

# READING DISABILITY AND LATERALITY<sup>1</sup>

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The purpose of the present investigation was to determine how retarded readers differed from normal readers in the various ways laterality is manifested. An additional purpose was to investigate the development of laterality as seen across several age levels.

Previous research in laterality and reading deficits has been conducted in two general areas: (a) the peripheral, sensorimotor phenomena of mixed, incomplete, or confused hand preference (manual laterality), and eye preference (visual laterality) (Harris, 1957; Orton, 1937; Zangwill, 1962); and (b) the more central mechanisms which belong primarily in the perceptual-cognitive sphere, such as left-right awareness, spatial awareness, and verbal intelligence (Belmont & Birch, 1965; Harris, 1957; Hermann & Norrie, 1958; Kinsbourne & Warrington, 1963). However, research on laterality and reading problems has yielded a plethora of mixed and conflicting results. For example, while Orton (1937), Dearborn (1933), and Harris (1957) found that mixed hand dominance was an important factor in reading disability, others (Belmont & Birch, 1965; Bennet, 1938) found no relationship between the two behaviors. Similarly, Hermann and Norrie (1958) and Belmont and Birch (1965) found that retarded readers showed deficits in lateral awareness while the research of Coleman and Deutsch (1964) found no difference between retarded and normal readers on this variable. Such conflicting results characterize almost the entire body of research on reading and laterality. Several factors have contributed to the lack of conclusive findings. First, most research has looked at isolated variables without attempting to integrate and conceptualize the aspects of laterality into any meaningful or theoretical whole. Second, methodology has been grossly inadequate with samples coming from clinic populations with unknown selection biases, e.g., IQs have been unknown or unreported, and sex and age ratios have varied widely. Third, investigations have relied on inadequate measures of laterality such as subjective reports of hand or eye preference. Finally, many studies have used inappropriate statistical analyses of results. A review of the literature leaves the impression of confusion and lack of closure.

In light of the ambiguity associated with the term laterality, the present study considered laterality along the following dimensions: (a) the sensorimotor aspects of manual preference and visual preference (manual preference, manual strength, manual dexterity, visual preference, controlling-eye-monocular, controlling-eye-binocular); and (b) the perceptual-cognitive aspects (finger differentiation, lateral awareness, ear asymmetry, verbal intelligence). These aspects were operationally defined by the behavioral measures derived from the tests presented in Table 1.

The current investigation was based on the hypothesis that retarded, relative to normal, readers would show increasingly greater deficits on laterality dimensions which become stabilized at later developmental stages. Research in various disciplines suggests that these functions follow a hierarchical development in the order just presented. Beginning with manual preference, eventually all of these

TABLE 1  
Laterality Variables and Tests for Their Measurement

Variable	Test
Manual preference	Behavioral tasks (10)
Manual strength	Dynamometer
Manual dexterity	Electric tapper
Visual preference	Sighting tasks (3)
Controlling eye (monocular)	Hole-in-the-mirror
Controlling eye (binocular)	Telebinocular
Finger differentiation	Kinsbourne and Warrington
Lateral awareness	Piaget schedules
Ear asymmetry	Dichotic listening
Verbal intelligence	WISC VIQ

functions are lateralized and controlled by one cerebral hemisphere.

## METHOD

A careful effort was made to avoid the inadequate sampling and matching procedures characteristic of the previous research. Thus, Ss in this study were 80 white male children from the regular classrooms in the public schools of a suburban middle-class community. None of the children with reading problems were from a clinic population. Forty of the Ss were retarded readers who ranged from 20% to 61% below the appropriate reading level for their ages. Forty were normal control children with reading scores at or above the expected levels for their ages. Both groups consisted of 10 9-year olds, 10 10-year olds, 10 11-year-olds, and 10 12-year olds. Each experimental S was matched with a control on age, sex, race, social class, and PIQ, and tested individually on all the laterality variables listed in Table 1.

Two major types of analyses of the data were computed, taking advantage of the matched design. These included analyses of variance of data based upon means and chi-square analyses of frequency data.

## RESULTS

The retarded readers differed from the normal readers on all perceptual-cognitive measures and in the incidence of noncontrolling eye. The retarded readers also had poorer performance on lateral awareness, finger differentiation, and verbal intelligence. In addition, they showed a higher incidence of both noncontrolling eye and left ear superiority (right speech-brain) than did the normal readers. However, there were no differences between the groups on

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TABLE 2

Summary of Comparisons between Retarded (RR) and Normal (NR) Readers on Laterality Variables

Variable <sup>a</sup>	How measured	Statistic	Result
Manual preference	Right minus left	F test *	not significant
Manual strength	Right minus left	F test *	not significant
Manual dexterity	Right minus left	F test *	not significant
Visual preference	Right minus left	F test *	not significant
Controlling eye (monocular)	Frequency count	$\chi^2$ test *	not significant
Controlling eye (binocular)	Frequency count	$\chi^2$ test ***	RR greater incidence of <i>no</i> controlling eye
Ear asymmetry	Frequency count	$\chi^2$ test **	RR greater incidence of left ear superiority
Finger differentiation	Total errors	F test ***	RR greater number of errors
Lateral awareness	Total errors	F test ***	RR greater number of errors
Verbal intelligence (VIQ)	Total VIQ	F test ***	RR lower VIQ

<sup>a</sup>Listed in order of hypothesized developmental complexity.

\* $p > .10$ .

\*\* $p < .025$ .

\*\*\* $p < .01$ .

manual laterality. For a summary of the results, see Table 2.

Additional results indicated that age effects were found on total tapping scores, total strength scores, and the number of errors on dichotic listening. On these tasks overall performance improved with age. A nonsignificant trend toward improved performance with age was found for lateral awareness and finger differentiation.

## DISCUSSION

The present results strongly suggest that many normal intelligence children with reading problems are exhibiting a maturational lag in the development of laterality. Thus, a potential picture emerges of the experimental group resembling younger normal children. The lack of findings for the sensorimotor measures can be attributed to the relatively early lateralization of these manual and visual functions. Since the youngest Ss were already 9 yr. old, one might hypothesize that sensorimotor laterality, although delayed initially, had by that time matured. On the other hand, the higher level and later developing perceptual-cognitive aspects of laterality strongly differentiated the retarded from the normal reader.

Lateralization generally refers to representation or control of a function primarily in one hemisphere. Delay in this lateralization to one of the hemispheres can result in deficits which interfere with learning to read.

The importance of this research appears to reside in the integration and conceptualization of a large variety of

seemingly isolated phenomena subsumed under the rubric of laterality, relating these phenomena to brain function, and through extensive and careful methodology, to bring some order to the relationship of laterality to reading problems.

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