Chapter 8

THE DESIGN OF THE PSYCHOLOGIC INVESTIGATION

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The basic problem of evaluating the psychologic changes accompanying frontal lobe operations probably will not be solved solely by psychologic methods. The cooperation of all the medical sciences as well as of the cognate basic sciences is essential for a solution of the fundamental problems which psychosurgery has raised. Within the field of psychology itself all the techniques that psychologists have evolved in their various specialties as well as those that they can borrow from adjacent fields must be mustered for the attack on this problem. The basic function of the psychologist doing research with psychosurgery patients may be described as the introduction of quantitative measures for the selection of patients who may benefit by the operation and for estimating changes in behavior following frontal lobe operations.

The changes brought about in the sensory, motor, and perceptual spheres by a brain operation can be readily measured with the tools and techniques of the psychophysiologist and the psychophysicist. It is important to bear in mind that psychosurgery patients are either psychotic or severely neurotic to begin with. The relative role of tissue removal in bringing about an improvement must be weighed against such factors as amelioration of psychotic processes, oscillation in psychoses, and even spontaneous improvement possibilities.

The selection and development of psychometric tests, interview techniques, and observational procedures are other areas which challenge the psychologist entering upon the evaluation of psychosurgery. Most of our present day techniques have been developed with normal persons. The usual testing of the psychotic and the severely neurotic patients with these procedures is primarily for diagnostic purposes. Tests of abnormal behavior itself must be adapted for each type of investigation. Even such simple materials as memory or perceptual tests, which have been developed with normal persons are not directly applicable to those who are abnormal. With the exception of a few standardized tests such as the Wechsler-Bellevue, all tests in the present battery were specially devised. The advantages of new methods are clear but they bring with them questions of standardization, reliability, and validity which are not easy to answer without a considerable amount of preliminary work.
The evaluation of the therapeutic outcome of psychosurgery presents a very difficult problem to the psychologist. The general effect of the "total push" to which all of the patients had been subjected also entered to confuse the issue. Furthermore, the role of the psychologic impact of the operation itself aside from the physiologic changes which it produces had to be considered. How much of the temporary or even permanent improvement is attributable to the psychologic expectancy or hope induced in the patient, in his family, and in the medical investigators? All of these factors needed scrutiny.

The relation of the preoperative personality of the patient and his attitudes towards the operation were important variables to be considered in the evaluation of outcome. Individuals with highly developed personalities and with capacities of a high order might possibly be altered by operation at a much greater cost to their capacities than patients whose initial level was low. In such cases it became important to weigh the eventual results against the expected losses. Patients who have very little to lose but whose well-being might be increased by operation present a different problem of psychologic evaluation than do patients whose initial capacity is high.

The statistical methods for evaluating the results of any method of therapy have heretofore depended largely on group methods in which the individuals undergoing the operation were regarded as a sample representing a given group of patients and the outcome of the operation was generalized for the whole group and each of its individual members. This procedure had many shortcomings when applied to the evaluation of brain-operated cases. The patients selected for operation were not a random sample representative of any patient population on a segment of such population. They were usually selected on the basis of availability and consent of relatives and absence of any physical contraindications to the surgical procedure. What generalizations can be drawn from a sample obtained in such an arbitrary manner, and how one can obtain satisfactory control group of patients remains an unresolved issue.

So far as the statistical methods of evaluation are concerned the observation of Von Mises ('47) is relevant. "It remains an invariable fact, dominating all problems in mathematical statistics, that no substantial inference can be drawn from a small number of observations if nothing is known 'a priori,' i.e., preliminary to the experiments about the object of experimentation."

Since some of the proposed operative surgical procedures were new, a repetition of some tests and techniques on the new variety of operations might lead to new findings. The ever-increasing crop of problems released by the wide-spread use of lobotomy, and of topectomy, as well as other varieties of brain operation was carefully sifted and the following procedures were selected: (1) psychometric functions, (2) complex mental functions, (3) attitude evaluation, (4) observational studies, and (5) psychophysiologic functions.

The psychometric procedures consisted of 2 intelligence tests
(Wechsler-Bellevue and the Porteus Maze) and 2 sorting and shift tests (Weigl and Homograph tests). The intelligence tests were selected in order to obtain a baseline for the preoperative intellectual level of the patients and to note whether any temporary or permanent changes occurred in intelligence. The sorting and shift tests were introduced in order to determine whether the new operative techniques produced a temporary decrement in performance on these tests.

The complex functions sampled in this investigation were memory, learning, maintenance of set, and perceptual functions. Some of these functions had been examined in the first Greystone project but the experimental procedures were modified so as to remove some of the difficulties which had been previously experienced. Other procedures had never been tried before with psychosurgery cases but were introduced because of claims and observations reported by other investigators.

Attitude evaluation (Anxiety and Complaint inventories) had been undertaken in the first Greystone project and led to the important conclusion that anxiety reduction seemed to be the most important underlying change resulting from brain surgery. In order to examine this hypothesis further, carefully constructed controlled interviews utilizing a standard interview technique of the type used by Kinsey et al., ('48) were prepared and applied to the patient group.

In the observational studies the patient was asked to wait in a pre-arranged room for his next appointment. During his 20-minute wait he was observed from behind a one-way screen and descriptive notes of his behavior were recorded. The responses of the patient while alone and when in company of another patient were contrasted preoperatively as well as postoperatively.

The psychophysiologic area sampled the functions of vision, audition, somesthesis, and kinesthesis. These functions which are among those for which exact measurements by standard techniques were possible, were investigated by the use of various tests to ascertain any reflections of brain operation in such spheres of behavior.

**EXPERIMENTAL DESIGN**

The experimental design for the psychologic techniques differed considerably from those ordinarily used in study of brain-operated patients. Until very recently only postoperative measures were available and inferences regarding possible deterioration or decrement in function were made on the basis of assumed preoperative functioning or by comparison with a more or less equated control group. Recent studies have introduced preoperative measures to serve as baselines for the postoperative results, viz., the first Greystone study. Here both preoperative and postoperative measures were available for the operated group as well as for a matched control group. Although the latter design was an improvement on its predecessors it nevertheless
had several shortcomings. First, when a control group is matched with an operated group, the matching can be done only on the basis of a limited number of variables. For the majority of variables the groups remain unmatched. Consequently certain statistical devices must be utilized to remove initial inequalities in the operated and control groups. At times these statistical devices are adequate, but in some situations they are totally inadequate. Second, even on variables for which the 2 groups were matched, the intraindividual variability in behavior which is so characteristically different from patient to patient, remained uncontrolled. In order to circumvent these difficulties, it was decided to develop a new design in which each patient would serve as his own control. Two preoperative and 2 postoperative measures were obtained on most tests. The availability of 2 preoperative scores provided not only a more stable measure of level of performance, but it also gave an estimate of the range of intraindividual variability.

Because of limitations beyond the control of experimental design, the control group could not be adequately utilized. Too few cases were available, and the degree of correspondence between them and the operated group was not close. However, in several instances the availability of several preoperative measures on these controls provided a firmer basis for evaluating the outcome of the operation.

In order to identify the various testing procedures, the following system was devised. In referring to a given test, the number of days it preceded or followed the date of the operation was noted. Taking the operation day as day zero, preoperative testings were designated by a minus sign preceding the number of days before day zero, while letters following the numbers indicated the sequence of the test applications. Thus -60A means that it was the first application of the test (A) and that it was given 60 days before the operation, while +10C would mean the third application of the test (C) given 10 days after the operation.

**SELECTION OF THE PATIENTS**

Each of the patients who had been selected for the project was studied by each of the examiners with a view to determining the patient's capacity in the various psychologic tests. Test results were evaluated individually for each test performance of each patient. If the performance were not thought by the examiner to be a fair representation of the patient's ability, the particular test results were thrown out and a new attempt made to secure a representative performance. If such a satisfactory record could not be obtained, no record of the patient's ability on the test in question is given in the reports which follow.

The background data for the patients included in the psychologic reports which follow are given in Table 5.
# Table 5

**Background Data of Patients Included in Psychologic Reports** (*Compare with Figure 5*)

<table>
<thead>
<tr>
<th>No. of Cases</th>
<th>Diagnosis</th>
<th>Mean Age</th>
<th>Range of Age</th>
<th>Mean Years Hospitalized</th>
<th>Preoperative Mean IQ</th>
<th>Preoperative Range IQ</th>
<th>Type of Surgery Employed</th>
</tr>
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<tbody>
<tr>
<td>11</td>
<td>C=4 H=4 P=3 M=2 F=9</td>
<td>37.4</td>
<td>26-52</td>
<td>6.5</td>
<td>92.2</td>
<td>85-114</td>
<td>VL</td>
</tr>
<tr>
<td>7</td>
<td>C=0 H=7 P=0 M=2 F=5</td>
<td>31.1</td>
<td>27-34</td>
<td>5.6</td>
<td>70.6</td>
<td>55-80</td>
<td>TO</td>
</tr>
<tr>
<td>2</td>
<td>C=1 H=1 P=0 M=2 F=0</td>
<td>30.0</td>
<td>30-30</td>
<td>2.4</td>
<td>77.0</td>
<td>73-82</td>
<td>TC</td>
</tr>
<tr>
<td>2</td>
<td>C=0 H=2 P=0 M=0 F=2</td>
<td>29.0</td>
<td>32-26</td>
<td>6.5</td>
<td>77.0</td>
<td>58-96</td>
<td>TH</td>
</tr>
<tr>
<td>6</td>
<td>C=1 H=2 P=3 M=2 F=4</td>
<td>39.0</td>
<td>32-52</td>
<td>6.1</td>
<td>100.3</td>
<td>83-115</td>
<td>None</td>
</tr>
<tr>
<td>28</td>
<td>C=8 H=16 P=6 M=6 F=20</td>
<td>35.4</td>
<td>26-52</td>
<td>5.7</td>
<td>87.3</td>
<td>85-115</td>
<td>T</td>
</tr>
</tbody>
</table>

**Legend:**

- VL = Venous ligation
- TO = Transorbital lobotomy
- TC = Thermocoagulation
- TH = Thalamotomy
- C = Catatonia
- P = Paranoia
- H = Hebephrenia
- M = Male
- F = Female
- T = Entire group studied
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It will be noted that the patients were primarily drawn from the fourth decade of life. Their preoperative IQ averaged 88. The average length of hospitalization was about 6 years. All of the patients were diagnosed as schizophrenia (usually hebephrenic schizophrenia).

Since it was expected on the basis of the first Greystone project results some tests would show a transient change during the first 3 to 6 weeks after operation, certain of the tests were repeated within 10 days after operation, but generally speaking the testing dates were -60A, -30B, +30C, +60D. The actual schedule varied somewhat from test to test.