

Simultaneous double discrimination response following brain bisection¹

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The performance of two choice reactions, one with each hand, in response to two visual discrimination tasks presented simultaneously, one in each half of the visual field, normally takes much longer than the performance of either one alone. In commissurotomed human patients, however, the double task was performed as rapidly as the single task. The results conform with the view that the neocortical commissures serve to unify adjustment to the visual world (Gazzaniga et al, 1965) and their presence tends to prevent the two half brains from making discordant volitional decisions.

When the cerebral hemispheres have been separated by complete surgical section of the neocortical commissures, each of the two disconnected hemispheres continues to function much as before except that their activities lack the high interdependence and unity that normally prevails. It has become clear from a number of studies in man (Gazzaniga et al, 1962, 1963, 1965), as well as in animals (Sperry, 1961, 1964), that the two separated hemispheres continue to cooperate much of the time in performing a single unified function. Each of the two disconnected hemispheres is also able to take over the directive controls of total behavior on different occasions. Left and right hemispheres may alternate in dominating the control of the lower motor system. When one hemisphere is in command, conflicting or interfering activity in the other hemisphere tends, as a rule, to be excluded from the motor system which swings over entirely to mediating the higher functions of whichever hemisphere is dominant at the moment. An exception occurs at times in the control of the hands, especially in man, where dissociated and even antagonistic performances can be carried out simultaneously under certain conditions.

It has been shown experimentally in monkeys that the two separated hemispheres working in parallel are able to perceive, learn, and remember contradictory discrimination tasks under conditions involving a polarized light technique whereby the separate hemispheres are made to see different things in the same place at the same time (Trevarthen, 1962). Rapid alternation of hemispheric dominance within the time span of a response trial in the foregoing could not be excluded. Also there were indications of the presence of unifying factors that tended to favor the use of one hemisphere at a time in a majority of cases.

Beyond the foregoing there is little information available concerning the extent to which the disconnected hemispheres can carry out simultaneously activities that normally would produce mutual interference in the presence of the commissures. The following is the

result of an attempt to investigate this question further in commissurotomed human subjects. A visual discrimination task was flashed to the left hemisphere first and then together with another different discrimination task to the right hemisphere and the reaction times to the single and double presentation were measured and compared with normal and with preoperative readings. The obvious interference produced by pairing the tasks under control conditions stood in marked contrast to the lack of interference that was found to prevail in the absence of the commissures.

Procedure

Four normal and four operated Ss were tested. The operated Ss were all patients of Drs. Philip Vogel and Joseph Bogen of the California College of Medicine and had undergone midline section of the neocortical commissures at the White Memorial Hospital in an effort to control advanced epileptic seizures (Bogen & Vogel, 1962, 1965). Results of other functional studies carried out on these same cases have been reported elsewhere (Gazzaniga et al, 1962, 1963, 1965). All operated Ss, both before and after surgery, were receiving several anticonvulsant drugs in varying amounts, which uniformly slowed down their reaction time both pre- and post-operatively.

Each S was seated in front of the panel pictures in Fig. 1, with gaze fixed on a central point and was instructed to respond as fast as possible to one of a pair of stimuli presented in either or both visual fields. In all Ss the left hemisphere-right hand combination was required to respond to the green of a red-green discrimination pair presented in the right visual field, and the left hand-right hemisphere combination to a light-dark discrimination task in the left field. Each trial was preceded by instructions to the S to look at a central point on the panel. When accurate fixation was attained, as checked by the experimenter behind the screen, the stimuli were tachistoscopically presented (tungsten 24 VDC source energized for 0.15 sec.). Presentation of visual material in this manner insured that stimuli in the right visual field would be projected solely to the

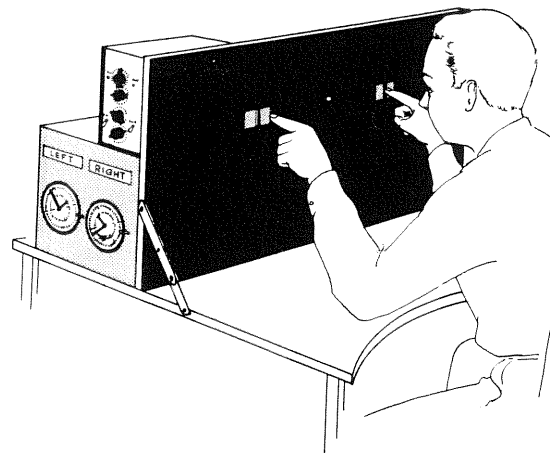


Fig. 1. Testing apparatus: While subject fixated central point, stimuli were flashed onto the translucent response panels.