

HYPNOTIZABILITY, LATERALITY OF EYE-MOVEMENTS AND FUNCTIONAL BRAIN ASYMMETRY¹

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Summary.—The direction of lateral eye-movements upon inward direction of attention or reflection is related to hypnotic susceptibility. A predominance of left eye-movements is associated with greater hypnotizability and also with humanistic interests, relatively poorer mathematical performance on the Scholastic Aptitude Test, and clearer imagery. Results are discussed in terms of functional asymmetry of the brain.

The purpose of this paper was to explore the relationship between the direction of certain lateral eye-movements and susceptibility to hypnosis and to discuss both laterality of eye-movements and hypnotic susceptibility in terms of functional asymmetry of the brain.

It has been observed that there is a lateral eye-movement response which is associated with the transition from external to internal direction of attention (Day, 1964, 1967). Thus, if *S* is looking at *E* while *E* asks a question whose answer requires reflection (e.g., mental arithmetic), *S* will break fixation on *E* by moving his eyes to the right or to the left as he begins to reflect on an answer. The direction of this lateral shift is sufficiently consistent to allow classification of *Ss* as *right-movers* or *left-movers* (Duke, 1968). It has been suggested that the direction of this lateral eye-movement has correlates at the physiological, cognitive, and personality levels (Bakan & Shotland, 1969; Day, 1964, 1967, 1968). Among the stated characteristics of the left-mover is a greater tendency to focus attention on internal subjective experiences. The right-mover, on the other hand, shows a greater tendency to external focus of attention.

Several descriptions of "good" hypnotic *Ss* have emphasized the subjective orientation of these people. One finds in these descriptions a striking parallel with Day's characterization of the left-mover as a subjectively oriented person. E. Hilgard describes the hypnotizable person as "one who has rich subjective experiences . . ., one who is interested in the life of the mind . . ., and one who accepts impulses from within (E. R. Hilgard, 1965, p. 342). J. Hilgard has shown that the "good" hypnotic *S* is characterized by deep imaginative involvements (J. R. Hilgard, 1965, 1969). The similarity between the subjective orientation of the "good" hypnotic *S* and subjective orientation of the left-mover suggested this study of the relationship between hypnotic susceptibility and the dominant direction of the lateral eye-movement.

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METHOD

The Stanford Hypnotic Susceptibility Scale (SHSS) Form C (Weitzenhoffer & Hilgard, 1962) was individually administered in a tape-recorded form to 46 undergraduates (28 males and 18 females). Immediately following administration of the scale each *S* was seen by the author (who was unaware of the hypnotic score) for the purpose of observing eye-movement direction in response to five reflective questions asked as *S* and examiner sat facing each other. The questions used were: (a) How many letters are there in the word ANTHROPOLOGY? (b) Tell me an English word that starts with *L* and ends with *C*. (c) If you were elected president what would be your first act to help solve the racial problems of this country? (d) How many letters are there in the word WASHINGTON? (e) With your eyes open try to have an image of a man crying (for female *Ss*—of a woman crying). On question (e), the imagery question, *S* was asked to rate the clarity of the image on a scale from one (no image) to five (very clear, just like real). The direction of the very first lateral movement following the question was recorded if an observable movement occurred. Lateral movements with a vertical component were scored in terms of lateral direction.

Ss were classified as right- or left-movers on the basis of the direction of the majority of movements. (Note that both movements were away from the examiner in a face-to-face situation.) Forty-two *Ss* were classifiable, and 4 were not since they made two movements in each direction and failed to make an observable movement on one trial.

RESULTS

Direction of Lateral Eye-movements and Hypnotizability

Twenty-two *Ss* made movements in the same direction on every trial, and on the average *Ss* made 85% of their lateral eye-movements in the same direction. The 42 classifiable *Ss* were divided into a high hypnotic-susceptible group ($N = 21$) and a low hypnotic-susceptible group ($N = 21$) on the basis of SHSS

TABLE 1
MEAN HYPNOTIZABILITY SCORE AS A FUNCTION OF NUMBER
OF RIGHT EYE-MOVEMENTS

No. Right Movements	No. <i>Ss</i>	Mean Score SHSS Form C
0	14	7.14
1	6	6.33
2	8	6.60
3	5	4.20
4	10	4.20
5	3	3.00

scores. Ss with scores of six or more and Ss with scores of five or less constituted the high and low susceptibility groups respectively. Thirteen of the 18 right-movers fell in the low hypnotizability group and 16 of the 24 left-movers fell in the high hypnotizability group. The relationship between characteristic direction of eye-movements and hypnotic susceptibility yielded a chi square of 6.24 (1 *df*), significant at between the .01 and .02 levels. The correlation between the actual *number* of right movements out of the five trials and hypnotizability was $-.44$, significant at the .01 level. Low scores on hypnotizability tended to be associated with more right movements. The results are summarized in Table 1.

Direction of Lateral Eye-movements and College Major

Further evidence relating the direction of lateral eye-movement to subject variables was found in incidental information on the student's major subject. This information was available for 35 of the Ss. Majors were classified as "hard" or "soft," and an analysis was carried out to test the hypothesis that left-movers are more likely to choose "soft" majors. It has previously been reported (J. R. Hilgard, 1969) that humanities majors and social science majors are more hypnotizable than natural science majors. For purposes of this analysis "hard" majors included mathematics, biology, engineering, economics, and physics; "soft" majors included psychology, political science, English, history, international relations, nursing, and communication. This classification was based on the author's intuitive judgment. It was found that 15 out of 18 left-movers were in "soft" majors and nine out of 17 right-movers were in "hard" majors. The 2×2 contingency analysis between hard-soft and right-left yielded a chi square of 5.1, significant at the .05 level.

Direction of Lateral Eye-movements and Mathematics-Verbal Discrepancy on the Scholastic Aptitude Test

Scholastic Aptitude Test (SAT) scores were available for 41 of the Ss who could be classified as right- or left-movers. An analysis of discrepancies between the V (verbal) score and the M (mathematics) score was carried out to test the hypothesis that right-movers score relatively higher on the M part and that left-movers score relatively higher on the V part of the SAT. A ratio score was computed for each S representing the percentage by which the M score is higher or lower than the V score, i.e., $(M - V)/V$. The mean M score for the left-mover group was 0.8% lower than the V score, whereas the mean M score for the right-mover group was 8.4% higher than the V score. The difference between right- and left-movers in $(M - V)/V$ scores is significant at the .05 level ($t = 2.04$, $df = 39$). This difference is congruent with the difference between the groups in choice of college major. Though the groups differ on the way in which the total score is constituted, there is no significant difference between right- and left-movers in total SAT scores.

Direction of Lateral Eye-movements and Clarity Ratings of Imagery

The fifth question presented to *S* required that he have an image. Following the report of an image *S* was asked to rate the clarity of the image on a scale from one (no image) to five (very clear image, just like real). The mean clarity rating of left-movers was 3.5 and that of right-movers was 3.1, indicating clearer reported imagery for the left-movers. The difference is significant at the .10 level (two-tailed *t* test). All five *Ss* who rated their images as 5 (very clear, just like real) were in the left-mover group.

DISCUSSION

To summarize, it was found that in contrast to right-movers, left-movers are more hypnotizable, more likely to be taking a "soft" or humanistic major, likely to score relatively higher on the V score than on the M score of the SAT, and more likely to report clear visual imagery.

The relationship between laterality of eye-movements, hypnotizability, and the other variables described above can be considered in terms of functional asymmetry of the brain. The right or left eye-movements which are the subject of this paper are controlled contralaterally by activity in Brodmann's area 8, the frontal eye fields (Robinson, 1968). It may be that the left- or right-movement associated with the reflective process is symptomatic of easier triggering of activities in the hemisphere contralateral to the direction of eye movement. Differences in ease of triggering dominant or non-dominant hemispheres may in turn be related to a wide variety of individual differences in cognitive, personality and physiological variables.²

There is evidence that the so-called non-dominant hemisphere may in fact be dominant for certain psychological functions which can be characterized as pre-verbal, pre-logical, subjective, intuitive, global, synthetic and diffuse. Sperry, for example, finds evidence from his commissurotomy experiments that functions such as the construction of spatial relations and spatial orientation are better developed in the right non-dominant hemisphere. He also notes that ordinary tests of capacity that rely on verbal or written expression give an impression that the non-dominant hemisphere is generally agnostic but that this clearly is *not* the case when non-verbal readout, such as pointing, signalling, or drawing, is employed (Sperry, 1967, 1968). Cohen, *et al.* (1968) have shown that unilateral electroshock to the right hemisphere produces memory decrement in a task requiring non-verbal recall based on visual imagery, whereas shock to the left hemisphere is more likely to produce memory decrement in a verbal task. There are reports that lesions of the non-dominant right hemisphere are more likely to interfere with general, non-verbal perceptual and cognitive functions than are lesions in the left hemisphere (Mountcastle, 1962; Hecaen & de Ajuria-

²The issue of handedness is not as critical to the argument as it might seem, since about 10% of people are left-handed and about half make right and half make left eye-movements.

guerra, 1964). Critchley (1962) finds that lesions in the right hemisphere may be followed by articulation difficulty, impairment of creative literary work, hesitations and difficulty in finding words, symptoms which have in common a difficulty in converting pre-verbal processes into words.

EEG alpha activity which is associated with inner-directed attention is found in greater amount and amplitude over the non-dominant side of the brain (Raney, 1939; Liske, *et al.*, 1967), and it has been reported that the amount of base level EEG alpha is related both to hypnotizability (London, Hart, & Leibovitz, 1968; Nowlis & Rhead, 1968) and laterality of eye-movements (Bakan & Svorad, unpublished). Jasper suggested that the non-dominant hemisphere acts in a more reflex-like, uninhibited, diffuse manner than the dominant hemisphere. He found in a study of eye-vergence movements that the eye controlled by the non-dominant side of the brain moved into its position more quickly, sometimes overshooting "in what might be termed a more reflex adjustment as compared to the other eye" (Jasper, 1932; Jasper & Raney, 1937). A similar result was found by Schoen and Scofield (1935).

Going somewhat farther afield, Haber has shown that, when eidetic children verbalize the image-inducing stimulus while viewing it, very little imagery develops (Haber, 1968), indicating an incompatibility between verbal encoding and eidetic imagery. Our analysis suggests that eidetic Ss might also be left-movers and readily hypnotizable. Fisher (1966) has found that in male college students a tendency to be more aware of the left side of the body is positively associated with various measures of heterosexuality. In his interpretation of these results he associates attention to the left side (related to non-dominant hemisphere) with greater spontaneity, and attention to the right side with more inhibition and control.

In conclusion, a relatively more active right hemisphere, possibly indicated by direction of eye-movements, implies a syndrome consisting of greater use of pre-verbal activities such as imagery, greater hypnotic susceptibility, greater interest in humanistic subjects, less mathematical ability, and more EEG alpha activity. Thus the laterality of eye-movements deserves further study, as in addition to being a correlate of hypnosis, it may also provide us with a reliable and easily observable correlate of individual differences in attentional and other internal processes.

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