CEREBRAL DOMINANCE FOR LANGUAGE IN LITERATES AND ILLITERATES: A STUDY WITH NORMALS†

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Abstract

Thirty normal right handed literate and thirty normal right handed illiterate adults were administered with a dichotic verbal recall task to determine cerebral dominance for language and to see whether there was any difference in cerebral dominance for language in between these groups. The results indicated a statistically significant difference in cerebral dominance for language for literate and illiterate adults. 13.42 per cent of the illiterate subjects and 90 per cent of literate subjects showed a left hemisphere dominance for language. Bilateral representation for language was observed in 43.29 per cent of illiterates and 10 per cent of literates. Right hemisphere dominance for language was observed with 43.29 per cent of the illiterates and it was not exhibited by any of the 30 literate subjects.

Literacy, that is the acquisition of reading and wiiting skills, has been considered now as a factor in the establishment of cerebral lateralization of language in the human beings.

It is presumed that all four modalities of language (speaking, reading, writing and listening) are necessary for complete lateralization of linguistic function to the left hemisphere, that is, the dominant hemisphere in most of the human beings. Just acquiring, only the speaking and listening modalities, will make right hemisphere to acquire the dominant role in illiterates. This presumption of the present investigator is facilitated by the studies of Cameron, Currier and Haerer (1971) and Wechsler (1976). For a detailed review in this area the readers are referred to Kumar and Purushothama (1980).

Cameron, Currier and Haerer (1971), in their study with left cerebral infarcts having literacy, semi-literacy and illiteracy, concluded that they found more language disturbances in literate and semi-literate groups than in group with illiteracy. They pointed out that literacy is a factor in the establishment of cerebral dominance

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for language. They found language disturbances more in literate and semi-literate groups, may be because the language was controlled by the left hemisphere because of their literacy and more years of schooling. 78 per cent of their literate group with 10.S years of schooling and 64 per cent of their semi-literate group with 5.6 years of schooling had aphasic disturbances. Whereas, 64 per cent of their illiterate group had no aphasic disturbances. This suggests that the language is not totally controlled by the left hemisphere.

From the study by Cameron, Currier and Haerer, (1971) one can imply that there is a relationship between literacy and cerebral dominance, and further that writing and reading skills play an important role in the establishment of cerebtal hemispheric specialization for language. They suggested'.....that literacy emphasizes cerebral dominance for speech.' (p. 163).

Wechsler (1976), documented a case of crossed aphasia in an illiterate dextral woman. The patient an eighty three year right handed old wcman, had loss of speech with the right hemisphere damage. The patient hadfew years of schooling, but had not used reading and writing for many decades. Wechsler's study showed that reading and writing modalities are important for the establishment of cerebral dominance in the left hemisphere. Wechsler (1976) suggested ' ...that the neural mechanisms involved in learning to read and write may be critical for complete establishment and maintenance of language dominance in left hemisphere, and, that, in this case, the patient's failure to acquire reading and writing skills altered normal evolution of language lateralization and resulted in the-right hemisphere assuming the dominant role'.

From Wechsler's case report,- a conclusion can be drawn if not a generalization, that all the four modalities of language—viz., speaking, listening, reading and writing, are necessary for the establishment of left hemisphere dominance for language, which may be true with literates. In illiterates, right hemisphere may acquire the role of dominance in the analysis of language due to lackness of reading and writing skills.

The studies by Cameron, Currier and Haerer (1971) and Wechsler (1976) have utilized stroke; patients. No studies have been available with us, here at present, which have used normal literate and illiterate adults to confirm the effects of literacy (that is, reading and writing skills) on the establishment of hemispheric specialization for language. Hence, the present sudy.

In the present study, a test of dichotic listening was administered to the normal right handed liteiate and illiteiate adults to study the ceitbial den irar.ee for language in these adults by obseivirg the right ear of left ear advantage. Data collected were statistically processed and were cenpaied fcr signifieance to test the following null hypothesis that:

> ' *There will be no significant difference in hemispheric lateralization, between literate and illiterate adults, for language'.*

for the purpose of the present study, an ' illiterate was defined as ' an adult who has had no education in reading and writing and who has not acquired these skills even in his early childhood '. This definition of an illiterate became necessary here in our country (India), because we have real illiterates, who have no, formal education in schools, and in reading and writing. In the study by Cameron, Currier and Haerer (1971), their illiterate group had formal schooling of an average 2.5 years for the reasons which have not been mentioned. Even the case reported by Wechsler (1976), had her formal schooling for few years but had no functional usage of reading and writing skills for many years.

A literate in this study meant ' an adult who has had education through reading and writing or who is continuing to have his education through all the four modalities of languate or who has had formal education and who is still using reading and writing skills in his day-to-day life '. In this study it was preferred to have those adults who were still using reading and writing skills in their day-to-day life, because the present investigator believes, that the lateralization for language is well stabilized in these subjects and, that there will be no alteration in their cerebral lateralization for language as it had happened in the case reported by Wechsler (1976). Wechsler's case did have her formal schooling, but had not used reading and writing skills for decades together.

In the present study, only right handers with no familial sinistrality were used. This was done to rule out the genetic effects on the cerebral lateralization of language.

METHODOLOGY

Subjects

Thirty literate adults and thirty illiterate adults in an age range of 15 to 35 years were selected for the study based on the following criteria :

(a) Criteria for selecting literate subjects:

1. The subject had to be in an age range of 15 to 35 years;
2. The subject had to be a right hander with no familial sinistrality at least for last three generations either on paternal or maternal side. This helped to rule out any genetic effects on the cerebral dominance for language;
3. The subject had to be using reading and writing skills in day-to-day life.

(b) Criteria for selecting illiterate subjects:

Even the illiterate subjects had to meet the same criteria those were specified for the literate subjects, except for criterion 3, which was modified. Here, the

subjects had to meet that criterion that they were never exposed to reading and writing skills formally or informally.

All the literate subjects of the present study met the specified criteria. The education in number of years ranged 12 to 18. All of them were right handers with no family history of left handedness. They used reading and writing skills actively because all of them were either students or employees in academic institutions.

All the illiterate subjects of the present study also met all the criteria those were specified for them. All of them were road construction workers. They had served under several contractors in a range of 8 to 22 years. This reflects that almost all of these workers were childhood labourers who had no opportunity to attend the schools.

Test

A test of dichotic listening developed by the present investigator (Kumar, 1978), was used to determine the cerebral dominance for language. The test, consists of two lists of seven familiar words each presented simultaneously to both ears and involves recalling the words immediately after cessation of the presentation. The number words recalled from each ear is considered to decide the ear advantage.

Test Administration

The test was administered in a quiet room at All India Institute of Speech and Hearing, Mysore in its Speech Therapy block. For the administration of Speech stimuli to both the ears simultaneously a dual channel Sonnett Tape Recorder with TD-39 ear phones were used.

Discussion and Results

Table-A reflects the number of subjects who had left hemisphere dominance, right hemisphere dominance and bilateral representation, for language in literates and illiterates.

TABLE A

Subjects	Left Hemisphere Dominance	Right Hemisphere Dominance	Bilateral Representation
illiterates	4 (13.42%)	13(43.29%)	13 (43.29%)
literates	27 (90.00%)	0	3 (10.00%)

The dominant hemisphere was evolved on the basis of the scores on the ears on dichotic competition. If there was a right ear advantage, that is, right ear forthcoming with more scores than the left ear, an individual with such an advantage was considered to have a left hemisphere dominance for language. In a similar manner, if there was a left ear advantage, it was considered to reflect the right hemisphere dominance. That is, hemisphere contialateral to the ear with advantage, on dichotic verbal recall task, was considered the dcmirant hemisphere. When both the ears performed equally well with no differences in scores, then an individual with such a performance was considered to have a bilater al representation.

Four of the 30 illiterate adults, that is, 13.42 per cent of the illiterate subjects showed left hemisphere dominance, where as, 27 of the 30 liter ate adults, that is 90 per cent of the literate subjects showed left hemisphere dominance.

None of the literates in the present study had a right hemisphere dominance, whereas, 13 of the 30 illiterate adults, that is, 43.29 per cent of the illiterate group exhibited the right hemisphere dominance.

Bilateral representation for language was observed in both the groups. More illiterates exhibited bilateral representation than the literate subjects. 13 (43.29 per cent) of the 30 illiterate subjects and 3 (10 per cent) of the 30 literate subjects showed bilateral representation for language.

Analysis of these differences, in hemisphere dominance for language, between literates and illiterates, for statistical significance using Chi-Square Test, reflected that they were significant beyond 0.001 level of confidence at 2 degrees of freedom with Chi-Square being equal to 36.32.

Hence, the null hypothesis that ' *There will be no significant difference in hemispheric lateralization, between literate and illiterate adults, for language'* was *rejected* as there was a significant difference in the hemispheric lateralizaticn for language in literate and illiterate adults.

In the present study, none of the illiterates had an exposure to reading and writing skills, whereas the literate subjects were active users of reading and writing skills in their day-to-day activities. Though, both the literates and the illiterates had an exposure to speaking and listening modalities of the language, that an exposure and active use of reading and writing modalities, seem to bring the language to the left hemisphere domain, as reflected by the literate subjects in comparison with the illiterate subjects in the present study. This shows that the acquisition and active use of all the four modalities of the language—viz., speaking, listening, reading and writing, are responsible for complete later alization of language to the domain of the left hemisphere and that the absence of acquisition of writing and reading skills lead an individual to, either have an equal participation of both his hemispheres of the brain to process the language or, to have a left hemisphere dominance,

However, left hemisphere dominance in illiterates is not totally ruled out. There were four illiterate subjects with left hemisphere dominance for language in the present study. Though it is unusual in lieu of the hypothesis in the present study, it is not unusual. This case can be viewed in the light of a subject reported by Kumar (1978). One of the ten subjects, who were all, right handed adults with literacy, showed a right hemisphere dominance for language, even in spite of a negative family history of sinistrality and no neurological disorder. In the same manner these subjects might also be rare subjects showing diversified results. Even in the study by Cameron, Currier and Haerer (1971) 34 per cent of their illiterate subjects showed aphasic disturbances with left cerebral hemisphere infarction.

In summary, it can be observed that there is a difference in terms of cerebral dominance for language in literates and illiterates, and that the acquisition and active use of reading and writing skills, seems to determine the language to be in the domain of the left hemisphere.

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