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INTERHEMISPHERIC INTERACTION DURING SIMULTANEOUS BILATERAL PRESENTATION OF LETTERS OR DIGITS IN COMMISSUROTOMIZED PATIENTS*

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Abstract—Interhemispheric interaction after forebrain commissurotomy was studied in six patients. Letters or digits were flashed for 0·1 sec either in the left or in the right visual field alone, or in both fields simultaneously. Patients were asked to identify the stimuli either verbally or by hand. Results showed generally better performance for each hemisphere during unilateral than during bilateral stimulus presentation. For both verbal and manual responses, identification of right-field stimuli was better than that of left-field stimuli, the latter often being completely ignored during bilateral presentations. Some evidence was obtained for right-hemisphere verbalization during unilateral presentation of left-field stimuli.

EARLIER studies on commissurotomized patients have repeatedly demonstrated the general isolation and independence between the disconnected cerebral hemispheres in the sense that each hemisphere is by and large oblivious of the mental activities of the other [for recent reviews, see 1–3]. In the present experiment, the extent of hemispheric independence in these patients is studied with a different emphasis: here we ask whether the operating *efficiency* of one hemisphere is affected by concomitant activities in the other hemisphere; or, in other words, to which extent the two hemispheres have to share the same attentional mechanism.

A previous inquiry has shown that some commissurotomized patients could simultaneously perform two different two-choice discrimination tasks, one presented to each hemisphere, without increase in reaction time, thus suggesting lack of interference between the two working hemispheres [4]. We now report results from some more difficult tasks of letter or digit identification where patients were asked to give answers either verbally or by hand retrieval from multiple choices. In all cases, interference and competition between the hemispheres during simultaneous bilateral task presentation are clearly demonstrated, as shown by increased error rates and unilateral neglect.

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METHOD

Subjects

The subjects were six patients of Drs. Philip J. Vogel and Joseph E. Bogen of Los Angeles. The forebrain commissures of these patients had been surgically sectioned to relieve otherwise intractable epileptic seizures. Their code names were AA, CC, LB, NG, NW, and RY, and brief case histories have been summarized [5, 6]. Since the patients varied in age, preoperative brain disorders, age at operation, period since operation, intelligence level, sex, etc., the different individuals were regarded as one source of independent variable in the experimental design and data analysis.

General experimental design

The main purpose of the present experiment was to compare the performance of each hemisphere during unilateral task presentation to that during bilateral task presentation. Performance on four tasks was examined in consecutive test periods separated by rest intervals. Patients were shown tachistoscopically either letters or digits, and were asked to identify them either manually or verbally. The exact order of testing was (1) manual indication of letters, (2) manual indication of digits, (3) verbal report of letters, and (4) verbal report of digits. Manual responses were tested before verbal report to avoid possible perseveration of the dominance of the left speech hemisphere into following test periods. The longer letter series was presented before the shorter digit series because the patients might have gotten more easily bored or tired in the later test periods.

Within each test period, stimuli to be identified were presented for 0·1 sec either unilaterally, or bilaterally. During unilateral-presentation trials, 2 letters or digits were flashed either in the left visual half-field (LF), or in the right visual half-field (RF). During bilateral-presentation trials, 4 letters or digits were simultaneously flashed, 2 in each visual half-field. Thus for each of the four tasks data were collected according to a three-way $6\times2\times2$ factorial design, the three independent variables being the 6 patients, whether stimuli were in the LF or RF, and whether stimuli were presented unilaterally or bilaterally.

Material

Sixteen slides were made for the letter series, and 10 were made for the digit series. The same slides were used in both the manual and the verbal series for closer comparison between the two response modes, but the patients were not informed of this fact and none of them seemed to be aware of it during testing, probably partly because the order of slides was changed. (Pretests on normals had shown no indication of memory carryover between the manual and the verbal test periods either.)

On each slide, there were either four uppercase letters, or four digits, taken from Letraset, Folio Light papers. All stimuli were transparent on opaque background. When projected on the screen and seen by the patients, the visual angle subtended by each letter was about 50′ high by 40′ wide, and that of each digit was about 40′ high by 30′ wide. The four stimuli were positioned one in each quadrant. The center of each stimulus was 4° from the vertical axis and 1° from the horizontal axis, with the fixation point at the center of the two imaginary axes.

Nineteen letters in the alphabet, with A, B, L, W, X, Y, Z excluded, were used in the letter slides. Each letter was used a total of one, two, or three times on each side of the slides. The four letters on each slide were taken from different segments of the alphabet and had at least one gap in alphabetical order between any two of them. Each digit from 0 to 9 was used a total of two times on each side of the ten digit slides, but no digit was repeated on the same slide.

For manual identification of the flashed stimuli, the 19 letters and the 10 digits were written on separate 2-cm square wood tiles in shapes corresponding to the stimuli on the slides.

Procedure

Each patient was tested individually in a private room with dim illumination. The patient sat comfortably at one end of a table, facing 55 cm away a translucent viewing screen with a fixation point at the center. Stimuli were back-projected with good contrast and no glare onto the screen. Monocular viewing with the right eye was used in all cases. At the beginning of each test period, instruction was given and the patient was asked to repeat it back to the experimenter (*E*) in his own words to insure understanding. This was followed by a few sample trials with an extra but similar slide, and all three types of input condition (LF only, RF only, Bilateral) were included. When stimuli on only one side of the slide were to be shown, the other side was covered by a piece of opaque negative film. The sample trials were first given at long exposures, which were then reduced to 0·1 sec, the standard exposure duration used in all test trials.

Each slide was used three times during a test period, once each for LF only, RF only, and bilateral, separated by at least 9 trials from other slides. Each of the three types of trials was approximately evenly distributed in the trial series. However, the field of stimulus presentation on any particular trial was unpredictable.

The first test period was manual indication of letters. The 19 choice letter tiles were arranged in alphabetical order on the table in front of the patient in full view. The patient was asked to use his left hand to retrieve the letters seen on the left side of the screen (thus both stimulus input and motor output involved primarily the right hemisphere), and to use his right hand to retrieve letters seen on the right side of the screen (thus involving primarily the left hemisphere). No order of hand use was specified for bilateral-presentation trials, and no patient inquired about it. The exact sequence for each trial was as follows: *E* gave a ready signal for the patient to position his head and to direct his gaze at the fixation point; the stimuli were flashed for 0·1 sec; the patient moved his head back from the eye piece and retrieved the letters from the choices with free vision. *E* recorded the responses and then replaced the letters. The *E*'s records included letters retrieved, hand used for each letter, and response time for each letter counting from the moment the stimuli were flashed to the moment a letter was retrieved. Stop watches were used for timing.

For the second period of manual indication of numbers, the same procedure was followed except that the 10 digit tiles were used instead of the letter tiles. In the third and fourth periods of verbal report of letters and digits, no choice tiles were displayed and the patients were instead asked to say what they saw.

Within each test period, patients were given rest intervals of about 3 to 5 min after every one third of the trials. The patients varied in their response times. On the average, the four test periods took about 35, 20, 10 and 8 min respectively, including rest time.

Scoring

Scoring of responses from manual indication of letters will be illustrated in detail. For each patient, response scores on every trial were entered into one or two appropriate blocks according to the 2 × 2 input conditions (LF or RF, Unilateral or Bilateral presentation), and classified as being either Correct, or Almost Correct, or Incorrect, or an Omission. For a response to be scored as Almost Correct, the retrieved letter was not identical to the stimulus letter, but the two bore close visual resemblance (e.g. O vs Q, C vs G, P vs F, J vs I, etc.). These misidentifications, in view of the brief exposure time, seem more likely to be the results of errors in perception rather than wild guesses, such as responding W for S, which would be classified as being incorrect.

On an actual trial, for instance, if GJ were flashed in the left field alone and the patient retrieved CK, one Almost Correct (C for G) and one incorrect (K for J) score would be entered into the LF-Unilateral block. If four letters were flashed simultaneously, with NT in the left field and SV in the right field and the patient retrieved W, S, V, one Incorrect score and one Omission score (W for NT) would be entered into the LF-Bilateral block, and two Correct scores (SV for SV) would be entered into the RF-Bilateral block.

Data from the other three tasks were scored and summarized in a similar fashion. The total number of entries was less in the digit series because of the fewer number of trials.

RESULTS

Two preliminary analyses were performed on the data. One compared results from correct and incorrect hand use, the other compared performances from the first half and the second half of each test period.

In manual indication of letters or digits, patients often forgot to use the appropriate hand as instructed, although they were perfectly willing and able to switch (left hand for LF stimuli, right hand for RF stimuli) when reminded. Comparison between the hands showed no noticeable difference in any patient, conforming to earlier findings that, when free vision was allowed, use of either hand in retrieval or pointing gave similar results in these patients [6]. Thus whether hand use was in accord with instructions or not will be ignored in the following analyses.

To check whether too many trials were packed into each test period such that performance deteriorated towards the end, the results from the first half of the trials for each task were compared with that from the second half. The average score from the two halves were found to be nearly identical.

Better performance during unilateral presentation, and left hemisphere superiority as shown from number of correct responses

Summaries of response classifications are presented in Table 1. A three-way analysis of variance [7] was performed on the number of correct responses for each of the four tasks of manual or verbal identifications of letters or digits, the three independent variables being the different patients, visual field of stimulus appearance, and input condition of unilateral

Table 1. Response frequencies on four tasks as a function of visual field and input condition in the six patients after forebrain commissurotomy. (C: Correct; A: Almost Correct; I: Incorrect; O: Omission)

Manual Indication of letters

	Patient	Left field Responses O	I	A	C	Right field Responses O	I	A	C
Unilateral	AA	3	14	4	11	1		2	29
	CC		20	4	8	1	2	1	28
	LB		15	4	13			1	31
	NG		18	1	13		4	3	25
	NW		19	3	10		1	1	30
	RY		24	4	4		1	3	28
	Sum	3	110	20	59	2	8	11	171
	%	2	57	10	31	1	4	6	89
Bilateral	AA	31			1	1	3	3	25
	CC	32					1	2	29
	LB	4	14	5	9				32
	NG	23			9	9	2	1	20
	NW	29			3	1	3	2	26
	RY	32					3	3	26
	Sum	151	14	5	22	11	12	11	158
	%	79	7	3	11	6	6	6	82

Manuel indication of digits

	Patient	Left field Responses O	I	A	C	Right field Responses O	I	A	C
Unilateral	AA		6		14		4		16
	CC		9		11		1		19
	LB		5		15		1		19
	NG		7		13		1		19
	NW	2	14		4		4		16
	RY		14		6		6	3	11
	Sum	2	55		63		17	3	100
	%	2	46		52		14	3	83
Bilateral	AA	11			9	9	1		10
	CC	20							20
	LB	4	4		12	1	2		17
	NG	12			8	8	2		10
	NW	18	2			2	4		14
	RY	18			2	2	2	2	14
	Sum	83	6		31	22	11	2	85
	%	69	5		26	18	9	2	71

Verbal report of letters

	Patient	Left field Responses O	I	A	C	Right field Responses O	I	A	C
Unilateral	AA	15	10		7	2	1	2	27
	CC	2	23	1	6			1	31
	LB	2	18	5	7		2		30
	NG		27	2	3		2		30
	NW	32				4	5	1	22
	RY	8	13	3	3		1	5	26
	Sum	59	96	11	26	6	11	9	166
	%	31	50	6	13	3	6	5	86
Bilateral	AA	31			1	1			31
	CC	32					1	2	29
	LB	6	11	4	11		1	1	30
	NG	32					2		30
	NW	32				2	3	1	26
	RY	32					1	1	30
	Sum	165	11	4	12	3	8	5	176
	%	86	6	2	6	2	4	3	91

Verbal report of digits

	Patient	Left field Responses O	I	A	C	Right field Responses O	I	A	C
Unilateral	AA	3	9		8	1	6		13
	CC		11		9		4		16
	LB		4		16		1	1	18
	NG	2	14		4		1		19
	NW	20					1	1	18
	RY	8	6	1	5		4	4	12
	Sum	33	44	1	42	1	17	6	96
	%	27	37	1	35	1	14	5	80
Bilateral	AA	16			4	4	3		13
	CC	20					2		18
	LB	1	12		7		1		19
	NG	20					1		19
	NW	18	1		1	6	3	1	10
	RY	20					2	2	16
	Sum	95	13		12	10	12	3	95
	%	79	11		10	8	10	3	79

or bilateral presentation. Since LF stimuli were primarily relayed to the right hemisphere and RF stimuli to the left hemisphere, for convenience hemispheric designations will sometimes be used instead of the visual fields in the following presentation.

On manual indication of letters, the patients varied among themselves on general performance level and extent of left-hemisphere dominance. Over and above these individual differences, however, left-hemisphere performance was better than right-hemisphere performance, and unilateral presentation was better than bilateral presentation, with the right hemisphere suffering more than the left during bilateral presentation. The significant main effects and interactions were: Patients ($F = 6{\cdot}7$, $df = 5/5$. $p < 0{\cdot}05$), Hemisphere ($F = 108{\cdot}3$, $df = 1/5$, $p < 0{\cdot}001$), Input ($F = 27{\cdot}6$, $df = 1/5$, $p < 0{\cdot}01$), Patient × Hemisphere interaction ($F = 7{\cdot}9$, $df = 5/5$, $p < 0{\cdot}05$), and Hemisphere × Input interaction ($F = 7{\cdot}9$, $df = 1/5$, $p < 0{\cdot}05$).

When verbal report was requested for these same letters, again the left hemisphere was better than the right ($F = 550{\cdot}1$, $df = 1/5$, $p < 0{\cdot}001$), but this was the only significant source of variance.

On manual indication of digits, the left hemisphere was better than the right ($F = 13{\cdot}2$, $df = 1/5$, $p < 0{\cdot}05$), and unilateral presentation was better than bilaterial presentation ($F = 16{\cdot}6$, $df = 1/5$, $p < 0{\cdot}01$), but there was no significant difference among the patients and none of the possible interaction effects were significant. When verbal report was requested to identify the digits, again the only significant finding was that the left hemisphere was better than the right ($F = 51{\cdot}7$, $df = 1/5$, $p < 0{\cdot}001$), and unilateral presentation was better than bilateral presentation ($F = 23{\cdot}0$, $df = 1/5$, $p < 0{\cdot}01$.)

Thus, when considering the number of correct responses alone, the results showed superior left-hemisphere performance for both letters and digits regardless of the response mode. In addition, each hemisphere performed better when it alone was being stimulated; the only exception was in verbal report of letters where hemispheric difference was most extreme, and right-hemisphere performance remained poor, whereas left-hemisphere performance continued to be good during both unilateral and bilateral input. The interaction between hemisphere and input was significant only for manual indication of letters, where the right-hemisphere performance suffered relatively more than the left-hemisphere performance during bilateral presentation. Again it was only on this same task of manual indication of letters where the six patients showed significant individual differences among themselves.

Neglect of left-visual-field stimuli during bilateral presentation

A more pervasive and striking interaction effect between Hemisphere and Input showed up when we looked into the distribution of "wrong" responses, which had been subdivided into three categories of Almost Correct, Incorrect, and Omission, as shown in Table 1. While the wrong responses from the inferior right hemisphere were predominantly incorrect responses during unilateral presentation, they became mostly Omissions during bilateral presentation. In other words, the right hemisphere was able to give few responses, if any at all, when it was stimulated simultaneously with the left hemisphere, while many incorrect responses and some correct or essentially correct responses were produced during unilateral presentation. This general pattern of LF neglect holds for all four tasks of manual or verbal indication of letters or digits, and applied to all patients except LB, whose responses to LF stimuli were better than the other patients, and remained good during bilateral presentation.

Above-chance-level correct verbal report of left-visual-field stimuli during unilateral presentation

Earlier studies with these patients have generally found their right hemisphere to be practically speechless [8]. Nevertheless, in the present tasks of verbal indication of letters or digits, many verbal responses were made during the unilateral-LF-stimulation trials. About 20 per cent of the reported letters were correct, and this value would increase to be nearly 30 per cent if we accept Almost Correct response (e.g. C for G) as essentially correct responses. Similarly, nearly half of the reported digits were correct. These findings demonstrated a clearly above-chance-level (about 4 per cent for the letters and 10 per cent for the digits) verbal identification performance during unilateral LF stimulation, even though the general performance level was indeed still inferior to that from the unilateral RV stimulation.

Reaction time analysis

Reaction times were obtained on most of the trials, but not always accurately, as primary attention was paid to the content of the responses, and occasionally a patient would change his mind about a response, but the stop watch had already been halted. For these reasons, only general impressions of the reaction time data will be reported here.

By far the largest variation in reaction time came from individual differences among patients, who varied grossly both in general speed level and in relative speed for different tasks and input conditions. For instance, the slowest patient, AA, took about 20 sec to retrieve a letter, 10 sec to retrieve a digit, and 5 sec to report a letter or a digit. In contrast, the corresponding reaction time from another patient, CC, was about 8 sec, 5 sec, and 1 sec, respectively. The second obvious difference in reaction times was among tasks. For manual retrieval, it took the patients on the average about 6 sec for a letter, and about 5 sec for a digit. Verbal report took 1 or 2 sec for each letter or digit.

Overshadowed by large individual variations and task variations, whether the stimulus was in RF or LF, or whether the input was unilateral or bilateral, or whether the response was correct or incorrect, did not result in appreciable or consistent differences in reaction times. The only two exceptional cases were AA and LB, both of them took much longer to report LF stimuli than RF stimuli.

It would have been interesting to compare order of output from the two hemispheres during the bilateral-presentation trials. If the output from one hemisphere consistently leads that from the other hemisphere, this will be another index for hemispheric asymmetry. In addition, if performance of the second hemisphere is inferior, the longer retention interval may account for at least part of the differences. As it turned out, however, in general no response was made to LF input during simultaneous bilateral presentations. Occasionally during manual retrieval NG and AA would retrieve one stimulus from each visual field, but the order of retrieval was inconsistent. AA also made a few such "split" answers, one from each visual field, during verbal report of letters or digits.

One exceptional patient, LB, did give more than two responses on many of the bilateral presentation trials. The RF stimuli were usually retrieved first in manual responses, and always reported first in verbal responses.

DISCUSSION

The main purpose of the present study was to determine the extent after forebrain commissurotomy of interhemispheric interaction during simultaneous bilateral presentation of letters and digits. Patients were asked to identify the stimuli either by verbal report or by manual retrieval from a choice array. Performance of each hemisphere during bilateral stimulation was compared to that during unilateral stimulation. Comparisons were also made between the two hemispheres. The results showed in general that more correct responses were obtained from each hemisphere when it was stimulated alone. In addition, for all six patients except LB, almost complete neglect of left field input was observed during bilateral stimulus presentation. Better performance was obtained with right-field than left-field stimuli, consistent with the general agreement in the literature that the left hemisphere is superior to the right on verbal tasks. However, during unilateral left-field presentation performance was better than expected in verbal report and poorer than expected in manual retrieval.

Some earlier studies with monkeys [9] and man [4, 10] have suggested a doubling of information processing capacity after forebrain commissurotomy. The current findings to the contrary serve to caution against such a generalization, and indicate that the presence and extent of interhemispheric interference depend in part on the complexity of the task.

Many tachistoscopic recognition experiments have been performed recently with normal subjects to compare visual field differenecs. When letters or short words were simultaneously presented in both the left and the right visual fields, recognition was comparable for the two fields when exposure was relatively long, at 150 msec [11]. Recognition favors the left field when exposure was shorter, between 50–100 msec [12, 13], and this is taken to reflect the left-to-right scanning habit in reading. However, in several recent studies where a very short exposure time of 20 msec was used, results similar to what have been found in the present study were also obtained in normal college students, including better verbal report on the right-field than left-field words, better performance for each hemisphere during unilateral than bilateral presentation, and perhaps most interestingly neglect of left-field words during bilateral presentations [14, 15]. Furthermore, this unilateral neglect could not be reduced by presenting the left-field word 20 msec ahead of the right-field word to account for transcallosal transmission time, or by forcing report of the left-field word ahead of the right-field word [15, 16]. These experiments seem to suggest that, when temporal summation of the visual signal is too short to provide enough transcallosal information, some "split-brain" phenomena can be simulated and studied in normals, and in the present investigation, the left-field deficit is more likely a result from lack of recognition than fast memory decay.

Although in the present study the right hemisphere seemed to have been particularly suppressed during bilateral presentation of either letters or digits, regardless of response mode, it should be pointed out that these patients showed no unilateral neglect during simultaneous bilateral presentation of pictorial material, or when the letters were aligned in a row across the midline [2, 17]. Even in the present study, LB did not show appreciable unilateral neglect, and AA and NG responded to one stimulus from each visual field in a few of the bilateral-presentation trials. On the other hand, continuous unilateral neglect of a whole visual half-field contralateral to the hand being used has been observed in some of the commissurotomized patients [18]. These findings indicate that the apparent distribution of attention between the two cerebral hemispheres is not static, but may change with the nature of the task, and varies among individuals.

Early studies with the commissurotomized patients have generally found that stimuli relayed to the right hemisphere cannot be correctly verbalized [e.g. 8]. In contrast, we found in the present study that correct or essentially correct verbal identifications were made by the patients for about 20 per cent of the letters, and for about 35 per cent of the digits, during unilateral left-field presentations. Failure in gaze fixation can be ruled out as a possible explanation of these results for the following reasons: First, the exposure time of 0·1 sec was shorter than the reflexive eye movement latency. Second, since the field of stimulus presentation was unpredictable for the patients, spontaneous fixation drift, if present, should be comparable during the left-field alone trials and the bilateral trials. If the 20 per cent or so correct verbal report of letters during left-field-alone trials was due to fixation drift to the left, we should expect the same to happen in about 20 per cent of the bilateral trials. If during a bilateral trial letters on both sides of the screen fell in the right visual field, we should expect better identification of the letters on the left than those on the right, because of the left-to-right reading habit, and that the letters on the left would be closer to the fovea. The results from the bilateral trials showed, however, that patients typically failed to respond at all to letters in the left side of the screen. Thus the present result not only confirmed an earlier finding on LB that verbal report could be made to left-field stimuli [19], but also extended this observation to some other patients.

It is more difficult to determined whether or not verbalization of left-field stimuli in the present study indeed came from the right hemisphere. Verbalization of stimulus onset or offset, or stimulus in motion, has been obtained in these patients when the stimuli were presented in the peripheral left field, about 45° away from the fixation point, and these peripheral stimuli were supposed to have reached the left hemisphere secondary visual centers through extrageniculate pathways [18]. In the present study, however, letters and digits were always presented only 4° away from the fixation point in foveal vision. Some cross-cueing strategies proposed to account for occasional correct verbal report of left-field stimuli [20] seemed to be ruled out in the present study in view of the large number of alternative answers involved.

The following considerations have led us to favor the view that in the present study at least some of the verbalization of left-field stimuli actually came from the right hemisphere. First, we found that verbal report of digits was better than that of letters when they appeared in the left-field (see Table 1). If these stimuli were indeed relayed to the left hemisphere and initiated verbal answers there, it is hard to imagine why the left hemisphere should identify digits better than letters (as a matter of fact, identification of right-field stimuli was better for letters than for digits). A more plausible answer seems to be that, the right hemisphere, generally speechless and less proficient in language, is nevertheless better in dealing with digits than with letters.

Second, since many incorrect responses were given to the left-field stimuli, patients were asked several times during testing whether they were guessing. Guessing was generally denied at length, sometimes emphatically and right after flagrantly incorrect answers to left-field stimuli. This obvious incongruity becomes more understandable if we assume that the lengthy verbal denials came from the left hemisphere, which was unaware of the incorrect answers because they came from the right hemisphere.

A third support favoring the interpretation for right-hemisphere speech was the perseveration of the same errors to the left-field stimuli, which was noticeable in CC and NG for both letters and digits, and in RY for letters. For instance, in a sequence of trials the patient would first respond incorrectly during a left-field-alone trial (e.g. reporting JG for SV). In the following few trials, stimuli were shown either in the right-field-alone, or bilaterally, and the patient correctly identified the stimuli in the right field on each trial. In the next left-field-alone trial, however, the patient gave the same wrong answers as in the previous left-field presentation (e.g. JG, this time for MP), and this same incorrect answer might be repeated again during the next left-field-alone trial, even though they were separated by several right-field-alone and bilateral trials. If the incorrect answer to left-field stimuli actually came from the left hemisphere, it is probably more likely that the patient would repeat what he had just said in the immediately preceding trial. In fact normal subjects usually do not remember responses given several trials back. On the other hand, this phenomenon becomes more understandable if we assume that the confabulatory responses actually came from the isolated right hemisphere, which was indeed repeating its own immediately preceding answers.

The interpretation of right-hemisphere speech in the present experiment is compatible with some clinical observations of speech after left hemispherectomy [21] or acute left-hemisphere ischemia [22], but no generalization is intended. More systematic studies with each patient are needed to clarify necessary and sufficient conditions favoring verbal report of left-field stimuli, and to determine its hemispheric origin.

In contrast to the better-than-expected success in verbal report found in the present study was the less-than-expected performance in manual indication of left-field stimuli, where the right hemisphere could have responded on visual match alone [5, 23]. This mediocre manual performance could be caused by the alternating activation of the left and the right hemispheres with verbal material, which may favor the dominance of the left-hemisphere to persist at the expense of the right, and to induce the latter to respond in a verbal mode. It has been proposed that verbal and spatial functions tend to be mutually antagonistic within the same hemisphere [24], and development of language ability in the right-hemisphere has been shown to suppress the development of its visual–spatial functions [2, 25–27]. The present result of relatively poor manual retrieval together with relatively good verbal report of left-field stimuli in the same test session seems to lend added support to the interference hypothesis.

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Résumé—On a étudé chez six malades l'intéraction hémisphérique après commissurotomie. Des chiffres ou des lettres étaient projetés durant 0,1 sec., soit dans l'hémichamp gauche, soit dans l'hémichamp droit, soit simultanément dans les deux hémichamps. On demandait aux sujets d'identifier les stimulus, soit verbalement, soit par indication manuelle. Les résultats montraient généralement que la performance était meilleure pour chaque hémisphère durant la présentation unilatérale du stimulus que durant la présentation bilatérale. Pour les réponses verbales aussi bien que manuelles, l'identification des stimulus dans le champ droit était meilleure que celle des stimulus dans le champ gauche, ce dernier étant souvent complètement ignoré lors des présentations bilatérales. On a obtenu quelques preuves d'une verbalisation de l'hémisphère droit lors de la présentation unilatérale des stimulus dans le champ gauche.

Zusammenfassung—Bei 6 commissurotomierten Kranken wurde die interhemisphärische wechselseitige Funktionsbeeinflussung untersucht. Dabei wurden für die Dauer von 0,1 Sekunde Buchstaben oder Ziffern entweder isoliert im rechten oder linken Gesichtsfeld oder zusammen in beiden Gesichtsfeldern projiziert. Die Kranken wurden aufgefordert die dargebotenen Reize sowohl verbal als auch durch Handzeichen zu identifizieren. Bei unilateraler Darbietung waren die Ergebnisse für beide Hemisphären durchgängig besser als bei bilateraler Reizung. Bei der Identifizierung im rechten Gesichtsfeld waren verbale als auch manuelle Antworten wiederum besser als im linken. Reize im linken Feld wurden bei doppelseitiger Gesichtsfeldbelastung oft völlig ignoriert. Es ergaben sich demnach gewisse Hinweise für eine rechtshemisphärische Verbalisation im Verlaufe einer halbseitigen Projektion in das linke Gesichtsfeld.