Perceptual and Motor Skills, 1982, 54, 23-28. © Perceptual and Motor Skills 1982

OCULAR DOMINANCE: A REPLICATION OF THE DIMENSIONAL APPROACH

ALBERTO CEI, CHIARA BERGERONE, VEZIO RUGGIERI[1]

University of Rome

Summary.—Confirming the results of a previous research this study has singled out, in a sample of 131 female undergraduate psychology students, four groups of ocular dominance: right, left, intermediate, and fluctuating.

In the present research we set out to check the results obtained in our previous work on ocular dominance (Ruggieri, *et al.*, 1980) by examining a larger group of subjects. The validity of the dimensional approach, which the data of the preceding research seem to confirm, is based on the quantification of the "dominant" phenomenon. In this way, it was possible to construct a graph in which subjects showing maximum dominance could be observed at the two extremes (respectively, right and left dominant), and, in the middle, subjects showing progressively reduced dominance which then disappeared.

The earlier data supported the hypothesis of a behavioral continuum of ocular dominance; in addition to right- and left-dominant subjects, there were subjects we defined as having no eye dominance.

The earlier data suggested that ocular dominance is not an absolutely stable phenomenon, as locus of control and as quantity. In fact, the second measurement showed a group of subjects who we defined as showing fluctuating dominance, for example, right-dominant subjects on the first measurement behaved as left-dominant or intermediate on the second measurement. Moreover, even though not strongly developed, the hypothesized continuum is suggested by other research. In fact, Porter, *et al.* (1976) showed that in dichotic listening, in addition to subjects who show a marked superiority of the right ear, there are subjects who show unstable behavior, i.e., who have right-ear dominance, then left-ear dominance, then show no difference between the ears.

In any case, it is possible that this fluctuating behavior affects test reliability. This behavior may be peculiar to certain subjects (with unstable dominance) since it is supported also by the results of subsequent research in which such subjects show scores on field dependence which are significantly higher than scores for subjects showing other forms of dominance (Ruggieri, *et al.*, 1980) and by a difference in the perception of parts of the body (Ruggieri, *et al.*, 1980). Further to explore this phenomenon, it seems appropriate to replicate the research and to enlarge the sample considerably.

Ocular dominance has been studied in various ways, i.e., with different

[1]Requests for reprints should be sent to Vezio Ruggieri, via Bisagno 28, Rome, Italy.

tests (Miles, 1929; Crider, 1944; Lederer, 1961; Coren & Kaplan, 1973). In our preceding study a classical alignment test (Diehl, 1942; Gronwall & Sampson, 1971) was modified to study functional asymmetry.

METHOD

Subjects

The experimental sample included 131 female undergraduate students, who ranged in age from 20 to 30 yr. All subjects had 10/10 visual acuity, with or without correction.

Apparatus

The subject looked into a black box (112 × 38 × 33 cm.) while the head was fixed in a headrest. Two luminous rods were presented, one fixed at 112 cm. and the other mobile, placed at 45 cm. The subject could move the mobile rod on either side of a horizontal plane. The extent of shift was read on a scale in centimeters.

Procedure

The subject was given the following instructions: "Sit comfortably and keep your head in the headrest. Look inside the apparatus; you will see two rods. One is fixed on the background and the other is mobile and nearer to you. You must align the mobile rod so that its image overlaps the other at the back. To move the rod operate this handle. You must do the task according to these instructions."

The following sequence was presented twice, once in reverse order: binocular vision, right monocular, binocular, left monocular. The score for ocular dominance was the difference between the scores for the left and right eyes. This last score was the algebraic difference in millimeters between binocular and monocular alignments obtained for each eye separately.

RESULTS

The results substantially confirm the previous research. Fig. 1a and b shows the distribution of ocular dominance scores. The mean score for the first measurement is 1.33, $SD = 2.29$; for the second measurement, 0.85, $SD = 2.54$. The Pearson correlation between the two trials is 0.69 ($p < 0.01$, $df = 129$). Fig. 2 shows the displacements, respectively, with the right eye and left eye open, measured separately, on the first measurement (2a and b) and on the second measurement (2c and d). The Pearson correlation for the displacements of the left and right eyes for each subject is for the first measurement, -0.69 ($df = 129$, $p < 0.01$) and for the second measurement -0.69 ($df = 129$, $p < 0.01$). There were four groups of subjects: right dominant (Fig. 1a and b) subjects who for right monocular vision show either a small or no displacement with respect to binocular vision (scores from 2.5 to 4);

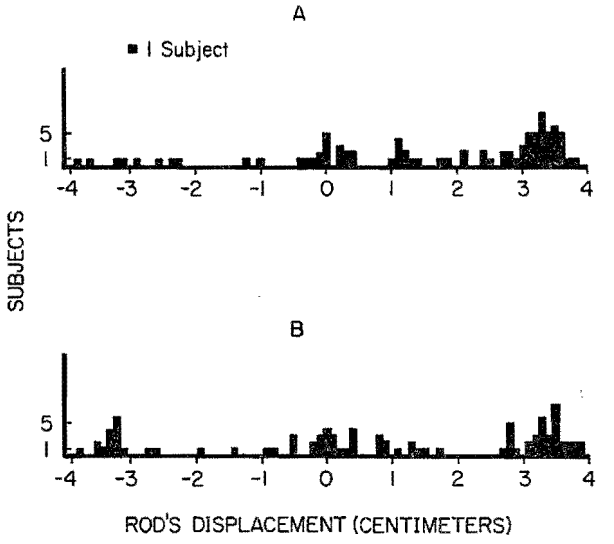

FIG. 1. Frequency distribution of differences between the displacements (from binocular to monocular vision) for the right and for the left eyes. The displacement indicates the degree of ocular dominance for the (A) first measurement and (B) the second measurement.

left dominant subjects who for left monocular vision show either a small or no displacement with respect to binocular vision (scores from —2.5 to —4); those with no-eye dominance, i.e., subjects who show no ocular dominance (scores from —1.5 to 1.5); and subjects with fluctuating dominance, those subjects who show a significant displacement in monocular vision between the first and second measurements. Moreover, a comparison, made by calculating χ^2 of the frequencies of scores in each area for the first and second measurements, is statistically significant ($\chi^2 = 85.85$, $df = 4$, $p < 0.05$). Fig. 3 shows how subjects fluctuating on the first measurement are distributed in the group of subjects who give right-dominant and intermediate responses; a greater number are in the first of these two groups. Instead, on the second measurement, the fluctuating subjects are grouped with those who give intermediate- and left-dominant responses; a greater number are present in the former group.

Our data substantiate the findings of our previous study, i.e., the same percentages appear for the four forms of ocular dominance. Also, there is a strong correlation between the two measures of ocular dominance, which allows us to discard the hypothesis of an error in measurement. These results show an accentuation of the behavioral continuum with regard to ocular dominance. In fact, in addition to subjects with right- and left-eye dominance,

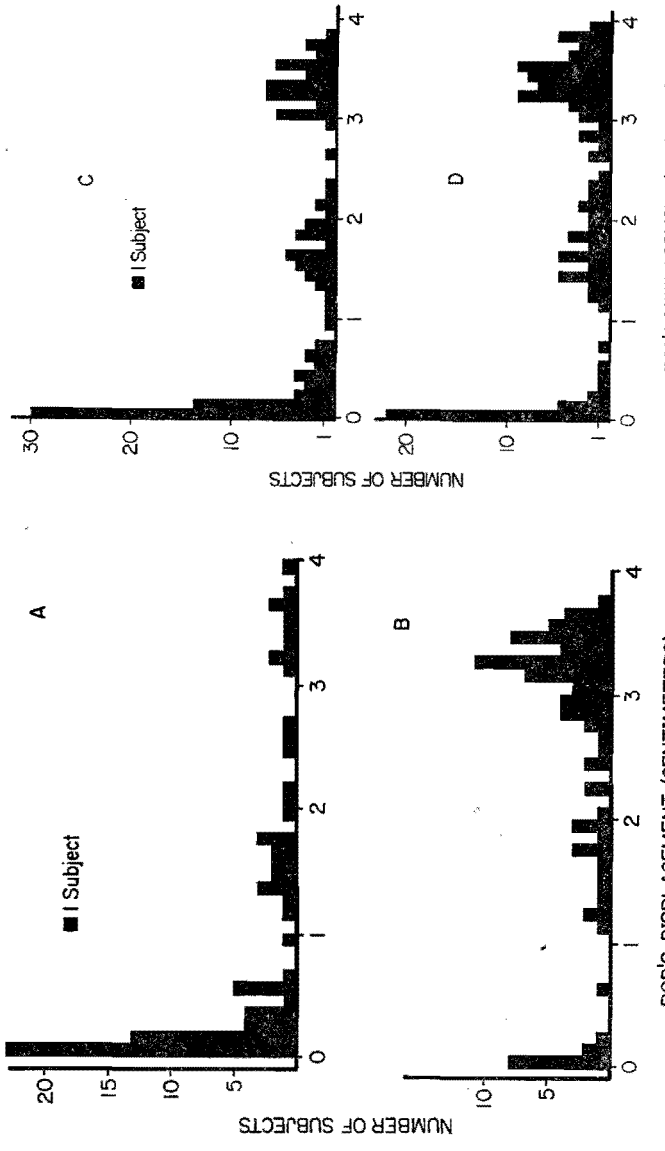

FIG. 2. Frequency distribution of the rod's displacement: for monocular-binocular vision the first measurement is (a) right monocular and (b) left monocular vision; for the second measurement (c) right monocular and (d) left monocular vision

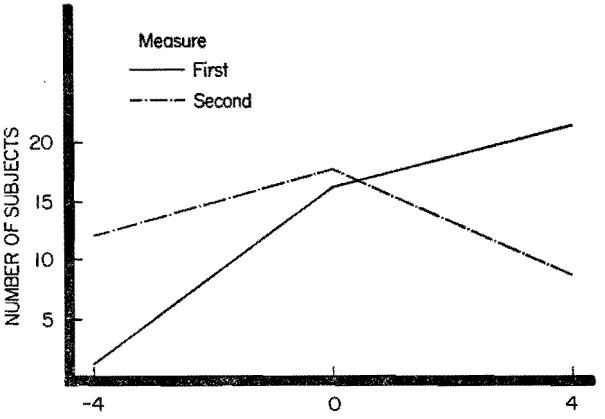

FIG. 3. Frequency distribution of the subjects who gave fluctuating responses

there are subjects with no eye dominance. It was possible to quantify the extent of shift of the image from binocular to monocular vision. Whereas markedly dominant subjects with one eye showed greater shift of the image when the dominant eye was closed, subjects with no eye dominance showed minimal shift of the image, equally for both eyes. It must be said, however, that the relationship between the two hemispheres is very complex and inferences require further exploration. The presence of "mobile" subjects may indicate that certain individuals make variable "hemispheric choices."

These data were interpreted previously as being determined by a functional equilibrium between the two hemispheres. Such an hypothesis is held also by other researchers. Moscovitch (1973) developed a model for a functional localization, hypothesizing that through inhibitory influences which cross the corpus callosum, the left hemisphere normally inhibits the attempts of the right hemisphere to analyze linguistic information. Kinsbourne (1978) has demonstrated that there is a mutual inhibitory balance between the two hemispheres and the organism shows behavior which results from their interaction. The presence of subjects with fluctuating behavior suggests that certain individuals make variable hemispheric choices. Also, other authors have shown this phenomenon; in fact, Kinsbourne (1978) has shown how the dominance of one ear decreases when the subject is told that he has forgotten part of the acoustic message sent to the other ear or that the shifts of the eyes to the right in right-handers, when they are asked to confront a lexical-verbal problem and to the left in response to a spatial problem disappear when subjects become conscious of the direction of their gaze while they are thinking. It is also important to remember that the type of response is determined both by the characteristics of the stimulus in a relatively neutral situation and by hemisphere when the context presents relatively emotional characteristics (Gur & Gur, 1979).

REFERENCES

CORENN, L., & KAPLAN, C. P. Patterns of ocular dominance. *American Journal of Optometry and Archives of the American Academy of Optometry*, 1973, 50, 283-292.

CRIDER, B. A battery of tests for the dominant eye. *Journal of General Psychology*, 1944, 31, 179-190.

DIEHL, H. T. An eye dominance gauge and some of its uses. *Journal of General Psychology*, 1942, 26, 181-184.

EHRLICHMAN, H., & WEINBERGER, A. Lateral eye movements and hemispheric asymmetry. *Psychological Bulletin*, 1978, 85, 1080-1101.

GRONWALL, D. M., & SAMPSON, H. Ocular dominance: a test of two hypotheses. *British Journal of Psychology*, 1971, 62, 175-187.

GUR, R., & GUR, R. Correlates of conjugate lateral eye movements in man. In S. Harnad, R. W. Doty, L. Goldstein, J. Jaynes, & G. Krauthamer (Eds.), *Lateralization in the nervous system.* New York: Academic Press, 1977. Pp. 261-281.

KINSBOURNE, M. (Ed.) *Asymmetrical function of the brain.* Cambridge: University Press, 1978.

LEDERER, J. Ocular dominance. *Australian Journal of Optometry*, 1961, 44, 531-574.

MILES, W. Ocular dominance demonstrated by unconscious sighting. *Journal of Experimental Psychology*, 1929, 12, 117-127.

MOSCOVITCH, M. Language and the cerebral hemispheres: reaction time studies and implications for model of cerebral dominance. In P. Pliner, L. Krames, & T. Alloway (Eds.), *Communication and affect: language and thought.* New York: Academic Press, 1973. Cited in A. Searleman, A review of right hemisphere linguistic capabilities. *Psychological Bulletin*, 1977, 84, 503-528.

PORTER, R. J., JR., TROENDLE, R., & BERLIN, C. I. Effects of practice on the perception of dichotically presented stop-consonant-vowel syllables. *Journal of the Acoustical Society of America*, 1976, 59, 679-682.

RUGGIERI, V., CEI, A., CERIDONO, D., & BERGERONE, C. Dimensional approach to the study of sighting dominance. *Perceptual and Motor Skills*, 1980, 51, 247-251.

Accepted October 24, 1981.