Brit. J. Psychiat. (1973), 123, 661–2 *ABSTRACT*

Brain Disconnection and Schizophrenia

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The concept of brain disconnection derives from work in which the two cerebral hemispheres are surgically separated by division of the corpus callosum. The patient behaves as if his two half-brains function to some degree independently. The syndrome of brain disconnection is exemplified by such split-brain cases (Geschwind, 1965). Neither hemisphere shows an awareness of the functions of the other, and there is a marked failure to cross-match stimuli across the midline of the body. The integrity of the corpus callosum is essential to normal integration between the hemispheres.

Abnormality of the corpus callosum in schizophrenia has been indicated by the finding of an increase in size to a highly significant degree in chronic patients (Rosenthal and Bigelow, 1972). An interesting possibility, therefore, is of differences in articulation of the hemispheres in schizophrenics and normals.

To test for abnormalities in transfer between the hemispheres in schizophrenia, we conducted an experiment in which the patients were required to cross-match two pieces of information flashed at the same time to different hemispheres. A comparison was made with the situation in which both were flashed to a single hemisphere, either the right or left. The performance of three groups was studied: a schizophrenic group, a psychiatric control group, and a group of normal persons in hospital.

There were twelve subjects in each group. The schizophrenic group was composed of patients attending a day centre, and judged to be currently suffering from an active schizophrenic illness. The psychiatric controls were attending the same day centre, but had at no time been diagnosed as schizophrenic; the diagnoses of this group included affective psychosis, reactive depression, anxiety states and personality disorder. The length of stay in hospital and of previous psychiatric illness was approximately equal in the two groups. The subjects in the normal control group were patients in a general hospital suffering from metabolic or systemic disorders, none of which was neurological. The mean ages of the three groups did not differ.

The apparatus has been described previously (Beaumont and Dimond, 1973; and see Fig. 1). The patient fixates a central light and faces four display screens on which stimuli are back-projected. Stimuli are exposed for 150 msec. to prevent orientation of the eyes away from central fixation. Screens 1 and 2 (numbering left to right) flash to the right hemisphere by left nasal and right temporal hemiretinae, and screens 3 and 4 to the left hemisphere by right nasal and left temporal hemiretinae. The stimuli were letters, digits and abstract shapes. In identification trials, the subject was merely asked to call out the name of the letter or digit that he saw. In matching, the subject was shown two stimuli and was to call out 'same' or 'different', as appropriate. For identification, the stimulus was directed to either the left or the right hemisphere. For matching, stimuli were directed to the right hemisphere, the left hemisphere, or across the hemispheres (balanced for screens nearer or further from fixation).

The results were analysed in terms of errors, including both incorrect responses and failures to make any response. It was found that the schizophrenics performed badly when required to match two stimuli across the hemispheres. Their performance was significantly worse in this condition than that of either the psychiatric controls or the normals for matching letters ($F = 5{\cdot}85$; $p = 0{\cdot}004$) and for matching shapes ($F = 7{\cdot}77$; $p = 0{\cdot}001$). In addition, the schizophrenic group performed worse than the normal controls in the left hemisphere for matching letters ($t = 2{\cdot}27$; $p = 0{\cdot}03$), and worse than the psychiatric controls in the right hemisphere for matching digits ($t = 2{\cdot}16$; $p = 0{\cdot}04$) and shapes ($t = 2{\cdot}47$; $p = 0{\cdot}02$), while the normal controls occupied an intermediate position. When simple identification rather than matching was demanded, the schizophrenic patients showed no deficit, and in fact performed better than the normals, although not significantly so.

The evidence reported here of a decrement in the ability to cross-match between the hemispheres, taken in conjunction with the evidence of enlargement of the corpus callosum, suggests a pathology of articulation between the two halves of the brain. It is as if the patient showed partial brain disconnection. This is not to suggest that a facile equation should be made between schizophrenia and the split-brain condition, but rather that there is a pattern of disconnection peculiar to the disorder, the nature of which now requires study.

Split-brain symptoms are believed to be present because an equivalent deficit to that in matching

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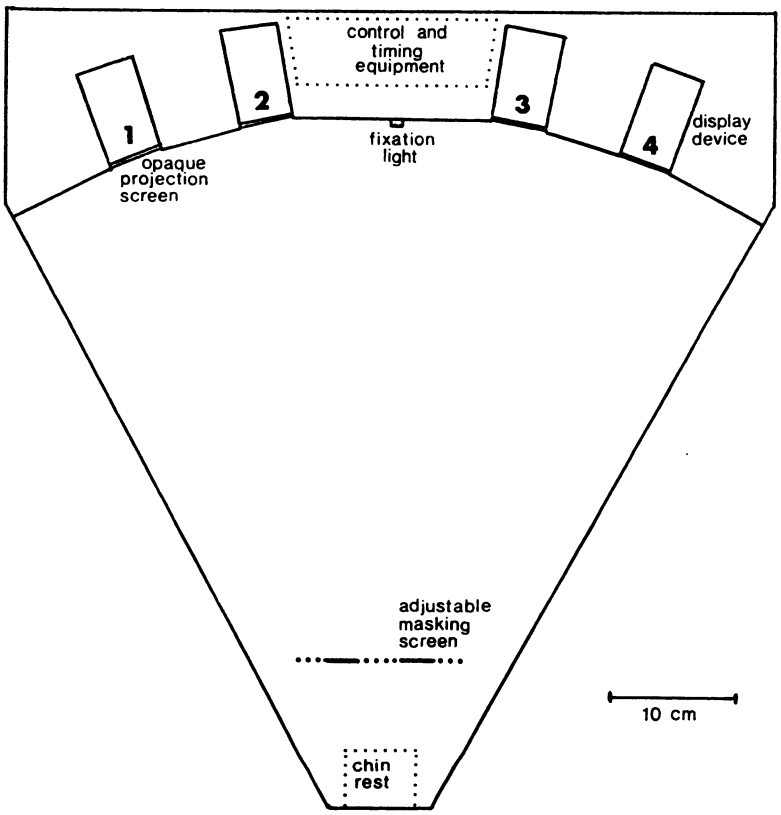


FIG. 1.—Diagrammatic scale plan of the apparatus.

between the hemispheres was not observed in matching within one hemisphere. In this respect the deficit is specific and is unlikely to be a reflection of such factors as drug administration or intellectual deterioration. The schizophrenic group performed as normals in matching within a hemisphere, with the exception of a significant deficit for matching letters in the left hemisphere. Clearly, there is some degree of specific hemisphere deficit, but the failure to cross-match cannot be attributed entirely to this source. The authors feel that the most direct explanation of these results is that in schizophrenia the two cerebral hemispheres are partially disconnected and that this reflects some change in the efficiency of the corpus callosum.

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