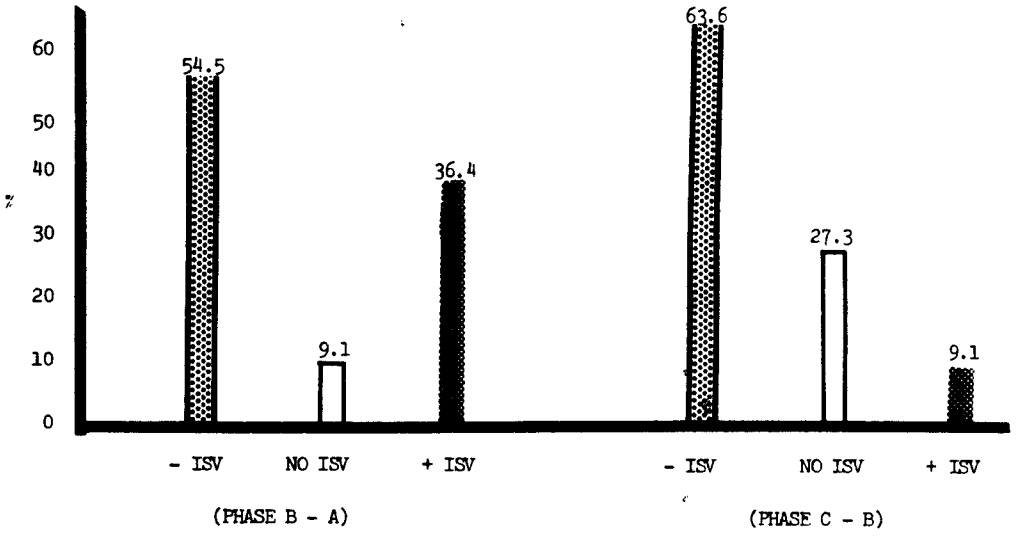


Figure 1. Occurrence of positive, negative and no change in ISV scores relative to improving modality mean scores in Cohort 2 (N = 4).

Our followup question was, "Is this trend of decreasing variability the same for each modality?" Because of the larger number of scores available, only scores from Cohort 1, which was comprised of all ten subjects, were analyzed. The occurrence of positive, negative and no change in intrasubtest variability relative to improving modality mean scores are shown in Figure 2, with gestural, verbal, graphic and all modalities combined shown from left to right. In both the gestural and verbal modalities, improving modality mean scores were associated with negative--i.e., decreasing--intrasubtest variability over 60% of the time. In contrast, improving modality mean scores in the graphic modality were associated with positive--i.e., increasing--intrasubtest variability. Thus, it appears that increasing or decreasing intrasubtest variability on test-retest is modality specific.

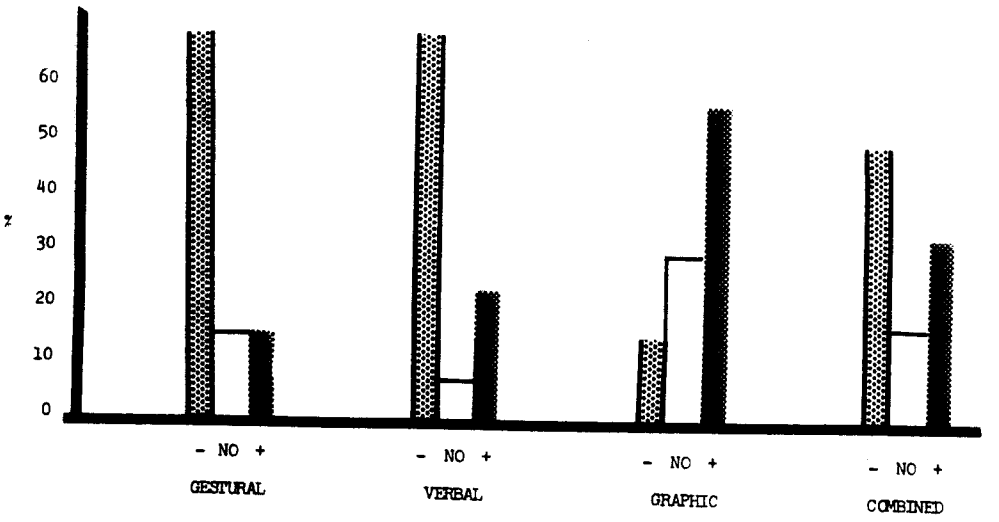


Figure 2. Occurrence of positive, negative and no change in ISV relative to improving modality mean scores, Cohort 1 (N = 10).

Question 3 was, "What is the relationship of intrasubtest variability and the actual level of performance on the PICA?" Figure 3 shows a scatterplot of modality ISV values and corresponding modality percentiles. It appears from this figure that intrasubtest variability tends to increase as performance approaches the 50th percentile and subsequently tends to decrease as performance approaches the 100th percentile.


Figure 3. Scatterplot of modality percentiles and ISV values.

## SUMMARY

Distribution of ISV values. Over half of the subtests were represented by ISV's of 1 or 2, and never by ISV's of 8, 9 or 10.
Direction if ISV change on test-retest. Improvement on the PICA was associated with decreasing ISV in the gestural and verbal modalities, and increasing ISV in the graphic modality.
Relationship of ISV to level of performance. ISV tended to increase as performance approached the 50th percentile and subsequently tended to decrease as performance approached the 100th percentile.

This was not a study of the predictive value of intrasubtest variability, but rather a descriptive study of the distribution and direction of change in intrasubtest variability over time. The findings neither confirm nor refute Porch's original speculation about the prognostic value of a wide variety of scores. The data do lend support to the idea that intrasubtest variability (ISV) as defined in this study, is an index of the patient's response repertoire, and that the variety of responses available is probably related to both the modality of response and the level of performance. The ISV has, we feel, two advantages. It is a direct measure of the patient's response repertoire, and it is unbiased by the actual numerical values of the multidimensional scoring system. If variety of scores within subtests is, in fact, predictive of recovery from aphasia, an index such as ISV may be helpful in describing this response variability.

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