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FUNCTIONAL ASYMMETRY IN BODY PERCEPTION AND OCULAR DOMINANCE: A STUDY OF THEIR INTERACTIONS[1]

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Summary.—The relationships between ocular dominance and body perception (for the left and right body halves) were examined for 41 undergraduate female psychology students. The results indicate an interesting connection between the two phenomena. The four groups of subjects classified on the basis of ocular dominance (right, left, fluctuating and no dominance) showed statistically significant differences on one aspect of body perception, measured by the 'Difference Deviation Scores.' Also three groups of subjects classified on the basis of body perception (subjects with major perceptual error on the left or on the right, and subjects showing no difference in perception of the two body halves) showed statistically significant differences in ocular dominance.

Previous research has shown that body perception is a lateralized phenomenon (Ruggieri & Valeri, 1980). The present investigation attempted to verify whether body perception is related to ocular dominance. In this research, ocular dominance was studied using a dimensional approach so that behavior can be defined quantitatively along a continuum. This approach allows for the definition of even extremely lateralized individuals in the perspective of functional balance between two hemispheres. Three types of ocular dominance (Porac & Coren, 1976) have been identified: (a) dominance of more sensory activity in one eye than in the other; (b) sensory dominance in situations of binocular rivalry; (c) ocular dominance, i.e., the dominant eye is considered the one whose input is favored in behavioral coordination. This requires the use of only one eye, otherwise the images of both eyes will be discrepant and will not be able to be fused (Porac & Coren, 1976).

Ocular dominance has been examined in various ways and with different tests (Miles, 1929; Crider, 1944; Coren & Kaplan, 1973). In this research the classical alignment test (Diehl, 1942; Gronwall & Sampson, 1971) was modified to study functional asymmetry using a dimensional approach. In studies of body schema, the body is considered as an object in space with physical properties (Shontz, 1969). In this investigation, the study of body schema was carried out using a test of body perception based on the approach

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employed by Shontz (1963, 1969). In our test we focused particularly on perceptions of the right and left halves of the body. Some authors have shown that bilateral differences exist in body awareness, tonic skin conductance (Varni, *et al.*, 1975), and in body perception (Friedlander, 1964). Previous investigation (Ruggieri, *et al.*, 1980) indicated the existence of three specific groups for this dimension: R+ subjects with greater error in the perception of the right half of the body, L+ subjects with greater error in the perception of the left half of the body, R = L subjects with no differences in the perceptions of the two halves of the body. Thus, this phenomenon, as well as that of ocular dominance, may be conceived as a continuum. With regard to the relationship between these two phenomena, Hécaen (1976) showed that the construction of body schema requires both somesthesic and visual information.

METHOD

Subjects

Forty-one undergraduate women in psychology who ranged from 19 to 39 yr. of age comprised the experimental group. Their median age was 27 yr. All subjects had 10/10 visual acuity, with or without correction, and declared themselves right-handed.

Materials

Ocular dominance.—The subject looked into a black box (112 × 38 × 33 cm) while her head was fixed on a headrest. She was presented with two luminous rods, one fixed at a distance of 112 cm and the other mobile at a distance of 45 cm. The subject could move the mobile rod on either side of a horizontal plane. The extent of shifting was read on a centimeter scale.

Body perception.—The study of body schema was carried out using a modified version of Shontz's test (1963) of body perception to compare the accuracy of perception of the dimension of parts half on the right and half on the left side of the body. Accuracy of perception was derived from the comparison of subjective evaluation with the corresponding real measurements of the following parts of the body: (1) width of face, (2) length of face, (3) length of shoulder, (4) length of trunk, (5) width of trunk, (6) thorax, (7) arms, (8) hand, and (b) length of body. Measurements were estimated for both right and left sides of the body. Subjective evaluation was carried out by moving two vertical bars attached to two rulers sliding along a horizontal board. The subjective evaluation was the distance in centimeters between the two vertical bars. The actual measurement of the body was carried out using compasses. Shontz's Deviation Index was obtained by calculating subjective estimation × 100. The index value of 100 represented correct perception; when the index value was greater than 100, the error was in overestimation; when less than 100, in underestimation. In addition, a "Dif-

ference Deviation Score" was calculated for each subject; this score was the difference between left Deviation Index and right Deviation Index.

Procedure

The two tests were presented randomly: measurements were taken between 9:30 AM and 12:30 PM.

Ocular dominance.—The subject was given the following instructions: "Sit comfortably and keep your head on 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. Be careful to follow these instructions."

The following sequence was presented twice in reversed order: binocular, right monocular, binocular, and left monocular vision. The ocular dominance score was the difference between the scores for the left and the right eyes. Another score was the algebraic difference in millimeters between binocular alignment and alignment for each eye separately.

Body perception.—The subject, fully clothed, was asked to sit in front of Shontz's apparatus. A sheet was stretched from the lower edge of the horizontal board of the apparatus so that it covered the entire body other than the head. The subject could move the sliding ruler on the apparatus without seeing any part of her body. The female experimenter was in front of the subject and the apparatus; she was separated from the former by a vertical screen. Unobserved, the experimenter could survey the distance between the sliding rulers through a horizontal crack in the screen. The subject was given the following instructions: "This apparatus is used to make linear measurements. From time to time I will ask you to approximate the size of a part of your body. By moving these two bars you can make a visual representation of the bodily measurements requested."

Results and Discussion

The subjects were classified into three groups on the basis of the Shontz test: (a) subjects with a larger deviation index on the right half of the body (R+); (b) subjects with a larger Deviation Index on the left half of the body (L+); and (c) subjects showing no difference between the right and left sides (L = R).

Means and standard deviations for these groups are indicated in Table 1, which also presents: (a) the means and standard deviations of these three groups on the ocular dominance test (first and second measurements); and (b) F for the ocular dominance scores for the three groups (R+, L+, L = R). The first measurement scores show only statistically significant differences. The mean of the "Difference Deviation Score" is for R+ subjects, 5.27 (SD =

TABLE 1

STANDARD DEVIATIONS AND MEANS FOR RIGHT AND LEFT HALVES OF BODY ARE INDICATED ON THE LEFT SIDE. OTHER COLUMNS INDICATE MEANS AND STANDARD DEVIATIONS OF OCULAR DOMINANCE BY GROUPS

Subjects			Ocular Dominance	
			Measure 1	Measure 2
L + Right half	*M*	122.77		
	SD	13.39	2.52	1.44
Left half	*M*	131.00		
	SD	16.49	1.19	2.43
R + Right half	*M*	143.07		
	SD	18.44	0.46	–0.28
Left half	*M*	128.17		
	SD	15.15	2.62	2.58
L = R Right half	*M*	128.88		
	SD	12.34	1.19	0.07
Left half	*M*	129.00		
	SD	12.75	2.51	2.50
$F_{2,38}$, $p < .05$			3.96	

6.3); for L+ subjects, –8.78 ($SD = 12.20$); and for R = L subjects, 0.49 ($SD = 10.09$).

The following mean scores were obtained from the Ocular Dominance test: (1) first measurement 1.62 ($SD = 2.21$); second measurement 0.59 ($SD = 2.55$). The subjects were then classified into four groups: right-eye dominant, left-eye dominant, no-eye dominant, and subjects with fluctuating eye dominance. Table 2 shows the means and standard deviations for these groups (on the first and second measurements) as well as the Deviation Indexes for the right and left halves of the body, and the "Difference Deviation Scores" of ocular dominance. In Table 2, F is given for right and left Deviation Indexes of the three groups of subjects (right dominant, left dominant, no-eye dominant) on the first and second measurements. None of these differences were statistically significant. F has shown that the "Difference Deviation Score" is statistically significant ($F_{2,38} = 6.41$, $p < 0.05$).

Using Student's t for dependent means, the "Deviation Index Scores" for the right half of the body were compared with those of the left half based on results from subjects studied for ocular dominance. Finally, the "Deviation Index Scores" for fluctuating and non-fluctuating behavior in ocular dominance were compared. Student's t for independent means for the right half of the body was 2.00 ($df = 39$, $p < 0.10$), and for the left half, $t = 0.39$ ($df = 39$, $p > 0.05$). The comparison of "Difference Deviation Scores" between fluctuating and non-fluctuating subjects shows Student's t for independent means to be 2.63 ($df = 39$, $p < 0.05$).

Interesting results have emerged from the study of the relationship be-

TABLE 2

MEANS AND STANDARD DEVIATIONS OF FOUR GROUPS CLASSIFIED BY OCULAR DOMINANCE AND OF RIGHT AND LEFT DEVIATION SCORES AND THEIR DIFFERENCES

Ocular Dominance			Deviation Index					
			Right		Left		Difference	
			M	*SD*	*M*	*SD*	*M*	*SD*
Right Subjects								
1	*M*	3.22	126.49	14.55	131.75	13.46		
	SD	0.39						
							5.27	6.37
2	*M*	3.40	130.51	16.14	134.68	16.21		
	SD	0.25						
Left Subjects								
1	*M*	−3.00	137.97	17.86	129.19	19.04		
	SD	0.38						
							−8.78	12.10
2	*M*	−3.16	128.30	17.04	129.01	18.59		
	SD	0.30						
No eye-dominant Subjects								
1	*M*	0.43	124.91	13.52	125.40	16.08		
	SD	0.91						
							0.49	10.09
2	*M*	0.08	124.07	12.12	125.55	9.09		
	SD	0.43						
1			$F_{2,38} = 1.50$ $p > 0.05$		$F_{2,38} = 0.70$ $p > 0.05$		$F_{2,38} = 6.41$ $p < 0.05$	
2			$F_{2,36} = 0.71$ $p > 0.05$		$F_{2,36} = 1.53$ $p > 0.05$			
Fluctuating Subjects								
1	*M*	2.28						
	SD	1.43						
			120.89	9.91	128.40	12.23	7.51	9.58
2	*M*	0.88						
	SD	1.76						

tween body perception and ocular dominance. The three groups we singled out on the basis of the Deviation Index for the two halves of the body showed statistically significant differences in scores of visual dominance. This score distributes the subjects along an axis from negative values which indicate left-eye dominance to the positive ones which indicate right-eye dominance. Be-

TABLE 3

STUDENT'S *t* FOR DEPENDENT MEANS OF DEVIATION INDEXES FOR RIGHT AND LEFT HALVES OF BODY FOR GROUPS CLASSIFIED BY OCULAR DOMINANCE

Deviation Index		Dominance							
		Right		Left		None		Fluctuating	
		t	*df*	*t*	*df*	*t*	*df*	*t*	*df*
Right vs Left	1	4.13*	23	1.62	8	0.11	9		
	2	3.17*	13	0.10	8	0.75	14	2.82*	11

*$p < 0.05$.

tween these two extreme positions there is a score which shows no eye dominance. Subjects who, in the evaluation of bodily dimensions, showed a greater Deviation Index for the left half of the body tend to have higher scores than those who showed a greater Deviation Index for the right half of the body. Finally, the group which showed the same deviation index for the two halves of the body had an intermediate ocular dominance score. The subjects with right, left, or no-eye dominance showed statistically significant differences in "Difference Deviation Scores." In fact, in the first measure of ocular dominance, the right-eye dominant persons showed a "Difference Deviation Score" of body schema (indicating a clear tendency toward a larger Deviation Index for the left side) which is larger than zero, while the contrary occurred for left-eye dominant subjects. Subjects with different ocular dominance do not show statistically significant differences in the Deviation Index of the two halves of the body, considered separately. The "Difference Deviation Score" discriminates the subjects more than does the Deviation Index. This consideration is supported by the fact that the right-eye dominant subjects show a statistically significant difference in the Deviation Index which is definitely larger for the right than for the left half, while this result was not observed for the left- and no-eye dominant subjects.

The major Deviation Index is concluded to be related to the ocular dominance of the opposite side; subjects with major Deviation Index for the left half generally show right dominance. Moreover, ocular dominance is strictly related to the functional discrepancy between the two hemispheres. The phenomenon of lateralization should not be studied only as a hemispheric specialization but also as an aspect of the functional balance between the two hemispheres. Another interesting result is that those subjects with fluctuating behavior show very high "Difference Deviation Scores," i.e., statistically significant in relation to those who show non-fluctuating ocular dominance. Moreover, those subjects with fluctuating dominance show a larger Deviation Index on the left, so that oscillation in ocular dominance appears to be related to a major discrepancy in the perception of the two halves of the body.

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