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Hemisphere specialisation and inter-hemispheric cooperation during a phonological task: Effect of lexicality as assessed by the divided visual field approach

M. Perrone-Bertolotti, S. Lemonnier, C. Bonniot, and M. Baciu

Laboratoire de Psychologie et NeuroCognition CNRS – UMR 5105 SFR "Santé et Société", Université Pierre Mendès-France, Grenoble, France

In the presented experiment we explored the effect of lexicality on hemisphere specialisation and cooperation during a phonological task. The divided visual field (DVF) method with bilateral presentation (BVF) of redundant (identical) stimuli is considered an appropriate approach to assess inter-hemispheric cooperation (IHC). IHC is supposed to increase the efficiency of cognitive processes. Specifically, it has been shown that, compared to unilateral hemifield presentation, word processing is significantly more efficient if stimuli were presented under bilateral redundancy conditions. The performance enhancement during bilateral vs. unilateral presentation is called bilateral redundant gain (BRG). In the present experiment a DVF was used and participants were required to perform a rhyme detection task in two blocks, one in words and another one in pseudowords. Each item was presented in two different modes, one unilateral (right or left hemi-visual field) and another one bilateral (simultaneous redundant presentation). Unilateral trials allow one to study hemispheric specialisation, while bilateral redundant trials allow one to study inter-hemispheric cooperation. We obtained left hemisphere specialisation for both types of items (word, pseudoword). Moreover, words were more efficiently processed than pseudowords. Additionally, words were processed more efficiently in BVF than in unilateral presentation, inducing BRG. No similar effect was obtained for pseudowords. These results are discussed in respect to findings reported by other studies suggesting that hemispheric specialisation depends on lexicality. Moreover, compared to lexical decision tasks used in previous studies, the phonological task used in the present study seems to modulate the inter-hemispheric cooperation less.

Keywords: Specialisation; Cooperation; Language; Lexicality; Rhyme; Divided visual field.

Address correspondence to: Marcela Perrone-Bertolotti, Laboratoire de Psychologie et Neurocognition, UMR CNRS 5105, Université Pierre Mendès-France, BP 47, 38040 Grenoble Cedex 09, France. E-mail: perronemarcela@gmail.com

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Language depends on the left hemisphere (LH) in the majority of individuals (Annoni, 2002; Chiarello, Kacinik, Manowitz, Otto, & Leonard, 2004; Hellige, 1990; Iacoboni & Zaidel, 1996; Josse & Tzourio-Mazoyer, 2004). However, the degree of hemispheric specialisation is relative and varies according to language tasks and psycholinguistic features of stimuli such as concreteness (Chiarello, Senehi, & Nuding, 1987), word frequency (Voyer, 2003; Weekes, Capetillo-Cunliffe, Rayman, Iacoboni, & Zaidel, 1999), imageabilty (Chiarello, Liu, & Shears, 2001; Chiarello, Shears, Liu, & Kacinik, 2005), degree of grapheme–phoneme conversion (Cousin, Perrone, & Baciu, 2009; Crossman & Polich, 1988; Perrone, Cousin, Baciu, & Baciu, 2009; Tremblay, Monetta, & Joanette, 2007, 2009; Waldie & Mosley, 2000). Moreover it has been proposed that a lexicality variable affects the degree of hemisphere specialisation (Mohr, Pulvermüller, Cohen, & Rockstroh, 2000; Mohr, Pulvermüller, Mittelstädt, & Rayman, 1996).

Hemisphere specialisation and factors affecting its degree may be approached by using the divided visual field procedure (DVF) with unilateral visual hemifield presentation of stimuli. The DVF procedure is based on the anatomo-functional properties of visual pathways, to be partially crossed (Bourne, 2006; Chiarello et al., 2004). Consequently a stimulus briefly presented (flashed) within one visual hemifield will be processed first by the opposite hemisphere (LH for right visual hemifield presentation; right hemisphere—RH—for left visual hemifield presentation). The logic underlying this procedure is that verbal stimuli are processed faster and more efficiently if they are presented first to the hemisphere specialised for language, generally the left (Bourne, 2006). However, all these studies exploring hemispheric specialisation have revealed RH abilities for language. This finding suggests that the hemispheres' involvement in language is a continuum rather than an absolute unilateral specialisation (Jung-Beeman, 2005). In this framework it is important to study not only specialisation but also the cooperation between hemispheres (inter-hemisphere cooperation, IHC). Hemispheres cooperate and interact permanently during cognitive processes in order to perform more efficiently (Zaidel, 1996).

The behavioural experimental approach that allows the study of the IHC is the bilateral presentation of redundant (identical) stimuli in the left and in the right visual hemifield during a DVF experiment (for a review see Bourne, 2006). Stimuli presented bilaterally and simultaneously in both visual hemifields induce concomitant stimulation of both hemispheres. Additionally their processing is significantly faster than unilateral presentation and than bilateral non-redundant (non-identical) presentation (Banich & Karol, 1992; Bourne, 2006; Hellige, 1993; Mohr, Landgrebe, & Schweinberger, 2002; Mohr et al., 1996, 2000; Mohr, Pulvermüller, & Zaidel, 1994; Rayman & Zaidel, 1991). Compared to unilateral presentation, the bilateral and simultaneous (redundant) presentation of items enhance the performance of task execution. The performance gain is called "bilateral redundancy gain" (BRG) and reflects the IHC (Hasbrooke & Chiarello, 1998; Mohr et al., 1996, 2002; Mohr, Pulvermüller, & Zaidel, 1994; Schweinberger, Baird, Blümler, Kaufmann, & Mohr, 2003).

Although the cooperation between hemispheres is generally admitted, the mechanisms and the specific factors underlying this interaction are not completely understood. Recent IHC studies revealed that the type of cognitive task and the tested material may modulate the degree of interaction (Baird & Burton, 2008; Hatta, Kawakami, Kogure, & Itoh, 2002; Koivisto & Revonsuo, 2003; Marks & Hellige, 2003; Mohr & Pulvermüller, 2002; Weissman & Banich, 2000; Welcome & Chiarello, 2008). IHC has been shown for verbal (Banich & Karol, 1992; Mohr, Pulvermüller, & Zaidel, 1994) and non-verbal (Mohr et al., 2002; Schweinberger et al., 2003) material. Additionally, BRG was reported for famous faces (Baird & Burton, 2008; Schweinberger et al., 2003), words (Banich & Karol, 1992; Hasbrooke & Chiarello, 1998; Henderson, Barca, & Ellis, 2007; Mohr, Pulvermüller, Rayman, & Zaidel, 1994; Rayman & Zaidel, 1991), consonant-vowel-consonant (CVC) and syllables (Hellige, Taylor, & Eng, 1989; Hellige & Adamson, 2007; Marks & Hellige, 1999) but not for identical letters and digits (Banich & Belger, 1990; Belger & Banich, 1992). For verbal material the IHC seems to depend on lexicality, as the BRG was obtained for words but not for pseudowords (Hasbrooke & Chiarello, 1998; Mohr et al., 1996; Mohr, Pulvermüller, & Zaidel, 1994).

Word specificity for BRG is generally explained by neurocognitive models based on Hebb's theory for cortical processing (Pulvermüller, 1996; Pulvermüller & Mohr, 1996). In this framework learned/familiar items like words have cortical representations (large interconnected neuronal populations constituting functional units) distributed across hemispheres; Pulvermüller & Mohr, 1996). A functional unit emerges consequent to frequent co-activation of its composing neurons. Thus the visual unilateral (one hemifield) presentation of a given familiar item activates its cortical representation across hemispheres. If the same item is simultaneously presented in each visual hemifield, the activation of its cortical representation is twice as strong according to a neuronal summation (additive) mechanism that increases performance (Pulvermüller & Mohr, 1996). In terms of behavioural performance the additive mechanisms are reflected by BRG. Following a similar logic, the BRG should not be obtained for unfamiliar items such as pseudowords (Mohr et al., 1996; Mohr, Pulvermüller, Rayman, et al., 1994; Mohr, Pulvermüller, & Zaidel, 1994; Pulvermüller & Mohr, 1996) as they do not induce the activation of large representations across hemispheres. In line with this theory, the BRG for words was not detected in split-brain patients (Mohr, Pulvermüller, Rayman, et al., 1994) suggesting that additive effects underlying the BRG would depend on inter-hemispheric anatomical connections.

The purpose of the present study using a DVF approach with unilateral and bilateral redundant presentation mode is to explore the effect of lexicality on (i) hemisphere specialisation and (ii) inter-hemispheric cooperation (IHC). The effect of lexicality was evaluated by means of rhyme detection in words and in pseudowords. We choose a phonological task, as this task requires equivalent attentional and cognitive resources for both types of stimuli, words and pseudowords. Using visual rhyme detection in words and bilateral vs. unilateral presentation, Banich and Karol (1992) obtained BRG. Although their results revealed increase of task efficiency via redundant presentation and based on IHC, the effect of lexicality was not tested as the authors used only words. In the present study we used both words and pseudowords to evaluate this effect.

From our theoretical considerations several hypotheses have been formulated. First, for all items we expect to obtain a classical hemisphere specialisation with better performance for RVF-LH than for left LVF-RH. Moreover, we expect to obtain significant interaction between lexicality and visual hemifield of presentation. Specifically, the unilateral LVF-RH presentation of familiar items (words) should induce higher performance than non-familiar items (pseudowords). Additionally, items presented bilaterally should induce better performance compared to unilateral RVF-LH (specialised hemisphere) item presentation. Moreover, the BRG reflecting IHC should be obtained only for words according to familiarity.

METHOD AND MATERIALS

Participants

A total of 30 healthy participants were tested (14 males, $M_{age} = 22.1$ years and 16 females, $M_{age} = 21.5$ years): native French speakers, graduate and undergraduate students who received course credit at the university for their participation. They were right-handed according to the Edinburgh Handedness Inventory (Oldfield, 1971) and had normal or corrected-to-normal vision. They gave their informed consent to take part in the study.

Stimuli

During *rhyme detection in words*, 96 frequent (New, Pallier, Brysbaert, & Ferrand, 2004) French words, displayed randomly were used. Half rhymed with /e/ or /ɛ/ (48 target items) and the other half did not (48 non-target items). Each word was composed of five (i.e., 16 target, e.g., “acier” and 16 non-target items, e.g., “avion”), six (i.e., 16 target, e.g., “bonnet” and 16 non-target items, e.g., "ballon"), or seven (i.e., 16 target, e.g., "charité" and 16 non-target items, e.g., "caillou") letters. The rhyme target items /e/ had different orthographic visual shapes: half used "é" (e.g., "comité") or "ée" (e.g., "lycée") and the other half "er" (e.g., "acier") or "et" (e.g., "filet"). Half of the non-target items presented the letter "e" but not the rhyme /e/ (e.g., "cigare"), the other half did not contain the letter "e" and the rhyme /e/ (e.g., "camion").

During *rhyme detection in pseudowords*, 96 legal pseudowords were used, displayed randomly. They were built by changing two or three letters of the words used in the previous task. Half of the items rhymed with /e/ or /ɛ/ (48 target items) and the other half did not (48 non-target items). Each pseudoword was composed of five (i.e., 16 target, e.g., "avier" and 16 non-target items, e.g., "céran"), six (i.e., 16 target, e.g., "beger" and 16 non-target items, "clafon"), or seven (i.e., 16 target, "grizulé" and 16 non-target items, e.g., "chornot") letters. The rhyme target items /e/ had different orthographic visual shapes: half of them included "é" (e.g., "nauré") or "ée" (e.g., cylée) and the other half "er" (e.g., "beger") or "et" (e.g., "nusiet"). Half of the non-target items had the letter "e" but not the rhyme /e/ (e.g., "masine"); the other half had neither the letter "e" nor the rhyme /e/(e.g., "coblan").

The experiment was built by means of E-Prime software (E-Prime Psychology Software Tools Inc., Pittsburgh, USA). The stimuli were displayed on a computer monitor (screen resolution 1024 by 768 pixels) located 110 cm in front of participants, and were written in black "Courier New" font size 24 on a white screen.

The trials were randomly displayed, either unilaterally (left, LVF; right, RVF) or bilaterally (BVF) with redundant (identical) stimuli. Each trial (see Figure 1) began with a fixation cross of 500-ms duration in order to keep the gaze direction on the centre of the screen. Then the stimulus was displayed for 180 ms either in UVF (e.g., RVF or LVF), or simultaneously in BVF. This short duration of stimulus presentation ensured the mono-hemispheric presentation (left hemisphere first, if stimulus is presented in RVF, and right hemisphere first, if stimulus is presented in LVF). After stimulus presentation a 30-ms visual mask composed of a sequence of seven stars was shown. The inner and the outer edges of the lateralised stimuli were located at 2° and 6° from eye fixation, respectively. The trial ended with 1500-ms fixation cross.

Tasks

Each participant was tested individually in a quiet darkened room. Participants had to decide as quickly and accurately as possible whether words and pseudowords rhymed with /e/. They were instructed to give the responses manually with the index (target items) and the middle finger

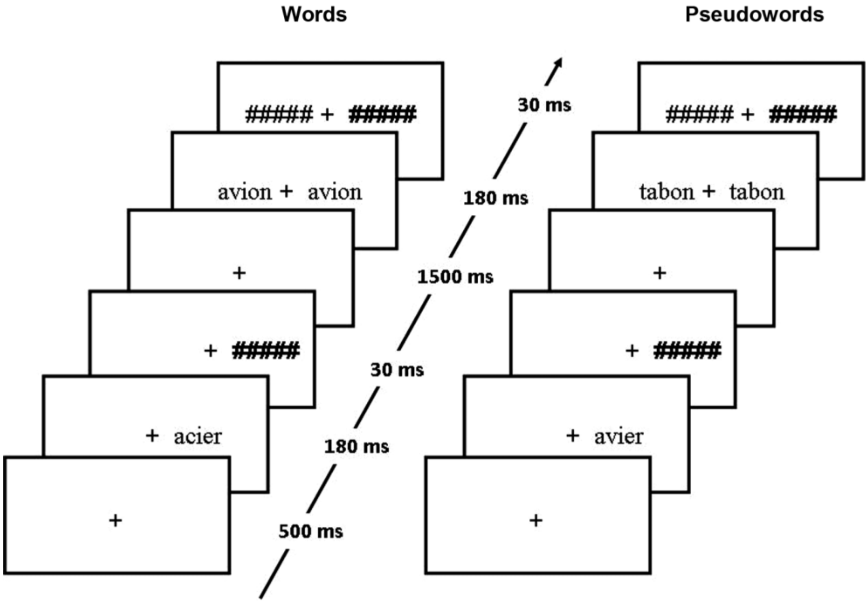

Figure 1. Example of stimuli presented during the experiment according lexicality. Each trial began with a fixation cross for 500 ms, followed by a stimulus (word or pseudoword) displayed in LVF, RVF, or in BVF for 180 ms. Each item was followed by a visual mask presented for 30 ms. The trial ended with a fixation cross for 1500 ms.

(non-target items). For half of the items the responses were provided with the right hand and for the other half with the left hand. The response hand was counterbalanced between participants. The whole experiment lasted 15 minutes. Before performing the task the participants went through a short training session with items that were different from those presented during the DVF experiment. Reaction time (RT) and accuracy (% Correct Responses, CR) were recorded for each participant in order to evaluate the performance of task execution for each condition according to the mode of visual presentation and lexicality.

Data analysis

Accuracy (percent of correct responses, %CR) and Latency (mean of correct response time, mRT) values were recorded and included in analyses of variance (ANOVAs). Only responses for target items were considered. For both Accuracy and Latency we took into account the Lexicality (words, pseudowords) and the Presentation mode (LVF, RVF, BVF) variables as within-participant factors.

RESULTS

Accuracy (%CR)

Based on %CR (see Table 1), the results show a significant main effect of Presentation Mode, $F(2, 58) = 29.58$, $p < .05$. Planned comparisons show that RVF-LH ($M = 88.99\%$, $SD = 11.96\%$) induced significantly, $F(1, 29) = 18.07$, $p < .05$, more accurate responses than for LVF-RH ($M = 75.28\%$, $SD = 13.23\%$), suggesting LH specialisation. Furthermore, the BVF ($M = 94.27\%$, $SD = 5.85\%$) induced significantly, $F(1, 29) = 8.20$, $p < .05$, more accurate responses than for RVF-LH, specialised hemisphere, suggesting a BRG. We also obtained a significant main effect of Lexicality, $F(1, 29) = 10.67$, $p < .05$, with more accurate responses for words ($M = 87.64$, $SD = 12{,}91$) than for pseudowords ($M = 84.72\%$, $SD = 13.86\%$).

We did not obtain a significant interaction between Lexicality and Presentation mode, $F(2, 58) = 2.34$. However, specific post-hoc (Scheffe) tests were used to assess a possible effect of the Presentation mode according to Lexicality. For the unilateral presentation mode, similar accuracy values, $F(1, 29) = .32$, were obtained for words ($M = 89.37\%$; $SD = 12.19\%$) and for pseudowords ($M = 88.61\%$; $SD = 12.12\%$) when the items were presented in RVF-LH. For LVF-RH presentation, accuracy for words ($M = 77.84\%$; $SD = 13.58\%$) was higher, $F(1, 29) = 8.54$; $p < .005$, than for pseudowords ($M = 72.70\%$; $SD = 12.81\%$). For the bilateral presentation mode, post-hoc tests revealed higher accuracy, $F(1, 29) = 11.51$; $p < .05$, for words presented bilaterally (BVF; $M = 95.69\%$; $SD = 3.87\%$) than unilaterally RVF-LH ($M = 89.37\%$; $SD = 12.19\%$). This result suggests BRG for words (Figure 2). For pseudowords no significant difference, $F(1, 29) = 3.96$; $p = .13$, was revealed for bilateral ($M = 92.84\%$; $SD = 7.19\%$) vs. unilateral RVF-LH ($M = 88.6111\%$; $SD = 12.12\%$) presentation (Figure 2).

TABLE 1
Accuracy (%CR) and *SD* for responses according to presentation mode and lexicality

	BVF	*RVF-LH*	*LVF-RH*	*Total*
Words	571.07ms	589.88ms	640.76ms	**600.57ms**
	109.81ms	115.91ms	133.50ms	126.35ms
Pseudowords	9612.47ms	634.07ms	672.03ms	**639.52ms**
	130.17ms	139.65ms	143.83ms	137.90ms
Total	**591.77ms**	**611.97ms**	**656.40ms**	
	120.19ms	128.09ms	137.323ms	

BVF = bilateral visual field; RVF-LH = right visual field–left hemisphere; LVF-RH = left visual field–right hemisphere.

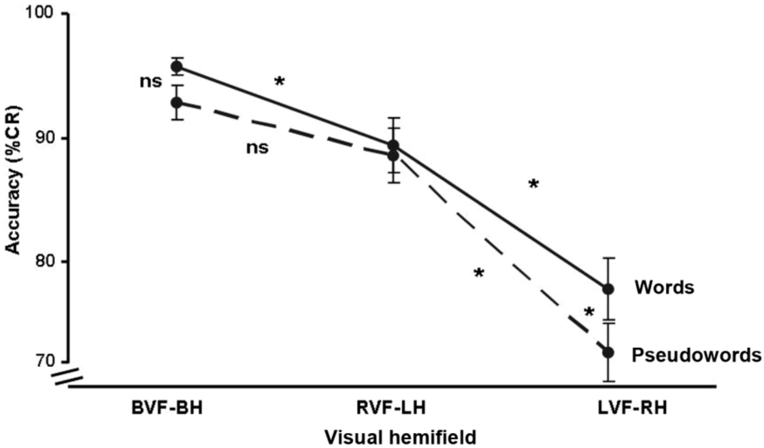

Figure 2. Results based on Accuracy (%CR) provided by the post-hoc Scheffe tests. Words were processed more accurately than pseudowords. Both words and pseudowords were more accurately performed if they were presented in the RVF-LH than in the LVF-RH. Only the words were processed more efficiently when they were presented in BVF than in the RVF-LH and this result reflects BRG. No similar effect was obtained for pseudowords. BVF = bilateral visual field; RVF-LH = right visual field–left hemisphere; LVF-RH = left visual field–right hemisphere.

Latency (mean RTs, mRTs)

Statistical analysis based on mean RTs (see Table 2) revealed a main effect of Presentation mode, $F(2, 58) = 28.66$; $p < .05$. Planned comparisons show that RVF-LH presentation ($M = 611.97$ ms, $SD = 128.09$ ms) induced faster responses, $F(1, 29) = 14.16$, $p < .05$, than LVF-RH presentation ($M = 656.40$ ms, $SD = 137.32$ ms), indicating LH specialisation. Furthermore, BVF presentation ($M = 591.77$ ms; $SD = 120.19$ ms) induced faster responses, $F(1, 29) = 11.99$; $p < .05$, than RVF-LH ($M = 611.97$ms, $SD = 128.09$ ms),

TABLE 2
Mean response time (mRTs, ms) and *SD* for correct responses according to presentaion mode and lexicality

	BVF	*RVF-LH*	*LVF-RH*	*Total*
Words	95.69%	89.37%	77.84%	**87.63%**
	3.87%	12.19%	13.58%	12.91%
Pseudowords	92.84%	88.6111%	72.70%	**84.72%**
	7.19%	12.12%	12.81%	13.85%
Total	**94.27%**	**88.99%**	**75.27%**	
	5.85%	11.96%	13.23%	

BVF = bilateral visual field; RVF-LH = right visual field–left hemisphere; LVF-RH = left visual field–right hemisphere.

indicating BRG. We also obtained a main effect of Lexicality, $F(1, 29) = 8.19$, $p < .05$, with faster responses for words ($M = 600.57$ ms, $SD = 121.75$ ms) than for pseudowords ($M = 639.52$ ms, $SD = 137.90$ ms).

The interaction Lexicality × Presentation mode was not significant, $F(2, 58) = .72$. However, specific post-hoc (Scheffe) tests were used to assess a possible effect of Presentation mode according to Lexicality. For the unilateral presentation mode, responses to words ($M = 589.88$ ms; $SD = 115.91$ ms) were significantly faster, $F(1, 29) = 8.71$; $p < .05$, than responses to pseudowords ($M = 634.07$ ms; $SD = 139.65$ ms) in RVF-LH presentation. For LVF-RH, responses for words ($M = 589.88$ms; $SD = 115.91$ms) were significantly faster, $F(1, 29) = 8.71$; $p < .05$, than responses to pseudowords ($M = 634.07$ ms; $SD = 139.65$ ms). For bilateral presentation, responses to words presented under BVF ($M = 571.07$ ms; $SD = 109.81$ ms) and under RVF-LH ($M = 589.88$ ms; $SD = 115.91$ ms) were not significantly different, $F(1, 29) = 5.02$. This result suggests a lack of BRG for words in terms of speed (Figure 2). Similarly, responses to pseudowords presented in BVF ($M = 612.47$ ms; $SD = 130.17$ ms) and in RVF-LH ($M = 634.07$ ms; $SD = 139.65$ ms) were not significantly different, $F(1, 29) = 13.83$. This result indicates lack of BRG for pseudowords in terms of speed (Figure 3).

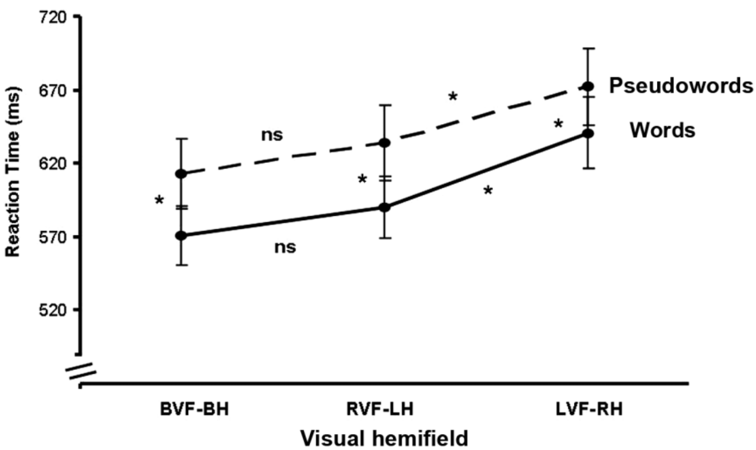

Figure 3. Results based on Latency (mRT, ms) provided by the post-hoc Scheffe tests. Words were processed faster than pseudowords. Both words and pseudowords were performed faster if they were presented in RVF-LH than in LVF-RH. Words and pseudowords BVF presentation shows a similar pattern to RVF-LH presentation. BVF presentation shows faster responses for words than for pseudowords.

DISCUSSION

This study aimed to evaluate the specialisation and cooperation between hemispheres during a phonological task. We used DVF presentation in unilateral and bilateral mode. Although we expected both types of items words and pseudowords to induce left hemisphere specialisation, we predicted that lexicality modulates the degree of specialisation, and stronger RH involvement should be obtained for words compared to pseudowords. Additionally, the bilateral redundant presentation of stimuli increased the cooperation between hemispheres and this cooperation depends on lexicality. According to cell assembly theory based on familiarity, only words induce BRG which is reflected by the increase of the performance.

The main results obtained in this study were: (a) left hemisphere specialisation for rhyme detection; (b) lexicality effect on rhyme detection with higher accuracy and faster responses for words than for pseudowords; (c) lexicality effect on hemisphere specialisation—we obtained an interaction between lexicality and unilateral visual presentation mode with lexicality effect only under LFV-RH presentation; (d) lexicality effect on inter-hemisphere cooperation—we obtained higher accuracy only for words under BVF than under RVF-LH presentation, indicating IHC and BRG for words.

Left hemisphere specialisation for rhyme detection

Our result is in line with other behavioural (Banich & Karol, 1992; Chiarello et al., 2004; Cousin, Peyrin, & Baciu, 2006; Perrone et al., 2009; Rayman & Zaidel, 1991; Smolka & Eviatar, 2006; Tremblay et al., 2004, 2009; Waldie & Mosley, 2000) and neuroimaging (Baciu, Juphard, Cousin, & Bas, 2005; Kareken, Lowe, Chen, Lurito, & Mathews, 2000; Simon, Bernard, Lalonde, & Reba, 2006; Vigneau et al., 2006) studies revealing that rhyme detection depends on the left hemisphere.

Lexicality effect on rhyme detection

Our results show task modulation by lexicality, as words were processed faster than pseudowords, in agreement with other studies (Forster & Chambers, 1973; Glushko, 1979; Lindell & Lum, 2008; Mason, 1978). In order to explain this effect we consider the specific operations involved in a rhyme detection task such as word recognition, grapheme-to-phoneme conversion, articulatory loop, and phonological storage (Halderman & Chiarello, 2005) If the last three processes are more or less equivalent for both types of items, the recognition is different for words and for pseudowords. In fact the multi-trace memory model (Ans, Carbonnel, & Valdois, 1998) proposed to account for different performance during word and pseudoword recognition. According to this model, words are analysed globally while pseudowords are processed more analytically. The global procedure is based on whole word form recognition induced by the familiarity of words. The analytical procedure is based on syllable recognition during a syllable-by-syllable analysis, as the pseudowords are not familiar and could not be recognised under a whole form. However, the syllables composing a pseudoword are familiar and may be recognised. Syllable-by-syllable processing takes longer than recognising the global orthographic form. This difference in terms of lexical recognition might explain our result indicating more accurate and faster responses for words than for pseudowords during the rhyme detection.

Lexicality effect on hemisphere specialisation

Our results showed that lexicality modulates the degree of hemispheric specialisation and this effect is specific for the RH. Specifically, during LVF-RH presentation rhyme detection in words was performed more easily than rhyme detection in pseudowords. During RVF-LH presentation both lexical items were processed equally accurately. However, words were processed faster than pseudowords. This pattern of results is in agreement with the proposal of right hemisphere abilities to process familiar stimuli such as words. Making rhyme decisions in words and pseudowords requires access to phonological representations. For items presented in the LVH the RH is able to find phonological representations for words based on their familiarity, but not for pseudowords. In order to be processed and their phonological representation found, the pseudowords should be "transferred" to LH specialised for analytical, syllable-by-syllable procedure. The inter-hemispheric transfer may induce loss of performance and elongation of reaction times (Reggia & Schulz, 2002; Zaidel, 1986).

Lexicality effect on inter-hemispheric cooperation

We did not obtain a significant interaction between modality of presentation and lexicality, neither for accuracy nor for latency.

Regarding latency, word rhyme detection was faster than pseudoword rhyme detection, independent of the modality of presentation. This result only suggests faster processing of words than pseudowords. Moreover, planned comparisons did not reveal any difference between words and pseudowords according to the modality of presentation. Overall, our results reveal that lexicality modulates speed of task execution. As words are not processed faster than pseudowords in BVF presentation, our results are not in line with the IHC hypothesis.

Regarding accuracy, we did not obtain a significant difference between words and pseudowords, independent of the presentation mode, suggesting that lexicality does not modulate the hemispheric interaction during rhyme execution. However, planned comparisons showed that words presented in BVF were more accurately processed than words presented in unilateral RVF-LH, suggesting BRG for words but not for pseudowords. BRG specificity for words provides evidence for right hemisphere (RH) participation during word processing and indirectly for IHC. The RH involvement may optimise the left-hemisphere activity to process words (Hasbrooke & Chiarello, 1998). We did not obtain a similar pattern for pseudowords. We suggest that, according to cell assembly theory, words have associated functional neural units distributed across hemispheres (Mohr, Endrass, Hauk, & Pulvermüller, 2007; Pulvermüller & Mohr, 1996). The functional units emerge consequent to frequent co-activation of neurons by familiar items. According to our theoretical framework we obtained only limited evidence for the inter-hemispheric cooperation particularly required for words but not for pseudowords in order to increase the accuracy of task execution. Our results could be explained by the choice of language task, rhyme detection, based on phonological mechanisms mainly dependent on the left, specialised hemisphere for language.

CONCLUSION

All together, our findings suggest that hemispheric specialisation may vary according to lexicality during phonological task execution. This effect is supported by the ability of the right hemisphere to detect familiar items (words) based on visual recognition. Moreover, inter-hemispheric cooperation appears to be less critical during a phonological task. Supplementary experiments are necessary in order to clarify these findings and to depict the inter-hemispheric cooperation for phonological tasks.

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