ATTENTIONAL MECHANISMS AND PERCEPTUAL ASYMMETRIES IN TACHISTOSCOPIC RECOGNITION OF WORDS AND FACES

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Abstract—In simultaneous bilateral tachistoscopic recognition tasks, normal right-handers named more words in the right visual field and recognized more faces in the left visual field. Priming the left hemisphere with a verbal task diminished the left field superiority for faces, and priming the right hemisphere with a face-recognition task, reduced the right visual field superiority for words. These priming effects disappeared when a recognition procedure was used. When words and faces were presented simultaneously, subjects required to attend to the faces and report them first showed a left visual field superiority for faces and a right visual field superiority for words. Subjects told to attend to the words and report them first showed only the right visual field superiority for words.

INTRODUCTION

Perceptual asymmetries are often thought to reflect the functional asymmetry of the cerebral hemispheres. When testing normal right-handed people, verbal material is perceived faster and more accurately in the right sensory field than in the left [1-4] and material that is difficult to code verbally is more readily perceived in the left sensory field than in the right [5-12]. Typically, these results are interpreted in terms of a relative access model which holds that stimuli are perceived more easily if they have direct access, via the crossed sensory pathways, to the hemisphere that specializes in processing them [1, 2, 4]. Recently, KINSBORNE [13] has proposed an alternative model. He claims that when there are differences in the level of activity of the two hemispheres, attention is biased toward the sensory field contralateral to the more active or primed hemisphere. According to this model, material-dependent perceptual asymmetries are produced because verbal and non-verbal perceptual tasks are thought to prime the left and right hemisphere, respectively. Hemispheric priming, then, is viewed as a procedure that differentially engages the processes of the left or right hemisphere. It is in this sense that the term “hemispheric priming” will be used in this paper. Thus, for example, tachistoscopic word-recognition tests will be considered as left-hemisphere priming tasks since verbal tasks presumably engage left-hemisphere processes.

It should be noted at the outset that this paper does not intend to challenge the concept of hemispheric priming, but merely tries to determine whether the concept is necessary for

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interpreting data on perceptual asymmetries. Since Kinsbourne's "attention" model is the only model to state explicitly that hemispheric priming has consequences on perception, it will be compared to the more traditional relative access model.

To test the adequacy of the two models, the effects of hemispheric priming on well-established perceptual asymmetries was examined. Kinsbourne's attention model predicts that the magnitude of perceptual asymmetry for a given task could be altered by differentially priming the right or left hemisphere. For example, priming the left hemisphere with a verbal task should enhance the right-field advantage for the detection of verbal material and diminish the left-field advantage for the recognition of non-verbal material. Such a prediction, if upheld, would argue against the adequacy of the traditional accessibility model.

EXPERIMENT 1

Word naming and face recognition

To guarantee that any significant changes in perceptual asymmetries were indeed caused by the relevant experimental manipulations, verbal and non-verbal tasks which produced large and consistent laterality effects were used. A tachistoscopic word-naming test, developed by McKeever and Huling [14] to control for fixation, served as the verbal task. Since the non-verbal tasks reported in the literature produce weak or equivocal left-field effects, an analogous face-recognition test which showed a strong and consistent left-field superiority was developed.

It was hypothesized that 40 trials of a word-naming task (priming set) would prime the left hemisphere sufficiently to direct attention to the right visual field and, thereby, reduce the expected left-field superiority in the subsequent 40 trials of the face-recognition task (test set). Similarly, presenting face-recognition prior to word-naming should diminish the expected right visual field superiority in word-naming. In brief, perceptual asymmetries for a given task should be more pronounced when the task serves as the priming set than when it is the test set.

Finally, if priming is effective, then as the priming set progresses, attention should shift increasingly towards the visual field contralateral to the primed hemisphere and should lead to larger perceptual asymmetries in the later trials of the priming set than in the early ones.

METHOD

Apparatus

A constant illumination electronic tachistoscope (Cambridge Tachistoscope model Mark III, BRM Electronics Ltd.) was used.

Subjects

Twenty right-handed undergraduate students at Erindale College each received $1.50 for participating in the experiment. The Ss were divided into 2 groups, both of which received 40 trials of a word-identification task and 40 trials of a face-recognition task. For Group WF the word identification task constituted the priming set and preceded the face-recognition task. The order was reversed for Group FW.

Stimuli

The pre-exposure field consisted of a white masking stimulus with 6 wavy lines radiating from an open space in the center in which a dot was located to serve as the fixation point. The design and stimuli in the word-identification task were identical to those used by McKeever and Huling [14]. Ten frequently occurring 4-letter nouns were used: bear, cove, dove, epic, farm, gold, hare, lane, mask, and post. Twenty pairs were chosen from the above words and typed in capital letters on 6 × 4 in. stimulus cards. A number from 2 to 9 randomly chosen was typed midway between the words and appeared at a point corresponding to the dot on the pre-exposure field. Each word subtended a horizontal visual angle of 2° 52' and was 1° 6' from fixation. Exposure time was 20 msec.
The stimulus cards in the face-recognition task consisted of 20 pairs of faces chosen from 10 graduation photographs of 5 male and 5 female students from Erindale College. Each face was 51’ from a centrally-located number and subtended an horizontal angle of 3° 21’ (see Fig. 1). The position of the faces on the card was counterbalanced so that they appeared equally often to the right and left of fixation. The exposure time was 90 msec.

Procedure
One sec before each trial, E said the word “Focus” as a signal to fixate on a dot in the pre-exposure field. A stimulus card bearing only a number was then flashed. When the subjects correctly identified the numbers on two of these cards, formal testing began. The subjects were told that the stimulus card would now contain a number in the centre and either faces or words on both sides. It was emphasized that first they were to report the number and then the stimulus material. In the word-identification task, Ss called out the words while in the face-recognition task, they pointed to the faces displayed on a card. The array card consisted of 16 faces, 10 of which were used in the experiment. Four subjects were instructed to point to the array card with the left hand and 16, with the right. No feedback was provided in either task.

In each task the Ss received 40 trials consisting of 2 different, random presentations of the 20 stimulus cards. Between tasks, the Ss were given a 5 min break during which Group WF studied the array of 16 faces. Group FW studied the faces for 5 min at the beginning of the experiment.

RESULTS AND COMMENTS

Table 1 shows the average recognition scores broken down by groups, stimulus, visual field, and practice. Each score consists of the number of words or faces recognized correctly. If the fixation number was incorrectly reported, recognition scores for that trial were omitted. This occurred on less than 2% of all trials. Also, the data from all subjects were pooled since those subjects responding with the left hand did not perform differently from those responding with the right.

The hypotheses being tested focus on the effects of 3 different factors on perceptual asymmetry, namely, type of stimulus material, order of presentation of the stimulus material, and practice. The results of the analysis of variance (three within factors, stimulus, practice, and visual field and one between, groups) and the ensuing discussion will, therefore, be split into three parts.

Table 1. Average scores according to stimuli, visual fields, and practice for both groups in the word-naming and face-recognition tasks (Experiment 1). 20 is the maximum possible score in each cell. A chance score in the face-recognition task is 2.5.

<table>
<thead>
<tr>
<th>Trials:</th>
<th>1-20 Words</th>
<th>21-40 Words</th>
<th>1-20 Faces</th>
<th>21-40 Faces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LVF</td>
<td>RVF</td>
<td>LVF</td>
<td>RVF</td>
</tr>
<tr>
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<td>7.5</td>
<td>10.0</td>
</tr>
<tr>
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<td>2.3/10</td>
<td>2.9/10</td>
<td>Ss favouring RVF</td>
<td>2/10</td>
</tr>
<tr>
<td>Group FW</td>
<td>5.5</td>
<td>6.2</td>
<td>6.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Ss favouring LVF</td>
<td>8/10</td>
<td>8/10</td>
<td>Ss favouring RVF</td>
<td>8/10</td>
</tr>
</tbody>
</table>

(a) The effects of stimulus material
An average of 18.6 words were identified in the right visual field compared to 8.8 in the left, whereas faces were better recognized in the left, than in the right, 12.8 vs 9.6. The right visual field superiority for words \(F(1,18) = 87.84, P < 0.001\) and the left for faces \(F(1,18) = 9.37, P < 0.01\) are highly significant as was the visual field by stimulus interaction \(F(1,18) = 38.64, P < 0.001\).

The results show that a tachistoscopic face-recognition task can provide a strong and reliable index of right hemisphere function in normal people [15-18]. When face-recognition
was uncontaminated by a previous word-naming test (Group FW) or by practice, 8 of 10 subjects favoured the left visual field and 1 subject was equal on both. Using Kimura's [19] test score ratio for perceptual asymmetries, Group FW's left-right ratio for faces is 2:23 for the first 20 trials and 1:65 overall. To our knowledge, this is the highest ratio favouring the left sensory field reported in the literature and compares well with ratios favouring the right sensory field for verbal material.

The controlled fixation procedure used in these experiments yielded a stronger right field superiority for word-naming than is normally found. The subject, however, may have scanned the memory trace of the words from the centre to the right, as is normal for English readers [20], thereby inflating the right field superiority caused by hemispheric dominance. Also, since more words than faces were identified, 548 as compared with 448, the large, right field advantage for words probably contributed to a significant visual field effect, subjects identifying more items in the right than in the left field, 27:3 vs 21:6 \([F(1,18) = 15:0, \ P < 0:01]\).

(b) The effects of order of presentation (groups)

Significance levels for the group by visual field \([F(1,18) = 8:97]\) and the group by stimulus interactions \([F(1,18) = 4:36]\) were 1\% and 6\%, respectively. Group FW, the one primed with a face-recognition task, recognized more words and fewer faces than Groups WF (Table 2). In addition, Group FW correctly recognized more items in the left visual field and fewer in the right than Group WF. Examination of Table 2 shows that these differences are caused entirely by the significantly higher word recognition scores of Group FW over Group WF in the left visual field \((t = 2:21, df = 18, \ P < 0:05)\) and the higher face recognition scores of Group WF over Group FW in the right visual field \((t = 2:68, df = 18, \ P < 0:02)\). Both groups obtained nearly identical scores for words in the right visual field, and for faces, in the left. One way, then, that hemispheric priming influences perceptual asymmetries is by improving the detection of stimuli presented to the primed hemisphere when that hemisphere is subordinate, as opposed to dominant, for a particular task. Given this pattern of results, it is puzzling that the group \(\times\) visual field \(\times\) stimulus interaction is not significant. The large, and nearly identical, scores obtained by both groups in the left and right visual field for faces and words, respectively, may have obscured this interaction.

It should be noted here that verbal priming exerted its effect over a 5 min delay during which subjects studied an array of faces (see [8] for similar results). A possible explanation for this phenomena is that the experimental situation reinstates the verbal cognitive set which produces an attentional bias towards the right sensory field.

(c) The effects of practice

Practice, not surprisingly, improved the detection of both words and faces from 21:5 on

<table>
<thead>
<tr>
<th></th>
<th>Words Visual field</th>
<th>Faces Visual field</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Group WF</td>
<td>5.4</td>
<td>13.6</td>
</tr>
<tr>
<td>Group FW</td>
<td>12.2</td>
<td>18.6</td>
</tr>
</tbody>
</table>

Table 2. Mean score according to stimuli and visual fields for the two groups in word-naming and face-recognition (Experiment 1). Maximum possible score is 40.
Fig. 1. A sample of the stimulus card used in the face recognition part of Experiments 1 and 2.

Fig. 2. A sample of the stimulus card used when words and faces are simultaneously presented (Experiment 3).
the first 20 trials to 28.4 on the last 20 \( [F(1,18) = 24.7, P < 0.001] \). In addition, Table 1 shows that practice selectively improved Group WF’s score on the left visual field and Group FW’s, on the right, regardless of the stimuli presented (practice by group by visual field interaction: \( F(1,18) = 6.3, P < 0.05 \)). This interaction shows that the effects of practice can act in a direction opposite to priming. Within the test set, practice shifts the subject’s attention back towards the hemisphere dominant for that set, as is consistent with the attention model. Within the priming set, however, practice increases the score of the visual field projecting to the non-primed, subordinate hemisphere, contrary to the prediction of the attention model. It is possible that a negative-feedback loop operates between the two hemispheres to offset the priming effects and to shift attention back to the non-primed hemisphere. Some support for this explanation comes from split-brain patients who neglect information presented to the non-primed hemisphere. This can be interpreted as an enhanced priming effect brought about by the loss of major pathways via which the hemispheres can influence each other [21].

Experiment 3 (see below) provides additional evidence for the view that priming effects cannot be fully explained by across-set practice effects. In Experiment 3, words and faces are presented simultaneously, thereby eliminating order of presentation as a possible priming procedure and, with it, across-set practice effects as a contaminating factor. Nonetheless, the priming procedure, in this case order of report, has similar effects on perceptual asymmetries.

**EXPERIMENT 2**

*Equating response modes by using a recognition procedure for both words and faces*

The second experiment was conducted to test whether priming depends on response mode. The naming response required of the subject in the word-identification task presumably involved the verbal functions of the left hemisphere. One cannot, however, be certain which hemisphere controlled the manual response required in the face-recognition task. Even if it is assumed that reporting faces by pointing is mediated by the right hemisphere, subjects may have resorted to different information processing strategies when they had to name the stimulus than when they had to recognize it. These different strategies may have interacted with the well-established processing differences between words and faces. To control for this, a recognition procedure with a manual response was adopted for both the word and face tasks.

**METHOD**

Twenty different undergraduates received $1.50 for participating in this experiment. Half of them received the word-recognition task followed by the face-recognition task (Group WF) while the other half received the tasks in reversed order (Group FW).

The procedure and stimuli were the same as those used in the first experiment. However, in the word-recognition task the subjects were now required to point to the words on an array card of 16 4-letter nouns that included the 10 words that were present on the stimulus cards. The 6 additional words were *coke, dome, hate, mark, past,* and *pear*. Before each task began, the subjects were allowed 5 min to study the appropriate array cards.

**RESULTS**

The average recognition scores for both groups are summarized in Table 3. A 4-way analysis of variance once again yielded a highly significant *stimulus by visual field interaction* \( [F(1,18) = 132.3, P < 0.001] \). An average of 28.8 words were recognized in the right
visual field as compared to only 19.5 in the left, whereas faces were better recognized in the left visual field than in the right, 17.6 vs 12.1.

There was also a main visual field effect \([F(1,18) = 4.86, P < 0.05]\), subjects identifying more items in the right visual field (mean 40.9) than in the left (mean 37.0). This is consistent with the highly significant main stimulus effect \([F(1,18) = 57.93, P < 0.001]\), whereby more words were correctly identified than were faces (means of 48.3 vs 29.7). Finally, as expected, the main practice effect was highly significant \([F(1,18) = 19.9, P < 0.001]\). No other main effects or interactions were significant.

Table 3. Average scores according to stimuli, visual fields, and practice for both groups in a recognition task for words and faces (Experiment 2); 20 is the maximum possible score in each cell. A chance score is 2.5

| Trials | Words | | | | | | Faces | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LVF | RVF | LVF | RVF | | | LVF | RVF | LVF | RVF |
| Group LL | 7.9 | 13.3 | 18.0 | 11.3 | 8.3 | 6.1 | 2.1 | 7.1 |
| 1s favouring RVF | 9/10 | 10/11 | 81% favouring LVF | 9/10 | 6/7 |
| Group LD | 11.7 | 16.3 | 20.4 | 11.3 | 7.4 | 5.0 | 5.1 | 5.6 |
| 1s favouring RVF | 9/10 | 9/11 | 83% favouring LVF | 8/10 | 8/10 |

**COMMENT**

The lack of any significant group interactions suggests that the order of presentation of the tasks does not influence established perceptual asymmetries when a recognition procedure is used for both tasks.* That many of the subjects verbalized their choices while pointing to the words, indicates that verbal output is not the critical factor in producing the hemispheric priming effects obtained in Experiment 1. A more likely explanation is that the cognitive operations involved in naming and recognition differentially engage the processing capacities of the two hemispheres. Although a word-recognition task engaged the left hemisphere sufficiently to establish a right visual field superiority, it may not have engaged those functions sufficiently to produce a priming effect. Furthermore, right-hemisphere processes may have been used more extensively since performance on word-recognition can benefit from a pictorial strategy [2, 22, 23]. The diminished right visual field superiority for words in the priming set of the recognition task, as compared to that of the naming task, supports this idea. When a recognition procedure was used (Experiment 2) only 61% of the correct responses were from the right visual field whereas when the words were named (Experiment 1), 80% were from the right. If attention is already slightly biased towards the left, faces should also lose their priming effect. This proved to be the case.

The results of the first two experiments suggest that the direction and strength of perceptual asymmetries may be determined by the degree to which experimental, and even extra-experimental, factors stimulate the activity of one hemisphere relative to the other. This may help explain why it is difficult to obtain a strong left-field advantage for non-linguistic stimuli [19, 24]. To insure that advantage, it may not only be necessary to stimulate right-hemisphere activity, but also to limit left-hemisphere activity by preventing the subject

*Because a minor change in procedure produced very different results, this experiment was replicated twice. Similar results were obtained each time.
from verbally encoding the stimulus and by keeping his extraneous linguistic thoughts to a minimum.

Similar causes may account for the failure to obtain hemispheric-priming effects in reaction-time studies [e.g. 23]. Because reaction-time tasks usually require only simple linguistic and pictorial comparisons between letters, they may not sufficiently prime either hemisphere. Significantly, when the linguistic comparison was made more difficult (comparison between terminal phonemes of letters) a slight priming effect appeared [2].

**EXPERIMENT 3**

*Simultaneous presentation of words and faces*

Because the first two experiments sought to examine the phenomenon of hemispheric priming, the interpretations offered were more in keeping with the attention model. It should be stressed that some of the results, especially the significant visual field by stimulus interactions, are also compatible with the relative access model. The relative merit of the two models was, therefore, examined in this experiment. Consider the situation in which faces and words are presented simultaneously to both visual fields and an attentional set is induced by emphasizing the importance of correctly reporting one type of stimulus first. If attentional biases are sufficient to explain perceptual asymmetries, then both faces and words should be perceived better in the visual field towards which attention is directed. If, however, perceptual asymmetries are primarily determined by the relative access that a stimulus has to the hemisphere specializing in its analysis, then words will be perceived better on the right and faces of the left regardless of the attentional biases imposed.

**METHOD**

*Material*

Twenty stimulus cards were made, each one consisting of a pair of words and a pair of faces which were chosen from the sample used in the earlier experiments. A number from 2 to 9, randomly chosen, was typed on each card at a position corresponding to the fixation point in the pre-exposure field. A face and word appeared on both sides of the number. The words always appeared above the faces. The words and the faces subtended the same visual angles as in the previous experiments. A sample card is shown in Fig. 2.

*Subjects*

Sixteen right-handed male and female students, were divided into 2 equal groups. Both groups received 40 trials of words and faces combined. Group WF was instructed to report the words before the faces, because the words were more important, while Group FW was instructed to report the faces prior to the words. Both groups were also told that once they had reported the most important stimuli, they should try to report or guess what the other stimuli were.

*Procedure*

The subjects fixated the dot in the pre-exposure field and after E said the word “Focus” they reported first the number and then the words followed by the faces, or the faces followed by the words, depending upon the group to which they were assigned. The words were called out and the faces were reported by pointing to an array card that just included the 10 faces that were presented tachistoscopically. Before beginning the experiment, all Ss were permitted 5 min to study the faces and another 5 min to study an array of the 10 words that were included in the experiment. The order of studying the array cards was counterbalanced. The Ss were encouraged to guess throughout the experiment.

The stimulus cards were exposed for 150 msec. The entire set of stimulus cards was presented twice to each subject, randomly sorted each time. If the number at the fixation locus was incorrectly reported, the S was informed and the trial was repeated later in the series.

**RESULTS AND COMMENT**

Table 4 shows the average recognition scores for both groups. The data were subjected to an analysis of variance with 1 between- and 3 within-subjects variables.
Table 4. Average scores according to stimuli, visual fields, and practice for both groups when words and faces are presented simultaneously (Experiment 3). Maximum possible score in each cell is 20. A chance score for face recognition is 4·0 (LVF = left visual field; RVF = right visual field)

<table>
<thead>
<tr>
<th>Trials:</th>
<th>1-20 Words</th>
<th>21-40 Words</th>
<th>1-20 Faces</th>
<th>21-40 Faces</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>LVF</td>
<td>RVF</td>
<td>LVF</td>
<td>RVF</td>
</tr>
<tr>
<td>Group WF</td>
<td>7.9</td>
<td>12.8</td>
<td>9.9</td>
<td>14.5</td>
</tr>
<tr>
<td>Ss favouring RVF</td>
<td>8/8</td>
<td>8/8</td>
<td>8/8</td>
<td>8/8</td>
</tr>
<tr>
<td>Group FW</td>
<td>8.5</td>
<td>10.4</td>
<td>7.4</td>
<td>11.5</td>
</tr>
<tr>
<td>Ss favouring LVF</td>
<td>7/8</td>
<td>5/8</td>
<td>8/8</td>
<td>6/8</td>
</tr>
</tbody>
</table>

(a) Results consistent with both the attention and relative access models

As expected, a highly significant visual-field by stimulus interaction was found \(F(1,14) = 29.5, P < 0.001\). Ss identified more words in the right visual field than in the left, 24·6 to 15·3, and more faces in the left than in the right 14·3 to 9·4.

Not surprisingly, the group attending to words (Group WF) recognized more words, 45·0 to 34·8, and fewer faces, 18·0 to 29·1, than the group attending to faces (Group FW). This contributed to a significant group by visual field interaction \(F(1,14) = 5.99, P < 0.05\), with Group WF favouring the right visual field overall by a score of 36·8 to 26·4 and Group FW slightly favouring the left, by 32·8 to 31·1.

As in the earlier experiments, there was a significant practice effect \(F(1,14) = 12.01, P < 0.005\) and a significant stimulus effect \(F(1,14) = 23.84, P > 0.001\), words being recognized better than faces, 31·9 to 18·9.

(b) Results that distinguish between the attention and relative access models

The results summarized in Table 5 show that when subjects attended to words, the left field advantage for faces was lost while the right one for words was maintained. On the other hand, subjects attending to faces maintained a right field advantage for words and a left one for faces. The group by stimulus by visual field interaction which closely approaches the 5% level of significance \(F(1,14) = 4.47, P < 0.06\) confirms this result.

Table 5. Mean scores according to stimuli and visual fields for the two groups when words and faces are presented simultaneously (Experiment 3). Maximum possible score is 40

<table>
<thead>
<tr>
<th></th>
<th>Words</th>
<th></th>
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<tr>
<td></td>
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<tr>
<td>Group WF</td>
<td>17.8</td>
<td>27.3</td>
<td>8.6</td>
<td>9.5</td>
</tr>
<tr>
<td>Group FW</td>
<td>12.9</td>
<td>21.9</td>
<td>19.9</td>
<td>9.3</td>
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</table>

The behaviour of the word-attending group was consistent with the attention model, while that of the face-attending group was consistent with the relative access model. This impression is strengthened if we examine those trials in which both a word and a face were reported correctly (see Table 6). Group WF subjects were as likely to report both stimuli from the right visual field as to report the word on the right and the face on the left. Group
FW, on the other hand, reported both stimuli from opposite visual field twice as often as from the left field.

Table 6. Total scores for both groups in which one word and one face were reported correctly on a given trial when words and faces were presented simultaneously (Experiment 3)

<table>
<thead>
<tr>
<th></th>
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<th>Lw-Rf</th>
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<tbody>
<tr>
<td>Group WF</td>
<td>22</td>
<td>5</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Group FW</td>
<td>53</td>
<td>9</td>
<td>26</td>
<td>19</td>
</tr>
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</table>

Why may a functional division of labour, corresponding to existing hemispheric asymmetries, be more easily established when a person attends to faces than to words? One possibility is that the words used were familiar and could, therefore, be easily and rapidly encoded and retained even while attending to faces. The faces, however, were both unfamiliar and very similar to each other and required more time and probably more attention to encode. When attention was diverted to the words, the faces, not being properly encoded, may have faded rapidly from memory, causing a drop in overall performance and eliminating any visual field differences.

Another possibility is that the number at fixation may have acted as a verbal primer and summated with the priming effect of the words but partially cancelled the priming effect of faces. By systematically varying the stimulus at the fixation locus with the types of lateralized stimuli used in these experiments, the priming effect due to the number was found to be insignificant [25]. Nor does the evidence support the notion that the location of the stimuli in the vertical plane confer any priority to words over faces. Experiment 3 was replicated with faces appearing above the words and identical results were obtained [25].

DISCUSSION

Factors affecting perceptual asymmetries

The evidence presented in this study makes it difficult to argue that a single mechanism is responsible for producing perceptual asymmetries in all situations. The mechanisms elucidated in the attention and relative access models, and perhaps others as well, contribute to laterality differences in perception. The problem, now, is not to choose the most likely candidate, but rather to understand how different variables, such as stimulus type, encoding processes, and cognitive strategies, determine the relative contribution of each of these mechanisms in producing perceptual asymmetries in different situations. For example, it is well-known that changing the stimulus from a linguistic to a non-linguistic one [19] will shift laterality from the right to the left field. What is more surprising is that similar shifts occur if the stimulus remains verbal but the written material is changed from print to script or from large print to small print [26]. Moreover, matching words or letters along a linguistic dimension leads to different perceptual asymmetries than if the identical stimuli are matched along pictorial lines [2, 10, 26, 27]. Aside from knowing that each of these
effects depends on the differential stimulation of right- or left-hemispheric processes, our understanding of the mechanisms involved is still meagre.

How priming affects perceptual asymmetries: some proposals

There is also some uncertainty regarding the manner in which priming with Task A influences perceptual asymmetries on Task B. Although Kinsbourne has suggested that priming achieves its effect by manipulating attention, other interpretations cannot be discounted. (1) Verbal priming may cause the subject to adopt verbal, as well as non-verbal, strategies in processing subsequent non-verbal material, whereas priming with a non-verbal task, would have opposite, and perhaps weaker, effects on processing verbal material. (2) Priming may influence the direction in which subjects scan a visual memory trace. In tachistoscopic word-naming, subjects may orient to the right of fixation and carry that bias over to face-recognition. Again, an opposite, but weaker effect, would hold if face recognition preceded word naming. In support of this contention it has been shown that direction of lateral eye movements is influenced by the cognitive demands of the questions eliciting the movements [28]. (3) Priming may stimulate activity in a particular hemisphere, thereby improving the performance of that hemisphere regardless of the nature of the stimuli that must be processed. It should be noted that points (1) and (3) can be incorporated easily into the relative access model. At present, the evidence does not favour any one of these interpretations over the others.

The relationship between perceptual asymmetries and cerebral dominance

Although the manner in which perceptual asymmetries operate is not fully understood, experiments on perceptual asymmetries are valuable in providing insights into the functional organization of the cerebral hemispheres. The priming phenomenon in particular, but other evidence as well, suggests that the degree of functional cerebral dominance is in constant flux.

Most studies of perceptual asymmetry begin with the assumption that for each individual adult the relative superiority of one hemisphere over the other with respect to a given function is fixed or constant. Failure to obtain perceptual asymmetries that reflect true dominance is usually attributed to variables such as encoding or response variability, serial ordering of directional scanning mechanisms, and perceptual and mnemonic limitations which may mask or counteract the effects of relative hemispheric dominance which, it is assumed, is unvarying (see White [1], [29], and Rizolatti et al. [9]. It is possible, however, that these variables may determine the degree of underlying functional asymmetry between the hemispheres. Although, by adulthood, the level of competence of each hemisphere with regard to specific functions may be relatively fixed, functional asymmetries need not remain constant but can vary with the level of activity and interaction of the two hemispheres. Interpreted in this light, Kinsbourne’s attention model [13] rests on the idea that the functional asymmetry between the two hemispheres can be made larger or smaller according to the extent to which the task at hand primes each hemisphere. Similarly, Moscovitch’s [2] model of functional localization emphasizes that the degree to which a hemisphere’s performance reflects its competence depends, in part, on the influence of the other hemisphere. Sectioning the commissures, removing or anaesthetizing the dominant hemisphere and, perhaps, priming the minor hemisphere will diminish the dominant hemisphere’s influence, release the minor hemisphere’s latent abilities, and improve its performance on tasks for which it is considered subordinate. Thus, one possible explanation for the changing
perceptual asymmetries in the present experiments, especially the results of Experiment I, is that they reflect a change in the underlying hemispheric relationships.

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Résumé :
Dans les épreuves de reconnaissance tachistoscopique bilatérale simultanée, des sujets normaux droitiers notaient plus de mots dans le champ visuel droit et reconnaissaient plus de visages dans le champ visuel gauche. Assurer un effet de primauté à l'hémisphère gauche avec une tâche verbale préalable diminuait la supériorité du champ visuel gauche pour les visages, tandis que assurer l'effet de primauté à l'hémisphère droit avec une épreuve de reconnaissance des visages préalable réduisait la supériorité du champ visuel droit pour les mots. L'effet de primauté disparaissait quand une méthode de reconnaissance était utilisée. Quand les mots et les visages étaient présents simultanément, les sujets à qui on avait demandé de prêter attention aux visages et de les reporter en premier, montraient une supériorité de l'hémisphère gauche pour les visages et une supériorité du champ visuel droit pour les mots. Les sujets à qui il était demandé de prêter attention aux mots et de les reporter en premier ne montraient qu'une supériorité du champ visuel droit pour les mots.

Deutschsprachige Zusammenfassung: