

A note on Filbey and Gazzaniga's "Splitting the brain with reaction time"

WALTER F. MCKEEVER and MAURICE D. HULING
Ventura County Mental Health Department, Ventura, Calif. 93003

A recent issue of this journal reported an interesting experiment by Filbey & Gazzaniga (1969). A condensed version of the original was subsequently reprinted (Filbey & Gazzaniga, 1970) in a widely circulated publication of the National Institute of Mental Health. Filbey and Gazzaniga implied that "splitting the normal brain with reaction time" was a new strategy conceivable only on the groundwork provided by the split-brain studies of Sperry and Gazzaniga, which the authors cited.

Actually, Poffenberger (1912) "split the normal brain with reaction time" 58 years ago. Poffenberger tested the hypothesis that reaction time should be longer when a visual stimulus was directed to one hemisphere and a response was required from the other hemisphere than when the same hemisphere both received the stimulus and initiated the response. The results provided clear-cut support for the hypothesis, showing that reaction time was 5-6 msec longer when transcallosal relay was necessary. Indeed, Poffenberger should be credited with having "split the normal brain with reaction time" 12 years before Bykov (1924) performed the first split-brain experiment on a dog.

Transcallosal transmission time (TTT) was also measured behaviorally by Efron (1963a, b) who hypothesized that judgments of simultaneity of the onsets of lights in the left and right visual fields were made in the left hemisphere. His results were consistent with the hypothesis and showed that, for lights of the same intensity, the left light had to precede the right by 2-6 msec in order to have them judged as simultaneous. Efron also showed that stimulus intensity appeared to be an important determinant of TTT.

More recently, Jeeves (1969), using reaction time measures, found TTTs on the order of 2-3 msec for normals, and much longer interhemispheric transfer times for persons with congenital agenesis of the corpus callosum.

It should also be noted that other behavioral techniques for demonstrating the functional asymmetry of the cerebral hemispheres have been studied by many investigators (see, for example, Kimura, 1966, 1967).

Finally, Filbey and Gazzaniga's conclusion, that they have established a base TTT against which either hemispheric processing or transfer times for more complicated tasks may be meaningfully compared, seems unwarranted. Poffenberger's, Efron's, and Jeeves's estimates of TTT are in agreement but differ considerably from the 30- to 40-msec value obtained by Filbey and Gazzaniga, despite the fact that the task complexity in all three experiments seems similar. One should be aware of these discrepancies and of the need for resolving them experimentally.

Variations of the Filbey and Gazzaniga procedures might be illuminating. It is not clear from their report why only trials from the last two of the five experimental days were analyzed. Also, the practice of

informing Ss of their reaction times to all trials might better be avoided, since it allows the possibility of subtle inadvertent shaping of left-right reaction-time differences.

REFERENCES

- BYKOV, K. Versuche an Hunden mit durchschneiden des Corpus Callosum. *Zentralblatt Neurologische Psychiatrie*, 1924-1925, 39, 199.
- EFRON, R. The effect of handedness on the perception of simultaneity and temporal order. *Brain*, 1963a, 86, 261-284.
- EFRON, R. The effect of stimulus intensity on the perception of simultaneity in right- and left-handed subjects. *Brain*, 1963b, 86, 285-294.
- FILBEY, R. A., & GAZZANIGA, M. S. Splitting the normal brain with reaction time. *Psychonomic Science*, 1969, 17, 335-336.
- FILBEY, R. A., & GAZZANIGA, M. S. Splitting the normal brain with reaction time. *Mental Health Digest*, 1970, 2, 15.
- JEEVES, M. A. A comparison of interhemispheric transmission times in acallosals and normals. *Psychonomic Science*, 1969, 16, 245-246.
- KIMURA, D. Dual functional asymmetry of the brain in visual perception. *Neuropsychologia*, 1966, 4, 275-285.
- KIMURA, D. Functional asymmetry of the brain in dichotic listening. *Cortex*, 1967, 3, 163-178.
- POFFENBERGER, A. T. Reaction time to retinal stimulation with special reference to the time lost in conduction through nerve centers. *Archives of Psychology (New York)*, 1912, No. 23.

Reply to McKeever and Huling

MICHAEL S. GAZZANIGA
New York University, New York, N.Y. 10003

The brief articles appearing in *Psychonomic Science* cannot possibly contain a full discussion or review of each subject introduced. In the present case the suggested addition would have left other dimensions of the problem uncovered. For those who do not know the history, it is as follows. Up until the mid-50s, the majority view in psychobiology was that the corpus callosum played little or no important role in integrating sensory or motor information across the cerebral hemispheres. This was in large part due to the seemingly exhaustive studies of Akelaitis (1941, 1943, 1944, 1942) at the University of Rochester who studied some 26 cases of partial and complete callosal section. His inability to demonstrate any reliable deficits undercut dozens of earlier studies—Poffenberger's (1912) being but one. Lashley, after reviewing the literature at the time commented that the corpus callosum's only function seemed to be to hold the cerebral hemispheres together.

It was in this context that Sperry and Myers commenced their now classic work on split-brains. It has now

been almost 20 years since their pioneering studies began to spell out the role of the callosum. Starting in the early 60s, Sperry and I had the opportunity to study in detail callosum-sectioned humans. The broad outlines of the earlier animal findings, enhancing the importance of the callosum in transferring sensory and motor information interhemispherically, were confirmed and extended. As a result, only recently has there been general agreement that the corpus callosum is the structure mainly responsible for interhemispheric transmission of sensory and motor information. It was this evolutionary process that generated the framework for the studies in question. Without the positive findings of the last 10 years, the idea of ascertaining the nature of the callosal code using lateralized stimuli and reaction time would never have been considered interesting or important.

At any rate McKeever and Huling miss the point. Poffenberger used manual responses in reaction time whereas we used verbal. Indeed, there