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# Right-Left Discrimination and Finger-Localization in Normal and Brain-Injured Subjects

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Right-left discrimination and finger-localization are perceptual skills of considerable clinical interest because impairment in these abilities is sometimes encountered in patients with cerebral disease (2). With the rather gross methods employed in the typical clinical neurological examination, isolated impairment in right-left discrimination or finger-localization does not appear to be a frequent finding in *adult* patients with cerebral injury or disease. This is not altogether surprising when it is realized that the responsible cerebral lesion is almost invariably to be found in the dominant cerebral hemisphere. A frequent consequence of such a lesion is, of course, an aphasic disorder which is likely to interfere with the assessment of these skills, since the tasks by their very nature involve some degree of symbol-understanding or symbolic response. Moreover, if a patient with gross sensory disturbances or profound impairment of the body-image is unable to identify the right and left sides of his body or to localize his fingers, the deficits are not usually designated as "right-left disorientation" or "finger-agnosia" because of the presence of the more general disability. Nevertheless, even when these factors are discounted, defective right-left discrimination and finger-localization seem to be rather infrequently observed in brain-injured adults.

However, it is possible that the comparative infrequency of occurrence of these isolated deficits is a function of the relatively crude methods which have been employed to disclose them. This suggestion is supported by the finding of Benton, Hutcheon and Seymour (1) of a significant incidence of defective performance in brain-injured and defective children. Utilizing methods which are somewhat more refined than those typically used and comparing normal children and mentally defective adolescents who were roughly matched with respect to mental age, it was found that an appreciable proportion of the defective and brain-injured subjects made pathologically poor performances. The question thus arises as to whether there is a real difference in the incidence of defective performance on these tasks in brain-injured adults as compared with brain-injured and defective children and adolescents or whether the discrepancy in impression is due to different methods of assessment, i.e., a clinical approach in the case of the adult patients and a more psychometric approach in the case of the younger patients. The present study attempts to answer this question by applying the relatively more refined assessment technique to the performances of adult patients.

## Procedure

The subjects were patients on various services of the Veterans Administration Hospital in Iowa City. They were selected with the following restrictions: (1) Age range—20-69 years; (2) Minimal IQ of 90, as defined by either the full Wechsler-Bellevue or the Verbal Scale of the Wechsler-Bellevue; (3) Absence of psychosis or important motor or sensory handicaps. Two groups of 22 patients each were formed, the one a brain-injured group, the other with no evidence of cerebral pathology, the criterion being final diagnosis by the medical staff.

The right-left discrimination test battery is presented in Table 1.

**Table 1**

Right-Left Discrimination Test

1. Show me your left hand.
2. Show me your right leg.
3. Show me your left eye.
4. Show me your right ear.
5. Show me your left leg.
6. Show me your right hand.
7. Point to the man's right leg.
8. Point to the man's left ear.
9. Point to the man's right eye.
10. Point to the man's left hand.
11. Touch your right ear with your left hand.
12. Touch your left foot with your right hand.
13. Cross your left leg over your right knee.
14. Touch your right knee with your left hand and your left elbow with your right hand at the same time.

(Subject closes his eyes)

15. Show me your right hand.
16. Show me your left leg.
17. Show me your right eye.
18. Show me your left ear.
19. Touch your left ear with your right hand.
20. Touch your right foot with your left hand.

It will be noted that five types of performance are elicited: (A) With eyes open, identification of parts of one's own body; (B) With eyes open, identification of body parts in a representation of a man; (C) With eyes open, execution of "crossed commands"; (D) With eyes closed, identification of parts of one's own body; (E) With eyes closed, execution of "crossed commands." In previous analyses (1,4), the internal consistency of this test, as estimated by the corrected split-half correlation coefficient, has been found to be about .90. Retest reliability, as estimated by the correlation coefficient between equivalent forms, has been found to be about .70.

The finger-localization test battery is presented in Table 2.

**Table 2**

Finger-Localization Test

1. (HAND VISIBLE) Subject names finger or points to it on model as examiner touches them in following order:
   Right Hand—1____4____2____5____3____4____1____3____5____2____
   Left Hand—Reverse above order.
2. (HAND HIDDEN) Subject names finger or points to it on model as examiner touches them in following order:
   Right Hand—2____4____1____5____3____4____2____3____1____5____
   Left Hand—Reverse above order.
3. (HAND HIDDEN) Subject names (or points to) fingers touched simultaneously as follows:
   Right Hand—2-4____2-3____3-5____3-4____1-3____
   Left Hand—3-4____3-5____2-4____2-3____1-4____

Three types of performance are elicited: (A) With his hand visible to him, the subject identifies single fingers which have been tactually stimulated; (B) Without the aid of vision (i.e., with his hand hidden from his view), the subject identifies single fingers which have been tactually stimulated; (C) Without the aid of vision, the subject identifies pairs of fingers which have been subjected to simultaneous tactual stimulation.

The arrangement for identification of fingers without visual guidance was as follows: A wooden box, from which the front and back sides had been removed and to the front side of which a curtain had been attached, was used. The subject inserted his hand under the curtain of the front side while the experimenter stimulated individual fingers with a pencil through the open back side. In order to eliminate the necessity (but not the possibility) of a verbal response on the part of the subject, a model of the right or left hand, with the thumb and fingers numbered from one to five, was placed before the subject who was told that he can identify the stimulated finger (or fingers) by naming it, indicating its number on the model or simply by pointing to it on the model. Internal consistency and retest reliability of the task has been found to be virtually the same as for the right-left discrimination test, i.e., about .90 and .70 respectively. The three subsections of the test have also been found to have adequate internal consistency (corrected split-half coefficients from .72 to .91).

## Results

### Personal Characteristics of the Subjects

The mean age of the control group was 43.6 years (S.D. 14.2) and that of the brain-injured group was 46.6 years (S.D. 13.4). The mean educational level of the control group was 9.1 years (S.D. 2.7), that of brain-injured group 9.5 years (S.D. 2.7). The mean IQ of the control group was 103.9 (S.D. 8.6) and that of the brain-injured group was 102.5 (S.D. 7.7). As measured by the t-test there were no significant differences between the two groups in respect to any of these characteristics.

### Right-Left Discrimination

The scores of the two groups of subjects on the right-left discrimination test are presented in Table 3. It is evident that there is no

**Table 3**

**Distributions of Right-Left Discrimination and Finger-Localization Scores in Control and Brain-Injured Subjects (N = 22 in each group)**

| Right-Left Discrimination | | | Finger-Localization | | |
|---|---|---|---|---|---|
| Score | Controls | Brain-Injured | Score | Controls | Brain-Injured |
| 20 | 19 | 18 | 50 | 13 | 9 |
| 19 | 3 | 4 | 49 | 4 | 1 |
| | | | 48 | 2 | 5 |
| | | | 47 | 3 | 3 |
| | | | 46 | .... | 1 |
| | | | 45 | .... | .... |
| | | | 44 | .... | 2 |
| | | | 43 | .... | 1 |

difference between the two groups, all patients performing at a virtually perfect level. Twenty-two patients constitute too small a number from which to generalize but the complete absence of defective performance suggests that traditional clinical impression is correct in the conclusion that isolated right-left disorientation is a relatively rare symptom in cerebral disease, at least in patients who are not suffering from severe general deterioration.

### Finger Localization

The scores of the two groups of subjects on the finger-localization test are also shown in Table 3. The results present a somewhat different picture from that seen for the right-left discrimination task. Utilizing Festinger's (3) test for the significance of the difference between means drawn from populations with an exponential frequency distribution, the mean number of errors (1.95) made by the brain-injured group proved to be significantly greater ($p < .01$) than the mean number of errors (.77) made by the control group. From inspection of the distribution of scores it is evident that this difference is determined largely by the scores of three brain-injured subjects who made what can be reasonably designated as pathologically poor performances, since their performance level was definitely below that of the poorest control subject.

Thus it seems that, utilizing a somewhat more refined examining technique than is typically employed, a small proportion of brain-injured subjects, who do not suffer from serious general intellectual impairment, will show defective finger-localization. The exact proportion can hardly be estimated from the small sample investigated in this study but it seems likely that it is high enough to be of clinical interest.

### References


1. Benton, A. L., Hutcheon, J. F. and Seymour, Elsie. Arithmetic ability, finger-localization capacity and right-left discrimination in normal and defective children. Amer. J. Orthopsychiat., 1951, 21, 756-766.
2. Critchley, M. The Parietal Lobes. London: Arnold, 1953.
3. Festinger, L. An exact test of significance for means of samples drawn from populations with an exponential frequency distribution. Psychometrika, 1943, 8, 153-160.
4. Swanson, R. and Benton, A. L. Some aspects of the genetic development of right-left discrimination. Child Developm., 1955, 26.



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