INTER-HEMISPHERIC AND INTRA-HEMISPHERIC TRANSMISSION OF INFORMATION ON BIMANUAL AND UNIMANUAL LETTER RECOGNITION AND MATCHING TASKS

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The purpose of the present study was to measure the time taken by normal subjects on bimanual and unimanual letter recognition and matching tasks. 30 *subjects* (15 *males and* 15 *females) in the age range* 19-28 *years were considered for this study.* 13 *pairs of plastic letter cut-out of English Alphabet were used. During testing the subjects were blind-folded and were asked match and recognise the letters by feeling. All the subjects were tested in four different conditions. It was found that the sensory information transmission from right hemisphere to left hemisphere is faster than from left hemisphere to right.*

Davidson (1982) reported that inter-hemispheric transmission of information from right hemisphere to the left hemisphere to be lagging behind when compared to the transmission of information from left hemisphere to the right in approximately one-third of the dyslexic children Dyslexic children were reported to perform poorly on bimanual object recognition and matching tasks when compared to their normal counterparts. He further observed these children to suggest a time-lag problem in transmission of sensory information from right-hemispher- to its left counterpart. However, the dyslexic children and their normal counterparts were observed to perform well on unimanual object feeling and matching tasks.

The purpose of the present study was to measure the time taken by normal subjects on 2 conditions of bimanual and two conditions of unimanual letter recognition and matching tasks.

In the bimanual letter recognition and matching task the subjects were required to feel the letter cutout in the right hand and choose the similar letter from the left hand (Condition A) and *vice versa* (Condition B). The time taken by the subject to choose the same letter cut-out from an array of 13 letter cutouts was presumed to be the inter-hemispheric transmission time.

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In the unimanual letter recognition and matching task, the subjects were required to feel the letter with *one* of the hands (right hand—Condition C and left hand—Condition D) and choose the same letter cutout from the array using the same hand. Time taken for such choosing was presumed to be the intra-hemispheric transmission time.

Methodology

Subjects :

15 males and 15 females in an age range ol 19 to 28 years constituted a group of 30 subjects. All of them were under-graduates or post-graduates. None of them had any history of neurological disability. 4 subjects (2 females and 2 males) had sinistral tendencies with *no* family history. 3 subjects (all males) had sinistral tendencies with family history of sinistrality.

Materials :

(1) 13 pairs of plastic letter cutouts of English Alphabet which measured 1" X 1" X 0-1" were used for the study. 13 letters were used to provide for feeling and other 13 letters were provided for choosing.

(2) Racer (7 jewels 1/10 Anti-magnetic) slop watch of Angloswiss watch company was used to measure the time.

(3) Blue two folded thick cloth band to blind-fold the subjects.

Administration

The manual letter recognition and matching tasks were administered under 4 conditions. The subjects were blind-folded in all the four conditions.

Condition A :

In condition A, the subjects were required to feel the letter in right hand and choose the similar letter using the left *h*and from an array of 13 letter cutouts. The time taken for choosing the right letter was noted down. In this condition, it is probable, that the left hemisphere had the spatial-linguistic perception of the letter and transferred the information *via* the corpus collosum to the right hemisphere which required to choose the same letter in the left hand. The time taken for transfer of information and choosing the letter was presumed here to be the inter-hemispheric transmission time from left hemisphere to the right hemisphere.

Condition B :

In Condition B, the subjects were required to feel the letter in left hand and choose the similar letter using the right hand from an array of 13 letter cutouts. The time taken for choosing the right (correct) letter was noted down. In this condition, it is probable that the right hemisphere had the spatial perception of the letter and transferred the information *via* the corpus collosum to the left hemisphere which required to choose the same letter with the right hand. The time taken for transfer of information and choosing the letter was presumed here to be the inter-hemispheric transmission time from right hsmisphere to the left hemisphere.

However, the inter-hemispheric transmission time measured in the above two conditions is not an absolute inter-hemispheric transmission time. It is only a relative value presumed to depict indirectly the inter-hemispheric transmission between the hemispheres. In both the above conditions, the subjects were allowed to feel the letter continuously till they choofe the letter from the other hand.

Condition C :

In Condition C, first the subjects were required to feel the given letter using the right hand and after giving back the letter to the examiner, they were required to choose the letter using the same hand. The time taken for choosing the letter from an array cf 13 letter cutouts was noted down. This time was presumed to be the intra-hemispheric transmission time for the left hemisphere.

Condition D :

Condition D was very similar to the Condition C, except that the subjects were required to feel and choose the letter using the lefthand, for which the time depicted was presumed to be the intra-hemispheric transmission time for the right hemisphere.

However, the intra-hemispheric transmission time depicted in Conditions C and D is again not an absolute one. It is used in this study only to compare the relative performance of the hemisphere.

To rule out the practice effect, if the subject 1 was started with Condition A, subject 2 was started with Condition D, subject 3 was started with Condition B, and subject 4 was started with Condition C. The order of presentation is depicted in Table I.

Results and Discussions

Table II shows the Mean Time taken and Standard Deviations for Condition A ; Condition B ; Condition C and Condition D for each subject.

TABLE I

Subject No.	Sex	Condition I	Comdition II	Condition III	Condition *IV*
1.	(M)*	A	B	C	D
2.	(F)	D	C	B	A
3.	(F)	B	A	D	C
4.	(F)	C	D	A	B
5.	(F)	A	D	B	C
f.	(F)*	D	A	C	*B*
7.	(F)	B	C	A	D
8.	(F)	C	B	D	A
9.	(F)	A	B	C	*D*
10.	(F)	D	*C*	B	*A*
11.	(M)	B	*A*	D	C
12.	(M)*	C	*D*	A	B
13.	(M)	A	D	B	*C*
14.	(M)	D	A	C	*B*
15.	(M)	B	C	A	D
16.	M)	*C*	B	D	A
17.	(F)*	A	*B*	C	n
18.	(M)	D	*C*	B	A
19.	(F)	*B*	A	D	C
20.	(M)**	C:	D	A	B
21.	(F)	A	D	B	C
22.	(F)	D	A	C	B
23.	(M)	B	*C*	A	D
24.	(F)	C	B	D	A
25.	(M)**	A	B	C	D
26.	(F)	D	C	B	A
27.	(M)	B	A	D	C
28.	(M)	C	D	A	B
29.	(M)**	A	D	B	C
30.	(M)	D	A	C	*B*

* Left handers.

** Left handers with family history of left handedness.

TABLE II

Subject	Mean Time Taken for Condition 'A' (seconds)	Mean Time Taken for Condition 'B' (seconds)	Mean Time Taken for Condition 'C (seconds')	Mean Time Taken for Condition 'D' (seconds)
1. (M)*	30.923	26.538	21.153	17.692
2. (F)	23.846	22.165	15.384	14.000
3. (F)	15.846	9.230	5.230	4.769
4. (F)	35.384	21.692	19.846	17.307
5. (F)	25.076	24.000	14.615	10.230
£, (F)*	25.846	25.615	15.000	17.692
7. (F)	61.153	17.692	16.846	13.300
8. (F)	53.230	45.615	20.461	15.153
9. (F)	91.153	48.923	20.384	11.230
10. (F)	35.230	23.000	14.846	9.461
11. (M)	75.615	34.769	24.230	12.384
12. (M)*	39.615	26.923	26.000	19.230
13. (M)	29.076	21.846	17.923	15.846
14. (M)	27.461	26.384	12.000	33.923
15. (M)	45.384	37.230	23.769	19.076
16. (M)	16.153	15.923	33.384	20.230
17. (F)*	26.307	16.846	16.846	16.846
18. (M)	25. 692	17.923	23.615	22.538
19. (F)	28.153	32.846	19.461	29.769
20. (M)**	16.769	22.538	19.230	24.461
21. (F)	16.538	14.000	14.800	12-692
22. (F)	30.307	25.846	14.153	18.615
23. (M)	19.461	20.461	17.384	17v230
24. (F)	31.846	32.923	19.230	28.923
25. (M)**	21.461	16.230	13.000	12.384
26. (F)	25 .153	17.846	16.769	17.000
27. (M)	46 .000	19.000	17.692	17.076
28. (M)	28.384	28.846	15 .153	26.230
29. *CM)***	17.769	16.615	16.076	25.538
30. (M)	35.153	26.153	25.923	15.384
Total	999.984	735.618	549.603	536.209
Mean	33v3328	24.5206	18.3201	17.8736
SD	17.187372	8.7574756	5.1730944	6.35966

D=	8.8122	D=	.446467
SE_D=	3.5218324	SE_D=	1.4967317
CR=	2.5021633	CR=	0.2982946
Significant at 0.02 level on two tailed probability (P = 2.457)		Not Significant	

* **Left handers.**

**** Left handers** with family history of left handedness.

D = difference between means of A & B ; C & D.

Between Conditions A and B :

1. The Moan time taken for Condition A ranged from 15.846 secs, to 91-153 secs, across the subjects with an average of 33.3328 secs.
2. The Mean time takenfor condition Brangedfrom 9.23 sec to 48.923 sees, across the subjects with anaverage of 24.5206 secs.
3. 25 subjects performed better on condition B than on Condition A and 5 subjects performed better on condition A than on condition B.
4. 25 subjects who performed better on condition B than on condition A included 4 subjects with sinistral tendencies and two subjects with sinistral tendencies with familial history of sinistrality. One subject with sinistral tendencies with positive family history was among the 5 subjects who performed better on condition A.
5. The difference of 8.8122 secs of the averages of condition A and B was found to be significant at 0.02 level of significance at 30 df (p-2-457) with a CR=2.5021633 (SE_D = 3.5218324).
6. This shows that the sensory information transmission from right hemisphere to the left hemisphere is faster than from left hemisphere to the right. This finding is in concurrence with the findings of Davidson and his associates (1982). However this findings can be discussed at two levels.

Level 1 : It might be that the transmission itself is faster from light hemisphere to the left hemisphere.

OR

Level 2 : Whatever might be the. transmission time between the hemispheres, that the left hemisphere is able to curvert the information received suit its linguistic need. This might be making the condition B tc be better than the Condition A. That is to say the left hemisphere might be more able say what is on the right more easily than the right might bo able to say what is on its left counterpart.

Between Conditions C and D :

1. The Mean time taken for Condition C ranged from 5-23 sees, to 33-384 secs, across the subjects with an average of 18.3201 secs.
2. The Mean time taken for Condition D ranged from 4.76 secs, to 33.923 secs, across the subjects with an average of 17.8736 secs.

3. 20 subjects performed better on Condition D than on Condition C and 9 subjects performed better on Condition C than on Condition D. In one subject there was no difference between the performance of the hands.

4. 2 subjects with sinistral tendencies and one subject with sinistral tendencies with positive family history were among the 20 subjects who performed better on Condition D. One subject with sinistral tendencies and 2 with sinistral tendencies with positive family history were among the 9 subjects who performed better on Condition C. One subject with sinistral tendencies performed equally on both the conditions.

5. The difference of 0-4465 seconds of the average of Conditions C and D was found to be not significant at any level of significance with a C.R. = 0 • 2982946 (SE_D = 1 • 4967317).

6. This shows that the performance of the hemispheres on unimanual tasks does not give rise to any significant differences between them. This again is in concurrence with the findings of Davidson and his associates (1982).

7. In general, it was observed that the left hand performed better than the right hand on unimanual tasks, though there was no significant difference between their performance on the whole. It can be explained at 2 .levels.

Level 1 : It might be that the spatial perception of the shape is better than its linguistic perception under non-competitive conditions.

OR

Level 2 : It might be that the pathways ipsilateral to the dominant hemisphere are stronger in performance under non-competitive conditions in most of the individuals. Such an observation was made by the first author (Kumar 1978) with the blind adults. Though the blind perceived Braille better with the right hand on dichhaptic Braille Reading Tasks, they read Braille faster and efficiently with their left hand under normal conditions.

8. The ipsilateral dominance hypothesis can be explained on the basis of limited lingusitic ability of the right hemisphere when compared to the dominant linguistic ability of the left hemisphere.

Implication

The task that has been evolved can be used with the dyslexic children to check its implication as a diagnostic tool.

Limitation

1. As it is time consuming, the items should be reduced.
2. Present tasks were constructed using letters of English alphabet, hence tasks should be developed using letter cutouts of alphabets of Indian languages.

References

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