On the Locus of the Bilateral Lexicality Priming Effect

Jocelyn M. Keillor

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in Psychology

Waterloo, Ontario, Canada, 1997

0-612-30617-8

The University of Waterloo requires the signatures of all persons using or photocopying this thesis. Please sign below, and give address and date.

Abstract

A long tradition in neuropsychological research has involved the delineation of relative specializations of the left and right cerebral hemispheres. Recently, emphasis in this field has changed to the nature of the interactions between hemispheres in cognitive processing. One example is the study of bilateral lexicality priming, which has been touted as the result of interhemispheric processing in word recognition (Iacaboni & Zaidel, 1996). In this task, two letter strings are presented bilaterally, and participants are required to determine if the cued stimulus is a word or a nonword. Lexicality priming is observed when the lexical status (word/nonword) of the unattended stimulus influences the response to the cued stimulus. Under the assumption that the left visual field stimulus is processed in the right hemisphere and the right visual field stimulus is processed in the left hemisphere (direct access), lexicality priming reflects an interhemispheric interaction. However, it is possible that, even under conditions of bilateral presentation, the left visual field stimulus is relayed to the left hemisphere for processing (callosal relay), and thus lexicality priming is not an interhemispheric process but one that occurs entirely within the left hemisphere.

The three experiments presented in this thesis were designed to determine whether lexicality priming could be observed in the presence of independent evidence for direct access, allowing for the interpretation of lexicality priming as an interhemispheric effect. Following the logic of Zaidel (1983) direct access can be inferred from an interaction between visual field and some stimulus variable, or from an interaction between visual field and response hand. In Experiment 1, participants performed a bilateral lexical decision task in which they were exogenously cued to respond to one stimulus. Stimulus imageability was manipulated in order to examine the visual field by imageability interaction. While a robust lexicality priming was

observed, the necessary visual field by imageability interaction was not observed, suggesting that lexicality priming occurred under a callosal relay pattern of processing. In Experiment 2, a response-hand manipulation was used to test direct access. Lexicality priming and a visual field by response hand interaction were both observed, suggesting lexicality priming under direct access. However, both these effects interacted with sex, such that only women demonstrated the visual field by response hand interaction, and only men demonstrated lexicality priming. Therefore lexicality priming was observed only in the presence of evidence for a callosal relay pattern. Experiment 3 also used a response hand manipulation with slightly different stimulus parameters. All subjects displayed lexicality priming, but no evidence for direct access. The findings from all three experiments are consistent with the hypothesis that lexicality priming exists only under a callosal relay pattern of processing, and is an intrahemispheric rather than interhemispheric effect.

Acknowledgments

There is no question that this thesis would not have been completed without the support of many people. I am very grateful to Eric Roy for his patience and advice, and also for his tact and sensitivity during difficult times. I would also like to thank Barb Bulman-Fleming for all of her support and encouragement, and of course her editing. A number of people were very generous with their time when things got down to the wire, including Dan Weeks who volunteered to step in as an external examiner and who offered many helpful comments. I was also very happy to have Ernie MacKinnon and Fran Allard on my committee, as they as they offered insightful comments during my defense while making me feel at home. It was a difficult day for me and I appreciated all of the support offered to me from various members of the department. I will be eternally grateful to Joy Fisher, who went out of her way to ensure that things went smoothly.

I was exceptionally fortunate to have had the help and support of many friends in the Bryden Lab. Shelley Loewen and Murray Guylee ran subjects for me and offered me both friendship and practical support. Marg Ingleton is a very special person who not only wrote data sorting programs, but also listened to me and took care of me at a very difficult time in my life. Lorin Elias also bailed me out on a number of occasions, ensuring that things got done on time (or at least close to it) and offered his support, humor, and friendship. Gina Grimshaw is a wonderful friend who made me do this, and gave up many, many hours of her time making sure that it happened. From the conceptual stage to the final hours of writing, Gina was there and her influence is woven throughout this dissertation. We are all very fortunate to have been brought together in such a warm and supportive environment.

Many friends spent hours on the phone with me offering comfort and support when it seemed as though the world was falling apart. Carol Querengesser managed to talk some sense into me on a number of occasions, and Tara MacDonald helped put me back on my feet a more times than I can count. During the writing of this thesis, Mathew Hamilton helped me in every practical way that he could. I don't know how I would have managed to deal with the sad and upsetting events that occurred during my last year in graduate school without the love and support of my friends.

Finally, and most importantly, I would like to thank my supervisor and mentor, Phil Bryden. Phil gave me what is in essence one of the most valuable gifts that one person can give to another: through his continued faith in me he somehow taught me to have faith in myself. He was an exceptional person who will be greatly missed by all of those whose lives he touched.

To Phil

1934 - 1996

Table of Contents

List of Illustrations

Introduction

It has been known for over 100 years that the two cerebral hemispheres are specialized for different processes (Broca, 1861). Early models of hemispheric processing focused on each hemisphere in isolation. The specialization of the left hemisphere for linguistic processing has long been inferred from the observation of patients with unilateral brain damage (Broca, 1861). However, evidence from patients with callosal disconnection serves to remind us that specialization is relative; patients with split brains demonstrate that the left hemisphere is superior but not uniquely capable of processing linguistic information (Sperry, 1974; Zaidel, 1983). More recent research has acknowledged that the two hemispheres may both participate in the completion of a task, and accordingly there has been a shift in the focus of laterality research to include the study of interhemispheric interaction using bilateral presentations. The purpose of this thesis is to determine the extent of the interaction between hemispheres in word recognition.

Assessment of Hemispheric Specialization for Language

Broca (1861) first reported that disruptions of linguistic processing subsequent to stroke are associated with left hemisphere lesions. Since that time, the dominance of the left hemisphere for language processing, including reading, has been well established (Coltheart, 1981; Wernicke, 1874). Right-hemisphere language appears to be extremely impoverished in these patients (Gazzaniga, 1983), however, these patients remain able to perform lexical decision, i.e., to determine whether letter strings form real words or nonwords (Glass, Gazzaniga & Premack, 1973).

A somewhat different picture emerges from studies of split-brain patients – individuals who have had the corpus callosum severed in an effort to control severe epileptic seizures. When lateralized stimuli are presented tachistoscopically to these patients (so rapidly that a saccade cannot be completed to their location) they project entirely to the contralateral hemisphere. It is therefore possible to examine the functions of a hemisphere in isolation. Early studies confirmed the dominance of the left hemisphere for language processing, in that the right hemisphere was incapable of producing verbal responses (Bogen, Fisher, & Vogel, 1965; Gazzaniga & Sperry, 1967). However, later studies used more sophisticated methods to tap the linguistic abilities of the right hemisphere and concluded that it had good auditory comprehension (Zaidel, 1976) and some reading ability, particularly for concrete nouns (Zaidel, 1990; Zaidel, White, Sakurai & Banks, 1988). Note however that there is considerable debate over the extent of right-hemisphere language in the split-brain population. Although Zaidel and colleagues maintain that the right hemisphere has reasonable linguistic capabilities (with the exception of phonological processing), Gazzaniga and colleagues argue that linguistic competence of the right hemisphere has been overstated. For example, in a review of the split-brain literature, Gazzaniga (1983) states that only 3 of 28 patients demonstrated any right-hemisphere language, and all these were suspected to have had early left-hemisphere damage.

Studies of clinical populations can be confounded by a number of variables that cloud interpretation of results. In patients with left-hemisphere lesions, it is impossible to know whether performance reflects the abilities of the intact right hemisphere or the damaged left hemisphere. Furthermore, patients are tested at various stages of recovery, and performance may reflect cortical reorganization or compensatory strategies. Similarly, split-brain patients have had a long history of brain dysfunction prior to surgery that may have produced cortical reorganization (Müller, 1996; Rasmussen & Milner, 1977). It is therefore fortunate that hemispheric specialization can be assessed in the intact brain (Bryden, 1982), using the same tachistoscopic procedures that have been used with split-brain patients. In a typical visual half-field experiment, stimuli are presented laterally for a brief duration (under 200 ms) so that they are presented initially to the contralateral hemisphere. Robust right visual field advantages (RVFAs), in both speed and accuracy, are observed for linguistic tasks, reflecting the superiority of the left hemisphere.

Models of Processing with Lateralized Presentation

Although the presence of a behavioral laterality effect suggests that one hemisphere is superior at performing a task, it does not specify the pattern of processing that underlies the asymmetry. For example, the RVFA that is observed when right-handed subjects perform lateralized lexical decision is a clear indication of left-hemisphere specialization for linguistic information processing, but it does not specify the extent of right-hemisphere involvement in the task. The fact that subjects are slower and less accurate at lexical decision when the stimulus is initially presented to the right hemisphere could reflect relatively inferior right-hemisphere performance on this task, but it could also reflect the delay and degradation that result from a copy of the stimulus being transferred across the corpus callosum to the more competent left hemisphere for processing. Thus, a "direct access" model of processing of lateralized stimuli suggests that a visual-field effect reflects the output of the inferior hemisphere, whereas a "callosal relay" model suggests that a visual field effect reflects the output of the superior hemisphere following some delay and degradation of the stimulus percept. Either pattern of processing is plausible in the case of lexical decision, as evidence from clinical populations suggests that the right hemisphere is capable of completing the task, but is certainly less proficient than the left.

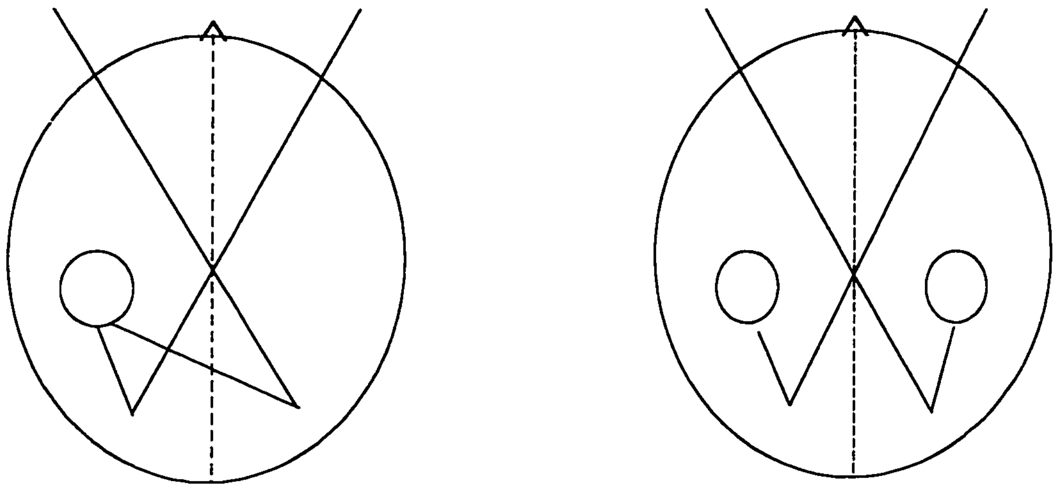
Zaidel (1983) has established a set of behavioral criteria that can be used to determine whether the hemispheric processing of a lateralized task follows a callosal relay or direct access pattern. This analysis is based on an examination of interactions between visual-field advantages and various stimulus and response variables (Measso & Zaidel, 1990; Zaidel, 1983; Zaidel, Clarke, & Suyenobu, 1990). Under conditions of callosal relay, one expects main effects of visual field and of some stimulus or response variable, but these effects should not interact. For example effects of imageability, or the ease with which a word evokes a mental image, are typically observed in lexical-decision tasks. Therefore, if the left hemisphere is processing all stimuli, the magnitude of the imageability effect should be identical for both left- and right-visual-field stimuli. Alternatively, under conditions of direct access, an interaction between visual field and imageability is predicted, as the right hemisphere has been shown to be more sensitive to imageability manipulations than the left (Boles, 1989; Bradshaw, 1980; Day, 1977; Ellis & Shepherd, 1974; Hines, 1976, 1977). Thus, one would expect larger imageability effects for left-visual-field (LVF) than for right-visual-field (RVF) stimuli.

A similar logic can be used in examining interactions of visual field and response hand. The motor programming necessary for a response is carried out in the hemisphere contralateral to the response hand. When the processing of the stimulus and the programming of the response are carried out in the same hemisphere, responses are faster and more accurate than when they take place in opposite hemispheres, because the latter requires callosal transfer of the motor command (Moscovitch, 1973; Poffenberger, 1912). Thus, the presence of a hand by visual-field interaction in the form of an ipsilateral hand advantage in each visual field indicates direct access. This effect may be superimposed on an overall visual-field advantage, so that in the case of lexical decision the RVFA would be attenuated when the subject is responding with the left hand because the processing of the LVF stimulus is completed within the right hemisphere. In contrast, a callosal relay pattern of processing is indicated when there is a main effect of response hand (faster and more accurate responses with the hand contralateral to the hemisphere responsible for processing the stimuli) coupled with an overall visual field advantage (faster and more accurate responses to the visual field opposite the hemisphere responsible for processing the stimuli), yet no hand by visual field interaction. So a callosal-relay pattern in a lexical decision task would take the form of an overall advantage for the right hand, and an overall RVFA, but no interaction between these factors. The two models are illustrated in Figure 1.

Although the interaction of stimulus variables with visual field, and hand by visual field interactions might appear to be equally diagnostic of hemispheric processing pattern, the interpretation of stimulus variable by visual field interactions can sometimes be ambiguous. The difficulty of interpretation arises because when a stimulus variable interacts with visual field it may be the case that one level of the stimulus variable is processed independently in each hemisphere whereas another level of the same variable may be relayed to the specialized hemisphere for processing. Hence, an observed interaction between imageability and visual field might simply indicate that low but not high imageability words presented to the right hemisphere are relayed to the left hemisphere for processing, rather than necessitating a direct-access interpretation. These difficulties of interpretation are compounded in cases in which a qualitatively different type of processing is required for each level of the stimulus. For example, Zaidel has used a stimulus-lexicality by visual-field interaction (larger RVFA for words than nonwords) to infer direct access (Measso & Zaidel, 1988). Yet given that "nonword" responses represent a failure of lexical access and "word" responses reflect a confirmed lexical access, it is quite possible that "word" responses reflect a match made within the left hemisphere and the "nonword" responses can be made without the input of a left-hemisphere confirmation. Zaidel (1983) has suggested that one way to get around this difficulty is to examine several stimulus variables that do not themselves interact, and see whether they all follow the same pattern.

Fortunately, the presence of a hand by visual field interaction is an unambiguous indication of a direct-access pattern of processing, and the absence of such an interaction (given sufficient power) indicates that one hemisphere is processing stimuli presented to both visual fields. Furthermore, it is possible to circumvent the problems of interpretation that arise when stimulus variables are used to assess hemispheric processing if there is independent evidence from both clinical and normal populations suggesting that the two hemispheres should be differentially affected by the manipulation (Boles, 1989; Bradshaw, 1980; Ely, Graves, & Potter, 1989). Therefore, main effects of imageability and visual field in the absence of an imageability by visual-field interaction could provide strong evidence that a lexical-decision task is accomplished through callosal relay.

Zaidel and his collaborators (Zaidel 1989; Zaidel, Clarke, & Suyenobu, 1990) have carried out a number of experiments investigating the interaction between stimulus and response variables and visual-field effects in lateralized lexical decision. They conclude that lexical decision follows a direct-access pattern of processing which they define as being carried out "independently by either hemisphere *in toto*" (Zaidel, et al., 1990, p.311). However, he also allows that a task that is direct access may be accomplished through callosal relay on some trials (Iacoboni & Zaidel, 1996).



Under a **callosal relay** pattern of hemispheric processing, the right visual field advantage should be of equal magnitude whether the subject is responding with the right or left hand, because the left hemisphere processes stimuli presented to both fields.

Under a **direct access** pattern of hemispheric processing, the RVFA should be attenuated when the subject is responding with the left hand, because left-hand responses to RVF stimuli require callosal transfer of the motor command.

Figure 1. Relation between response hand and visual field for callosal relay and direct access models of hemispheric processing.

Hemispheric Processing with Bilateral Displays

Of course, unilateral displays limit the examination of hemispheric processing patterns to the situation in which a single stimulus is presented to one hemifield. Researchers are increasingly interested in how the two hemispheres interact for tasks in which both of the hemispheres are capable of carrying out independent processing of the stimuli (Banich, 1995; Zaidel & Rayman, 1994). It is a well-established phenomenon that when different stimuli are projected to each hemisphere simultaneously, the magnitude of visual-field advantages is larger than when unilateral presentations are used (McKeever, 1971; Boles, 1995). However, the simultaneous presentation of two stimuli does pose some methodological problems that could result in magnified visual-field effects. Early bilateral studies required subjects to respond to both stimuli and controlled fixation by having the subjects report the identity of an item presented at fixation in addition to the two stimuli (McKeever and Huling, 1971). However, the nature of the material at fixation may bias the way the stimuli are processed (Kirsner & Schwartz, 1986). Furthermore, the procedure is prone to order-of-processing and order-of-report effects because subjects can voluntarily choose to deal with one stimulus prior to the other, providing it with an advantage (Bryden & Bulman-Fleming, 1994). Adequate control of attention in bilateral displays is particularly important in the light of Kinsbourne's (1975) hemispheric activation hypothesis in which he proposes that laterality effects result from attentional biases toward the visual field contralateral to the hemisphere specialized for the task. One way to reduce the effects of attentional biases is to provide a partial report cue at the onset of the stimulus (Bryden & Bulman-Fleming, 1994) so that the subject responds to the single stimulus that is cued on each trial.

The increase in field differences that is observed when different stimuli are displayed bilaterally has been termed "Bilateral Effect", and has been intensively studied by Boles (1983,1987,1990). Boles (1995) examined 13 separate possible explanations for the effect and concluded that it is the simultaneous activation of homotopic cortical areas by similar stimuli that causes a disruption of interhemispheric communication between them. One piece of evidence Boles uses to support this explanation is the finding that visual-field effects for word targets are larger when the distractor is a word than when it is a nonword, because words and nonwords are not processed in the same way and are therefore less likely to activate homologous areas (Boles, 1990). Thus Boles (1995), and Iacoboni and Zaidel (1996) have argued that bilateral displays force direct access by disrupting normal interhemispheric communication through homotopic callosal channels. This echoes an argument made by Hines (1975) who suggested that the simultaneous activation of the two hemispheres by any type of stimulus inhibits transfer from one hemisphere to the other. Hines went on to argue that if one wants to understand the capabilities of the two hemispheres it is important to prevent the transfer of stimulus information across the corpus callosum by using bilateral displays. Hines conducted a number of studies in which he examined the magnitude of the RVFA for word identification when the stimuli simultaneously presented to the opposite visual field were faces, shapes, or other words. He found that the magnitude of the RVFA was not influenced by the nature of the material presented to the opposite field, and concluded that the hemispheres operate quite independently under conditions of bilateral presentation.

Interhemispheric Interaction in Bilateral Lexical Decision

Bryden and Bulman-Fleming (1994) have pointed out that Hines (1975) may have underestimated the potential for interaction between hemispheres at a number of different stages of a complex task. A possible limitation of both the direct-access and the callosal-relay models of processing is that they both assume that processing occurs entirely within a single hemisphere. However, there are many stages in word recognition and it is possible that interactions between hemispheres could occur at later stages of processing, an idea that Zaidel (1989) has termed "resource sharing". Bryden and Bulman-Fleming noted that Hines' "argument for hemispheric independence fails if one can show conditions under which the processing of information in one visual field is affected by the nature of the material in the opposite visual field" (p. 123). Bryden and Bulman-Fleming proposed that this could be tested by using a bilateral lexical-decision task in which a partial cue dictated the item to which the subject should respond. If the lexical status of the distractor item influenced response time or accuracy of the word/nonword judgement for the target, then there would be evidence for interhemispheric interaction as opposed to complete hemispheric independence or isolation.

Iacoboni and Zaidel (1996) did this experiment, and found "lexicality priming", that is, congruent bilateral trials (word pairs or nonword pairs) were processed more accurately and faster than incongruent bilateral trials (word-nonword pairs). In the same experiment they also found evidence for direct access in the form of a hand by visual-field interaction and they concluded that the task was being accomplished through direct access. Iacoboni and Zaidel further concluded that "it follows that interhemispheric cooperation and resource sharing can occur automatically even in direct-access tasks when the two hemispheres engage in similar computations, albeit with different inputs (p.135)." As a result of this finding, lexicality priming has been used as a "measure of interhemispheric interaction", under the assumption that "the hemisphere which directly receives input (via the contralateral visual field) performs all of the necessary processing" (Weekes & Zaidel, 1996, p.278). Weekes and Zaidel compared the extent to which menstruating and non-menstruating women showed lexicality priming, and found that menstruating women demonstrated a significant lexicality priming effect whereas non-menstruating women did not. They concluded that women in the low-estrogen phase of their cycle showed greater interhemispheric interaction than women in the high-estrogen phase of their cycle.

If lexicality priming is to be used as a method of assessing interhemispheric interaction, it is important to be certain that it occurs as a result of interaction between hemispheres that have independently processed the two stimuli. One possible concern with Iacoboni and Zaidel's (1996) study relates back to concerns voiced by Bryden and Bulman-Fleming (1994) that it is very important in bilateral tasks to ensure that subjects are attending to the target item. Otherwise, a large component of the visual-field advantages under examination may result from attentional biases rather than processing asymmetries (Mondor & Bryden, 1992). Iacoboni and Zaidel (1996) indicated the stimulus to which subjects should make a word/nonword judgment with an arrow at fixation that pointed in the direction of the target. This cue was positioned near the center of the screen and appeared at the same time as the stimuli, therefore requiring the subject to voluntarily shift his attention in the direction of the arrow. Posner (1980) has termed this type of attentional manipulation endogenous cueing. The problem with requiring a voluntary shift of attention is that the subject must actively overcome the tendency to bias attention to one side, which may be particularly difficult if attentional biases arise from hemispheric activation during a task (Kinsbourne, 1975). Such biases make lexicality priming data difficult to interpret in that it is important to know whether the subjects are responding to the cued stimulus. In the case of Iacoboni and Zaidel's (1996) result, it is possible that subjects were more accurate on congruent trials (in which both target and distractor fall into the same response category) simply because a response to either stimulus would have been scored as correct, whereas for incongruent trials a response to the uncued item would have been scored as incorrect. A similar artifact could be present in the reaction-time data because subjects should be faster on trials in which they do not attend to the cue, particularly if they are already attending to the location in which the RVF stimulus is presented.

The Present Experiments

The experiments in this thesis were designed to further examine the lexicality priming effect in bilateral lexical decision, while controlling the subjects' deployment of attention. This was accomplished by using a peripheral, exogenous cue to "pull" the subjects' attention to the location of the target stimulus. Such cues invoke the operation of a reflexive attentional system and are thought to be a reliable method of controlling attention and immune to higher-level cognitive influences (Posner & Briand, 1990; Posner, Cohen, & Rafal, 1982). Three experiments were conducted with the same rationale: to determine whether lexicality priming occurs in the presence of evidence for direct access, under conditions in which attentional biases are minimized. Experiment 1 made use of an imageability manipulation to clarify the degree to which the hemispheres were processing the stimuli independently (i.e., to determine whether a direct access or callosal-relay pattern of hemispheric processing was present). In Experiments 2 and 3, a response-hand manipulation was used to determine the pattern of hemispheric processing. Experiment 3 also included a central condition in which stimuli were presented above and below fixation, in order to determine whether a similar pattern of lexicality priming occurs when the stimuli are not lateralized.

In addition, all three experiments in this thesis examined the relation between the sex of the subjects and their patterns of hemispheric processing (direct access vs. callosal relay), as well as their tendencies to demonstrate lexicality priming. This variable was considered important because male subjects demonstrate greater lateralization for linguistic stimuli than do women, a factor that could influence the pattern of hemispheric processing used to accomplish the lexical-decision task (McGlone, 1980). Furthermore, there are sex differences in the corpus callosum that may underlie sex differences in interhemispheric processing (Abotiz, Scheibel, Fisher, & Zaidel, 1992). Weekes and Zaidel (1996) found that women in the low-estrogen phase of their menstrual cycle demonstrate lexicality priming whereas those in the high-estrogen phase do not. Iacoboni and Zaidel (1996) did not include sex as a factor in their analyses, nor did they report the sex of their subjects, so it is unclear whether their male and female subjects exhibited different patterns of hemispheric processing or degrees of lexicality priming.

EXPERIMENT 1

Experiment 1 was designed to determine whether lexicality priming could be observed in a bilateral lexical decision task when a stringent control of attention is used, and to further determine whether this priming represents interhemispheric interaction. That is, does lexicality priming occur in the presence of evidence supporting a direct-access pattern of hemispheric processing? To this end, attention to the target was controlled by means of an exogenous cue, and an imageability manipulation was used to clarify the pattern of hemispheric processing. A direct-access pattern of processing would be suggested by an interaction between visual field and imageability such that the imageability effect is larger in the LVF, whereas a callosal-relay pattern would be revealed by the absence of such an interaction in the presence of main effects of visual field and imageability.

Method

Participants

Participants were 64 right-handed undergraduate students (33 men and 31 women) who participated in the experiment for pay. All subjects had normal or corrected-to-normal vision and were native speakers of English.

Stimuli and Apparatus

The stimuli were 224 words and 224 pronounceable nonwords. All stimuli were five letters in length. Half of the words were of high imageability and half were of low imageability according to the ratings of Pavio (1982), Pavio, Yuille, and Madigan (1968), the Toronto Word Pool (Friendly, Franklin, & Hoffman, 1982), Benjafield and Muckenheim (1989), and

Gilhooly and Logie (1980). A list of the stimuli used in this experiment is provided in Appendix A, along with a list of stimuli used for the practice trials. Stimuli were divided into lists of targets and distractors, and words were matched for imageability and frequency (Kücera and Francis, 1967). The stimuli were presented on a PowerMacintosh equipped with a 15-inch monitor. A chin rest was used to maintain a viewing distance of 65 cm. Stimuli were presented in a black courier font on a white background, and subtended 1.5° of visual angle. Each string was lateralized by 1.2° of visual angle (from the inside edge of the stimulus to fixation). Target letter strings were precued by an underscore that was centered under the target such that it subtended 2.2° of visual angle and was lateralized by 0.7° of visual angle. PsyScope software was used to control the experiment (Cohen, MacWhinney, Flatt, & Provost, 1993). The same computer apparatus was used for all three experiments.

Procedure

Subjects were tested individually in a 15-minute session. Subjects were seated in front of the computer with the index fingers of their left and right hands resting on the [z] and [/] keys, respectively. They were instructed that their task was to decide whether the underlined string formed an English word or not, while ignoring the string in the opposite visual field. Half of the subjects responded by pressing the [z] key to indicate "word" and the [/] key to indicate "nonword," and half of the subjects used the opposite mapping. Subjects were informed that targets appeared in each visual field with equal probability and that 50% of targets were words and 50% were nonwords. Instructions emphasized both speed and accuracy of response.

Each trial began with the presentation of a central-fixation cross that remained in place throughout the trial. The side of the target was precued by the presentation of an underscore, 800 ms after the onset of fixation, that remained in place throughout the duration of the stimulus. Each pair of lateralized letter strings was presented 30 ms after the onset of the cue and remained on the screen for 150 ms. A blank white screen followed the simultaneous offset of the letter strings, underscore, and fixation, and remained in place until the subject responded.

Each subject completed 24 practice trials followed by 224 experimental trials. Both targets and distractors were counterbalanced across subjects so that each target appeared in each visual field, paired with each type of distractor (high imageability, low imageability, or nonword). Similarly, each distractor appeared in each visual field, paired with each type of target.

Results and Discussion

Data Reduction and Initial Analyses

Correct response times and percent errors were averaged across items for each visual field (left and right), target type (high imageability, low imageability, and nonword), distractor type (high imageability, low imageability, and nonword), and by subject. Outlying response times were identified using a simple recursive outlier procedure with a criterion of 3 standard deviations (Van Selst & Jolicoeur, 1994). Fewer than 1% of data points were excluded on this basis. As an initial step, means for both dependent measures were submitted to separate mixed-design analyses of variance (ANOVAs) in which sex was a between-subjects factor and visual field, target type, and distractor type were within-subjects factors. A source table for the reaction-time analysis is presented in Appendix B, and for the error analysis in Appendix C.

Individual subject data are included as Appendices D and E. Because there were no significant main effects or interactions involving distractor imageability (high vs. low) for either dependent measure, subsequent analyses were conducted collapsing across this variable so that distractors were considered only in terms of their lexical status (word vs. nonword). These means were analyzed in a 2 (sex) × 2 (visual field) × 3 (target type) × 2 (distractor type) ANOVA. There was a robust RVFA. There were no main effects or interactions involving sex for either dependent measure.

The test of Zaidel's claim for interhemispheric interaction between stimuli processed independently in each hemisphere requires lexicality priming in the presence of evidence for direct access. Accordingly, all results are graphed in terms of the relation between target and distractor, to reflect lexicality priming (Figure 2), and between imageability and visual field, to reflect hemispheric processing pattern (Figure 3).

Lexicality Priming

Response Times. In order to evaluate lexicality priming, mean response times for both types of word targets (high- and low-imageability) were combined. A source table for this analysis is presented in Appendix F. As can be seen in Figure 2, there was clear evidence for lexicality priming in the form of a target by distractor interaction, $F(1,62) = 12.3$, $p=.001$. One-tailed comparisons revealed that for nonword targets in the left visual field responses were faster when the distractor was also a nonword, $t(63) = 2.45$, $p=.009$, this congruency effect was also present in the right visual field for nonword targets $t(63) = 2.16$, $p=.018$, and approached significance for word targets $t(63) = 1.50$, $p=.069$. The finding of lexicality priming in the present experiment is important because the subjects' deployment of attention was controlled through the use of an exogenous cue. The use of such a cue corrects the methodological problem in the work of Iacoboni and Zaidel (1996) that made it impossible to determine whether the advantage observed in congruent trials resulted from the presence of some trials in which the subject may have been responding to the distractor rather than the target (which would be advantageous on congruent trials because this type of error would be scored as "correct").

Response Times for Error Trials. An additional analysis was performed to confirm that the observed lexicality priming effects were not an artifact produced by subjects attending and responding to the distractor rather than the target location, despite the use of an exogenous cue to control attention. This was accomplished by examining response times for error trials (a source table for this analysis is presented as Appendix G). Two subjects were excluded from this analysis because of empty cells. Given the robust RVFAs apparent in response times for correct trials (see below), one would expect a LVFA in response times for incorrect trials, if they occurred because the subject was actually responding to the distractor item on a portion of trials. That is, if subjects were responding to the wrong stimulus, one would expect that they would show maximal benefit when responding to the RVF distractor. Therefore one would expect to see, in the error trials, a reaction-time advantage for LVF targets (RVF distractors). In contrast to this, a significant RVFA was observed for incorrect trials, $F(1,60) = 53.34$, $p<.001$, consistent with the claim that subjects were in fact responding to the cued stimulus. Therefore, the lexicality-priming effect observed in the present experiment is not an artifact resulting from subjects sometimes attending to the wrong location, as was possible in the work of Iacoboni and Zaidel (1996).

Error Rates. In order to evaluate lexicality priming, mean error rates for both types of word targets (high- and low-imageability) were combined. A source table for this analysis is presented in Appendix H. Mean percent errors for each visual field are plotted in the lower panel of Figure 2 as a function of target and distractor type. The error rates did not reveal a lexicality priming effect ($F<1$). However, there was also no evidence that the interaction between target type and distractor type observed in the response-time data was the result of a speed-accuracy tradeoff.

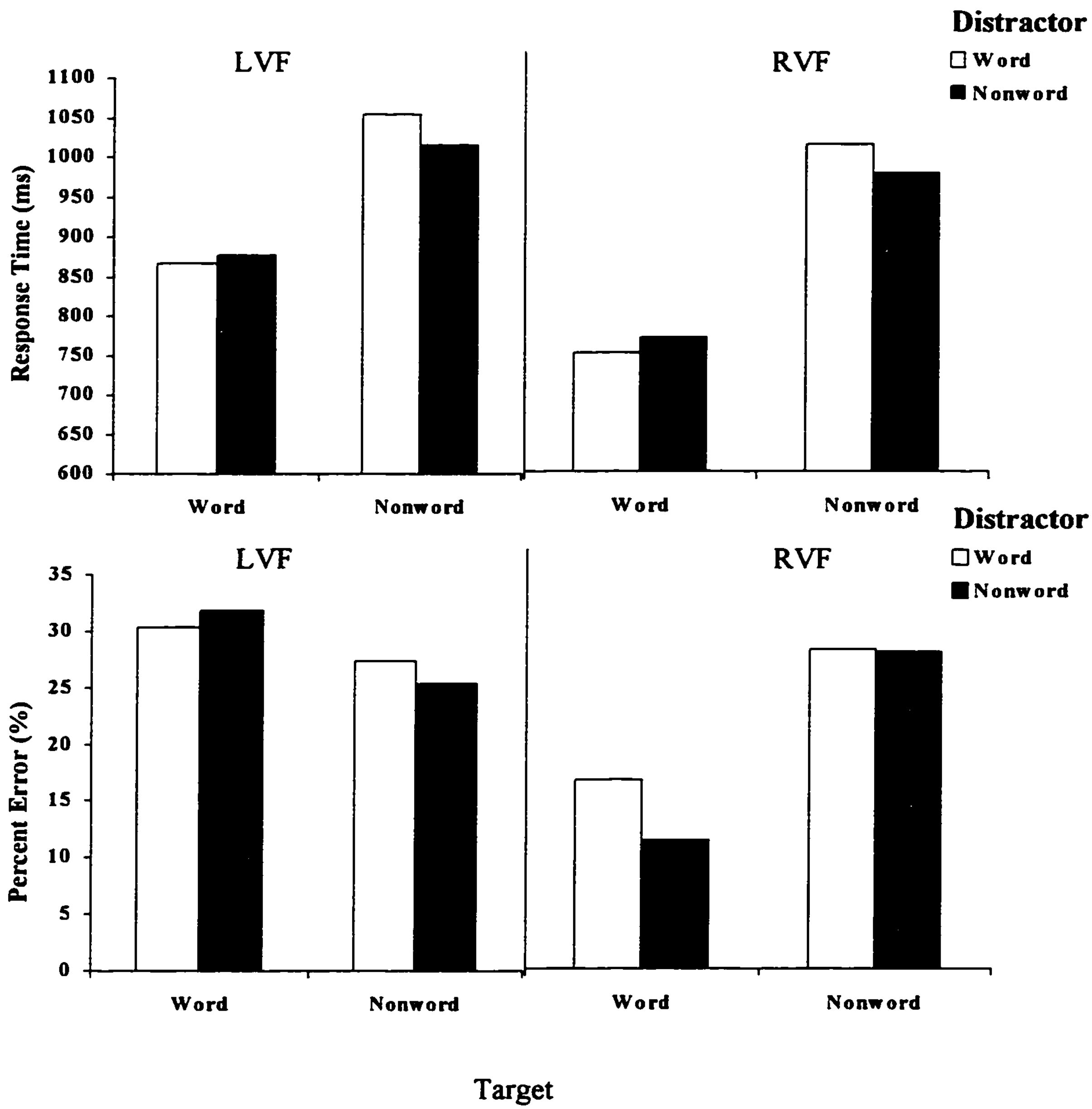


Figure 2. Experiment 1: Mean correct response time and mean percent error as a function of distractor type and target type.

Pattern of Hemispheric Processing

Response Times. In order to assess whether a direct-access or callosal relay pattern of hemispheric processing was present the data were considered in terms of the relation between imageability and the magnitude of the RVFA. Recall that an imageability by visual field interaction would suggest direct access processing, whereas main effects of both imageability and visual field would indicate direct access. Appendix I is a source table for an analysis that excludes nonword targets. These means are plotted in the upper panel of Figure 3. A reliable RVFA was observed, $F(1,62) = 36.95$, $p<.001$ in that responses were faster overall when the target was projected to the left hemisphere. There was a main effect of target type $F(1,62) = 4.70$, $p=.034$, in that responses to high imageability targets were faster than those to low imageability targets. However, there was no evidence of a target imageability by visual field interaction $F(1,62) = 2.69$, n.s., and in fact the means were in the direction opposite to that predicted. The absence of a larger effect of target imageability for stimuli projected to the right hemisphere, in the presence of a robust RVFA and main effect of imageability is a pattern of results strongly suggestive of a callosal-relay pattern of processing.

In order to determine whether word and nonword targets were processed differently by the two hemispheres, an analysis was performed collapsing across target imageability (a source table for this analysis is presented in Appendix F). Responses to word targets were faster than those to nonword targets, $F(1,62) = 86.55$, $p<.001$. The RVFA was larger for word targets than for nonword targets, $F(1,62) = 42.33$, $p<.001$. Measso & Zaidel (1988) have suggested that a larger RVFA for word targets than for nonword targets may indicate a direct-access pattern of processing. However, it is most likely that responses to "word" targets reflect left-hemisphere processing whereas responses to "nonword" targets may (at least on some trials) reflect direct-access processing. That is, words and nonwords may differ in the extent to which they require left-hemisphere resources to complete a response, and therefore the difference in the magnitude of the RVFA for these two stimulus types may reflect the extent to which the left hemisphere contributes to the task. So, differences in the magnitude of the RVFA may occur simply because the right hemisphere uses mostly direct-access for one level of the variable, and callosal relay for the other. Because word and nonword responses require qualitatively different types of processing, the fact that this stimulus variable interacts with the magnitude of the RVFA does not suggest that the task is being performed through direct access, particularly in the absence of similar findings with other stimulus variables (Zaidel, 1983).

Error Rates. As for the response-time analysis, the pattern of hemispheric processing was evaluated by excluding nonword targets from the analysis and considering the effects involving imageability. A source table for this analysis is presented as Appendix J. The mean percent errors are plotted in the lower panel of Figure 3 as a function of visual field and imageability. The mean error rate was lower in the right visual field than the left , overall $F(1,62)=119.36$, $p<.001$. The mean error rate was lower for high imageability targets than low imageability targets $F(1,62)=55.86$, $p<.001$. The magnitude of the RVFA was larger for word targets than for nonword targets $F(1,62)=68.35$, $p<.001$ (see Appendix G for a source table collapsing across imageability). However, the RVFA was not different for high and low imageability targets ($F<1$). These data are therefore consistent with a callosal relay pattern of hemispheric processing.

In summary, the results of Experiment 1 demonstrate that the lexical status of a letter string presented to one hemisphere can influence a lexical decision to a stimulus presented to the opposite hemisphere. This is inconsistent with the contention of Hines (1975) that bilateral presentations prevent the transfer of stimulus information across the corpus callosum, forcing each hemisphere to process the stimuli completely independently. The presence of main effects of imageability and visual field, along with the finding that imageability effects were not larger in the left visual field is indicative of a callosal-relay pattern of processing. Therefore, the lexicality priming observed in this experiment results from intrahemispheric rather than interhemispheric interaction, because the lexical processing of both items appears to have been carried out within the left hemisphere.

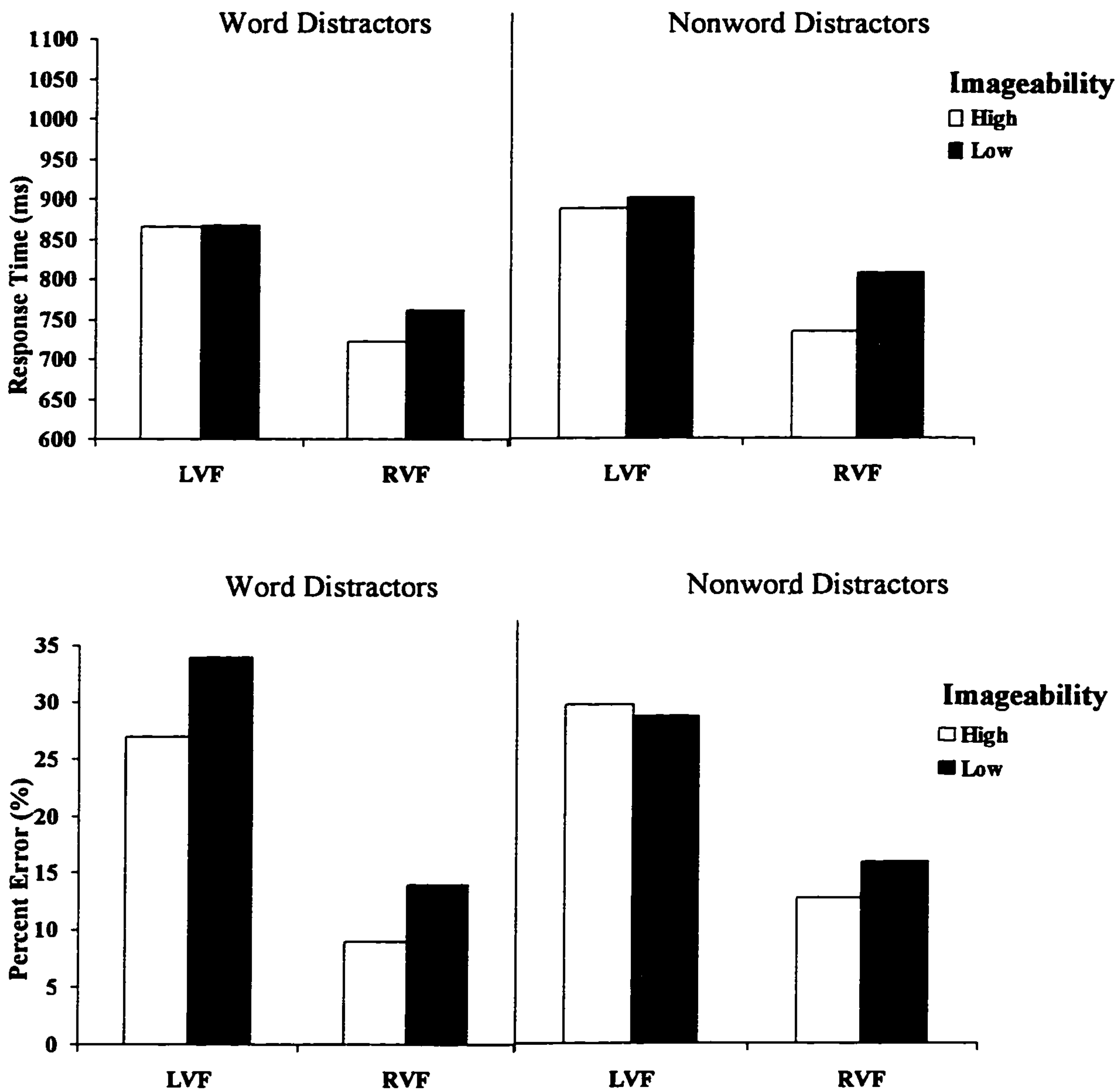


Figure 3. Experiment 1: Mean correct response time and mean percent error as a function of target imagery and visual field.

EXPERIMENT 2

In Experiment 2 a response-hand manipulation was used instead of a stimulus-variable manipulation to indicate whether the task was accomplished through a direct access or callosal-relay pattern of hemispheric processing. In order to maximize the chance that the right hemisphere could process the stimuli, only concrete nouns of relatively high frequency were used. Once again the purpose of the experiment was to determine whether lexicality priming occurs when the two hemispheres independently process the stimuli. If lexicality priming is an effect that occurs only within the left hemisphere (under a callosal-relay pattern of processing) then it should not occur in the presence of the significant response hand by visual field interaction that is indicative of direct-access processing.

Method

Participants

Participants were 72 right-handed undergraduate students (36 men and 36 women) who participated in the experiment for pay. All subjects had normal or corrected-to-normal vision and were native speakers of English.

Stimuli and Apparatus

The stimuli were 272 words and 272 pronounceable nonwords. Two hundred strings in each category were four letters in length; the remaining 72 were 5 letters in length. All words were concrete nouns and had frequency ratings above 5.11. A list of the stimuli used in this experiment is provided in Appendix K, along with a list of stimuli used for the practice trials. Stimuli were divided into lists of targets and distractors that were matched for frequency according to the Kücera and Francis (1967) frequency ratings. The stimuli were presented using the same computer equipment as in Experiment 1. Stimuli were presented in a black courier font on a white background; four-letter strings subtended 1.3° of visual angle and five-letter strings subtended 1.5° of visual angle. Each string was lateralized by 1° of visual angle (from the inside edge of the stimulus to fixation). Target letter strings were precued by an underscore that was centered under the target such that it subtended 1.7° of visual angle and was lateralized by 0.8° of visual angle.

Procedure

Subjects were tested individually in a 20-minute session. They were instructed that their task was to decide whether the underlined string formed an English word or not, while ignoring the string in the opposite visual field. Each trial began with the presentation of a central fixation cross that remained in place throughout the trial. The side of the target was precued by the presentation of an underscore, 800 ms after the onset of fixation, that remained in place throughout the duration of the stimulus. Each pair of letter strings was presented 30 ms after the onset of the cue and remained on the screen for 165 ms. A blank white screen followed the simultaneous offset of the letter strings, underscore, and fixation cross, and remained in place until the subject responded.

Subjects completed 60 practice trials followed by two blocks of 136 experimental trials. Subjects responded with the index and middle fingers of the right hand for one block of trials (using the [m] and [k] keys), and with the left hand ([c] and [d] keys) for the other block of trials. Practice trials were always completed using the right hand. The order of the experimental blocks (right and left-hand responses) was counterbalanced across subjects. In all cases index-finger responses indicated "word" and middle-finger responses indicated "nonword". Subjects were informed that targets appeared in each visual field with equal probability and that 50% of targets were words and 50% were nonwords. Instructions emphasized both speed and accuracy of response. Targets were counterbalanced across subjects so that each target appeared in each visual field, paired with each type of distractor (word or nonword), and was responded to with each hand.

Results and Discussion

Data Reduction and Initial Analyses

Correct response times and percent errors were averaged across items for each visual field (left and right), response hand (left and right), target type (word and nonword), distractor type (word and nonword), and by subject. Outlying response times were identified using a simple recursive outlier procedure with a criterion of 3 standard deviations (Van Selst & Jolicoeur, 1994). Fewer than 1% of data points were excluded on this basis. In addition, data from four subjects (two men and two women) were excluded from the analyses because of substantial response biases (more than 75% of responses falling in the "word" or "nonword" category). Means for both dependent measures were submitted to separate mixed-design analyses of variance (ANOVAs) in which sex was a between-subjects factor and visual field, response hand, target type, and distractor type were within-subjects factors. A source table for the reaction-time analysis is presented in Appendix L, and for the error analysis in Appendix M. Individual subject data are included as Appendices N and O. Notably, there was a marked

RVFA present for both response times $F(1,66) = 41.77$, $p<.001$, and percent error $F(1,66)=62.07$, $p<.001$. Right-hand responses were more accurate than left-hand responses overall $F(1,66)=4.21$, $p=.044$. However there was evidence of a speed-accuracy tradeoff in the effect of response-hand for the word targets as response hand and target-type interacted $F(1,66)=10.72$, $p=.002$ so that left-hand responses were significantly faster than right-hand responses for these items $F(1,67)=4.85$, $p=.031$. Responses to word targets were both faster $F(1,66)=116.08$, $p<.001$, and more accurate than responses to nonword targets $F(1,66)=4.08$, $p=.047$.

In order to report an analysis that parallels that of Iacoboni and Zaidel (1996) the results will be briefly examined without reference to sex differences, before the results are broken down by sex of subject (source tables for these analyses are included as Appendices P and Q). Of greatest interest for the present study is the interaction of target and distractor, and that of hand and visual field. When the results were examined without the inclusion of sex as a factor there was evidence for an overall effect of lexicality priming. The mean response times are plotted as a function of target type and distractor type in Figure 4, and percent error for these variables is presented in Figure 5. A significant lexicality priming effect was observed in the error data, $F(1,67)=5.33$, $p=.024$, but not for response times ($F<1$), as was observed by Iacoboni and Zaidel. As in Experiment 1, an analysis of response times for error trials was conducted to confirm that subjects were in fact responding to the target item and not to the distractor. An ANOVA table for this analysis is included as Appendix R. It was possible to perform this analysis for only 31 of the subjects because the rest did not make errors in all cells. There was no evidence for a LVFA for error trials. In fact, subjects showed a trend toward faster responses to RVF targets $F(1,30)=3.95$, $p=.056$, indicating that the exogenous cue was effective at directing subjects to respond to the target rather than the distractor. When the pattern of hemispheric processing was considered without reference to the sex of the subjects a direct access pattern of processing was observed. Figure 6 depicts the interaction of hand and visual field for response time, and Figure 6 depicts the same interaction for error rate. As can be seen in Figure 5 there was a larger RVFA for right-hand responses than for left hand responses that interacted with target type $F(1,67)=4.66$, $p=.034$ and was more reliable for word targets $F(1,67)=4.04$, $p=.049$, than nonword targets $F(1,67)= 3.70$, $p=.057$. Similarly, Figure 6 indicates a larger RVFA for right-hand responses in the error data that interacted with target type $F(1,67)=4.66$, $p=.034$, and approached significance for word targets $F(1,67)=3.17$, $p=.080$ but not nonword targets $F(1,67)=2.38$, n.s.

These findings are similar to those reported by Iacoboni and Zaidel (1996), and seem to indicate that interhemispheric interaction was observed in the presence of evidence for direct access. Note, however, that such a conclusion cannot be reached because both of these effects interacted with sex, a variable that Iacoboni and Zaidel did not record. There was a significant interaction between sex and the magnitude of the lexicality priming effect observed for errors $F(1,66)=4.90$, $p=.03$. The interaction observed between response hand, visual field, and target type was also modulated by sex for both percent error $F(1,66)=3.73$, $p=.058$, and response time $F(1,66)=3.93$, $p=.052$. Accordingly, separate analyses were conducted for men and women. The results of these 2 (visual field) × 2 (response hand) × 2 (target type) × 2 (distractor type) ANOVAs are reported below with reference to lexicality priming and pattern of hemispheric processing (the relation between response hand and visual field). If lexicality priming is to be considered an interhemispheric effect, it must be found to occur in the context of direct access processing (as indicated by a smaller effect of visual field when the participant is responding with the left hand) for either men or women (or for both sexes).

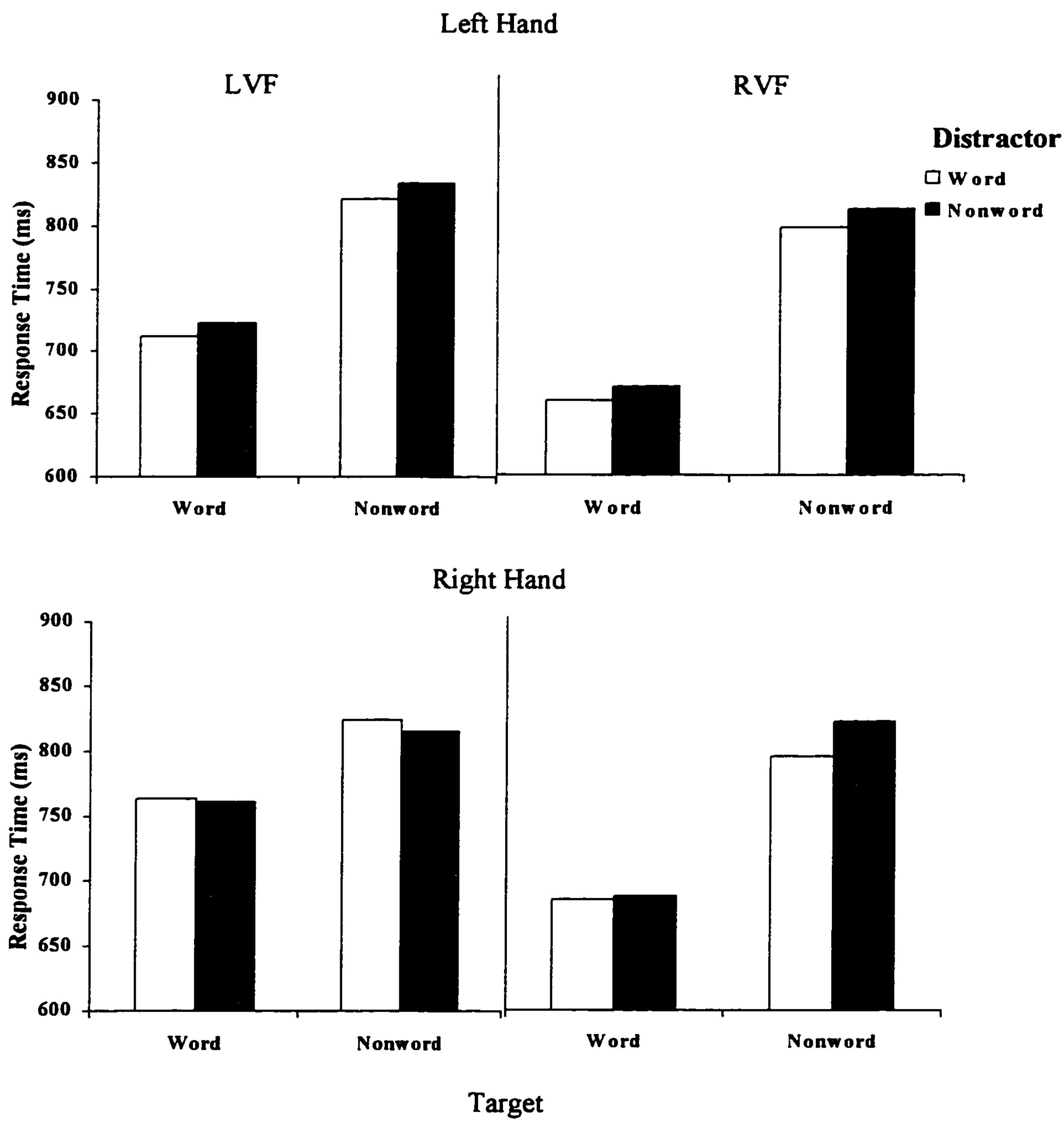


Figure 4. Experiment 2: Mean correct response time as a function of target type and distractor type for all subjects.

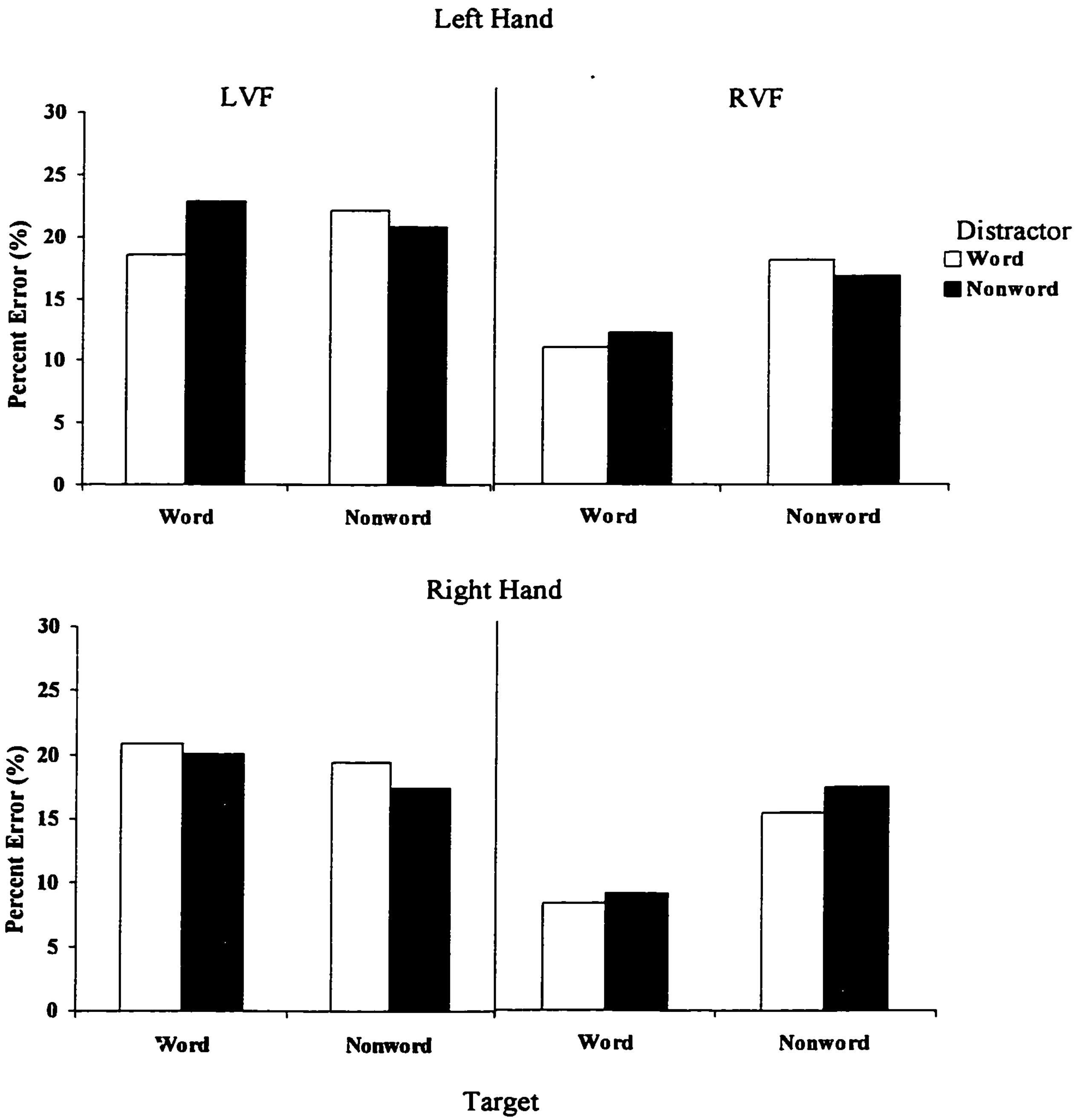
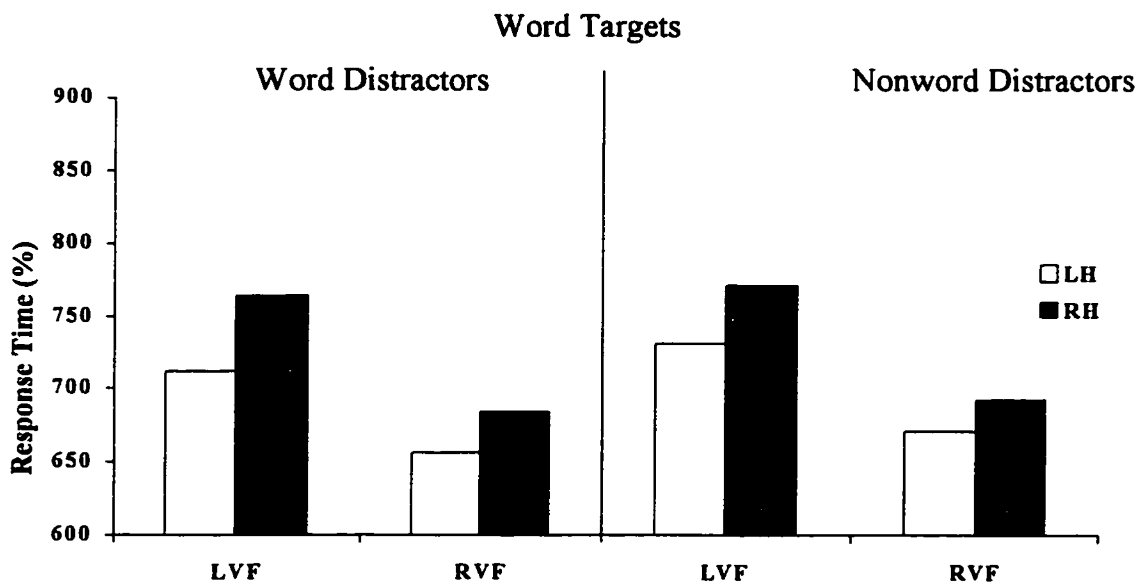


Figure 5. Experiment 2 Mean percent error as a function of target type and distractor type for all subjects.



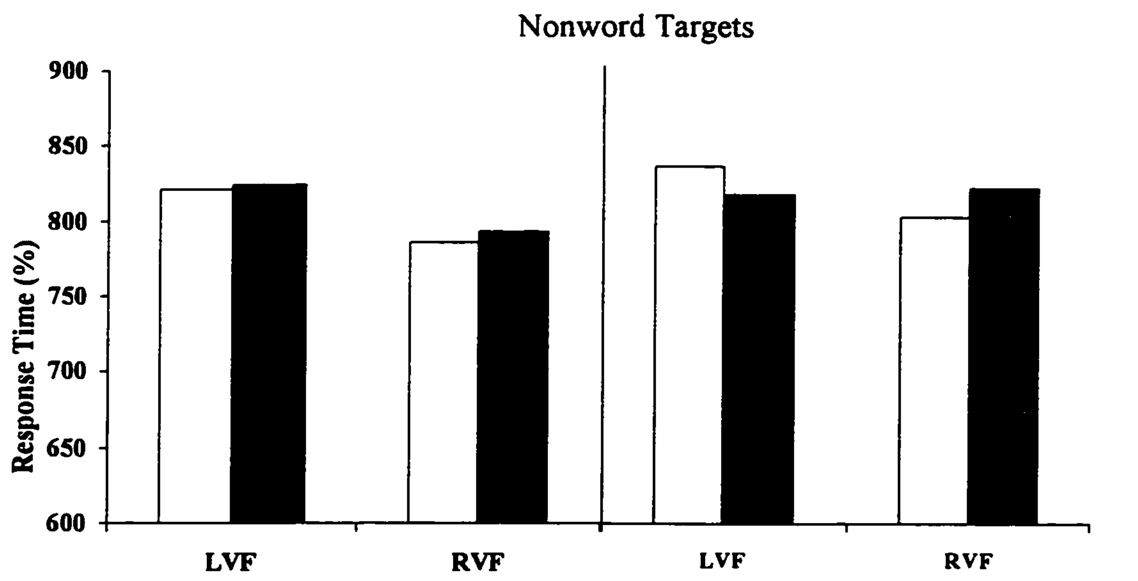
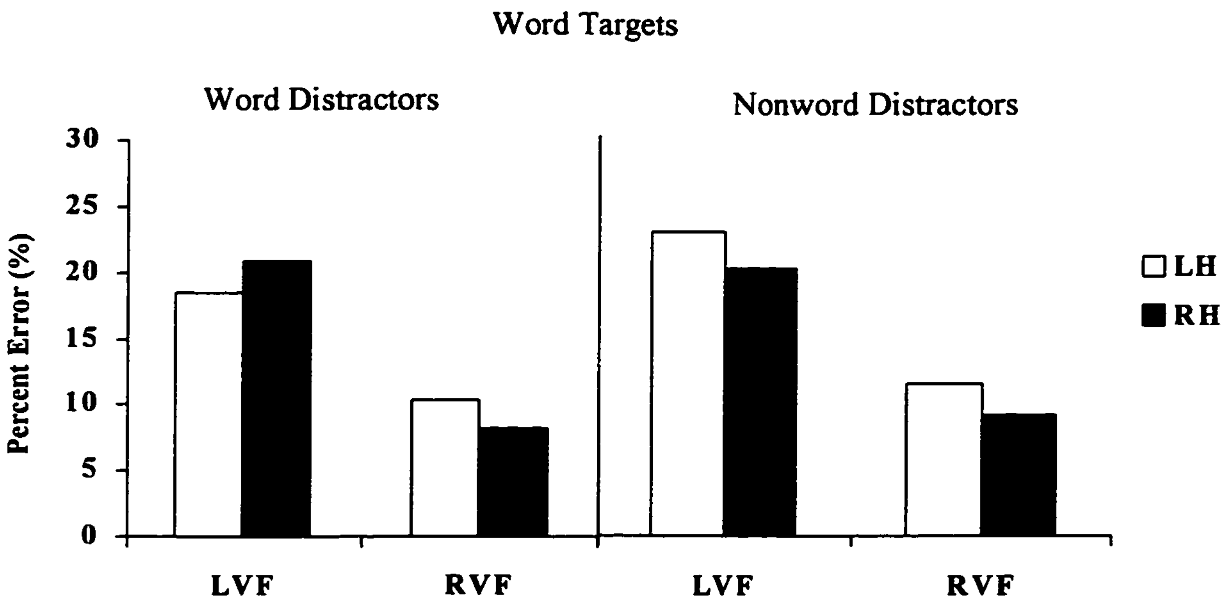


Figure 6. Experiment 2: Mean correct response time as a function of response hand and visual field for all subjects.



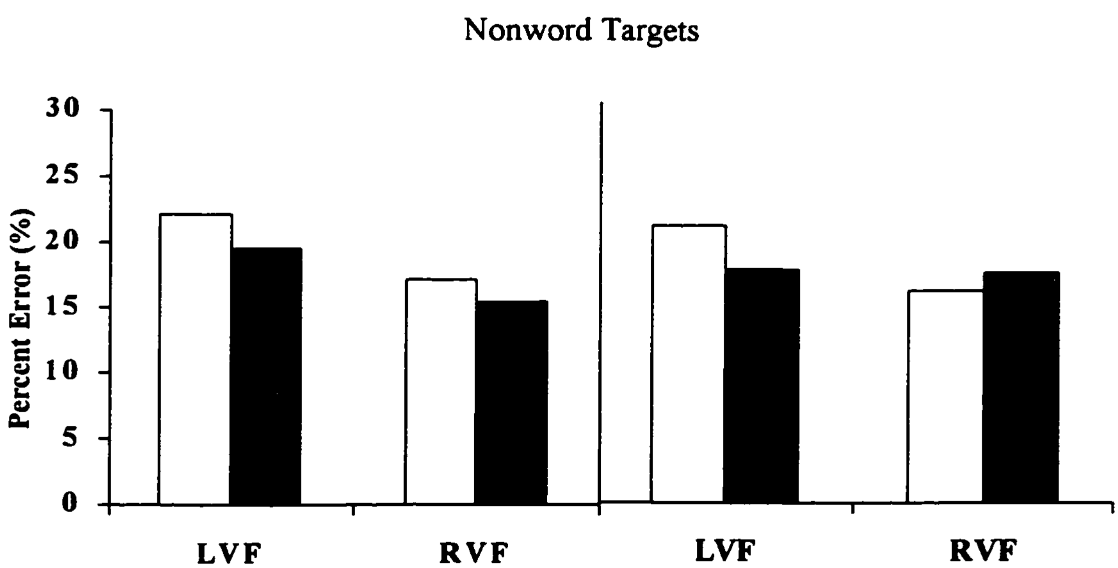


Figure 7. Experiment 2: Mean percent error as a function of response hand and visual field for all subjects.

Lexicality Priming

Response Times. Correct response times are plotted as a function of target type and distractor type in Figure 8 for men and Figure 9 for women. ANOVA tables for these analyses are included as Appendices S and T, respectively. As can be seen in Figure 8, men showed a significant lexicality priming effect in the form of a visual field by target by distractor interaction $F(1,33)=4.27$, $p=.047$. One-tailed comparisons revealed that for men responses to word targets were significantly faster when paired with word distractors than when paired with nonword distractors $t(33)=2.57$, $p=.008$. [This lexicality priming reached significance in the RVF $t(33)=1.70$, $p=.049$, but not the LVF $t(33)=1.67$, $p=.052$]. In contrast, women showed no effect of lexicality priming $F(1,33)=1.51$, n.s.

Error Rates. Percent error is plotted as a function of target type and distractor type in Figure 10 for men and in Figure 11 for women. ANOVA tables for these analyses are included as Appendices U and V, respectively. Men demonstrated lexicality priming in the form of a target by distractor interaction $F(1,33)=9$, $p=.005$, an effect that was larger in the LVF $F(1,33)=10.58$, $p=.005$. One-tailed t-tests revealed that for men responses to word targets in the LVF were more accurate when the distractor was also a word $t(33)=2.68$, $p=.005$. Similarly, for LVF trials men responded more accurately to nonword targets when the distractor was also a nonword $t(33)=3.02$, $p=.003$. Women showed no effect of lexicality priming ($F<1$). Thus, the error rates reveal the same pattern as the response time data: men demonstrated lexicality priming and women did not.

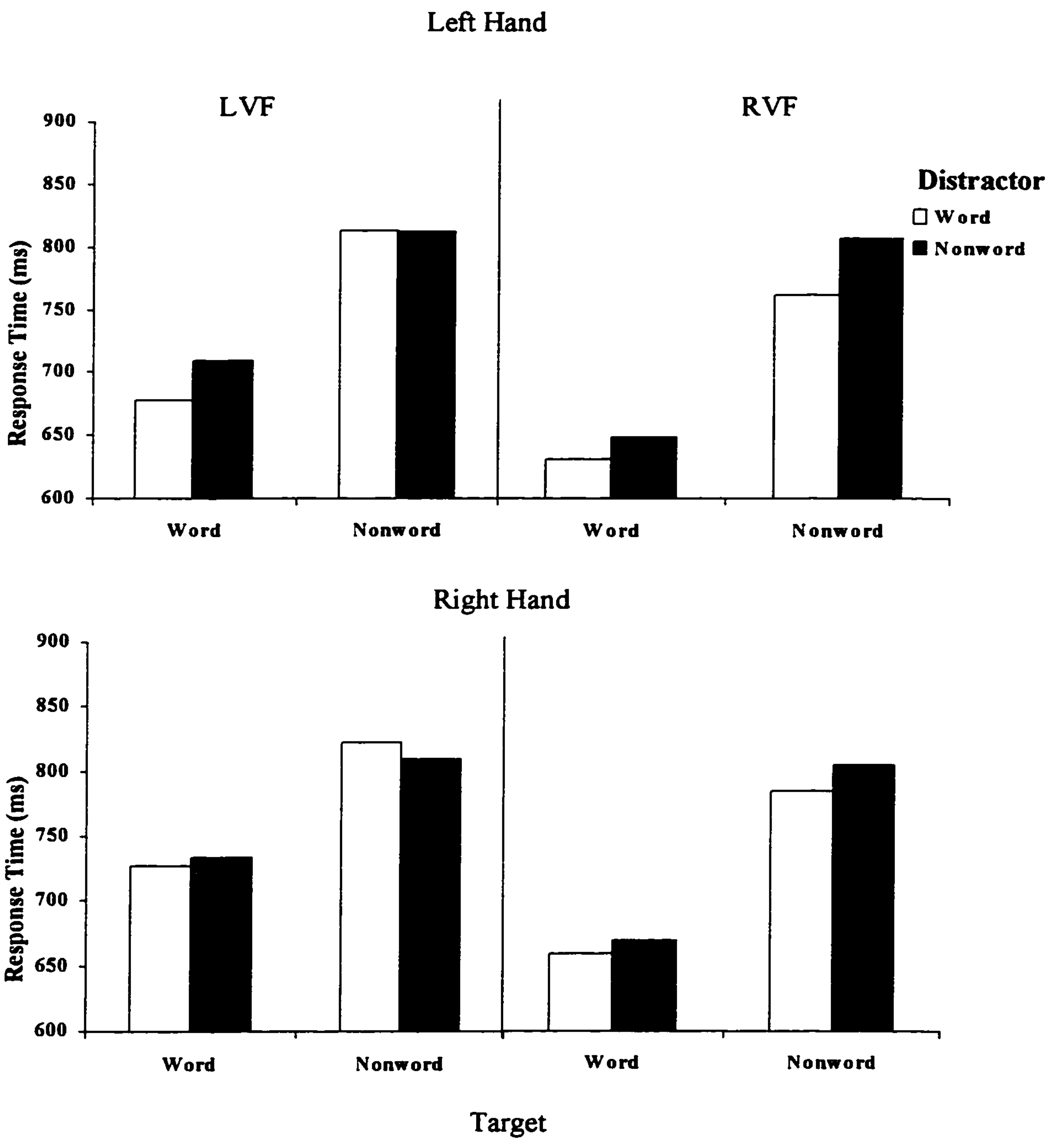


Figure 8. Experiment 2: Mean correct response time for men as a function of target type and distractor type.

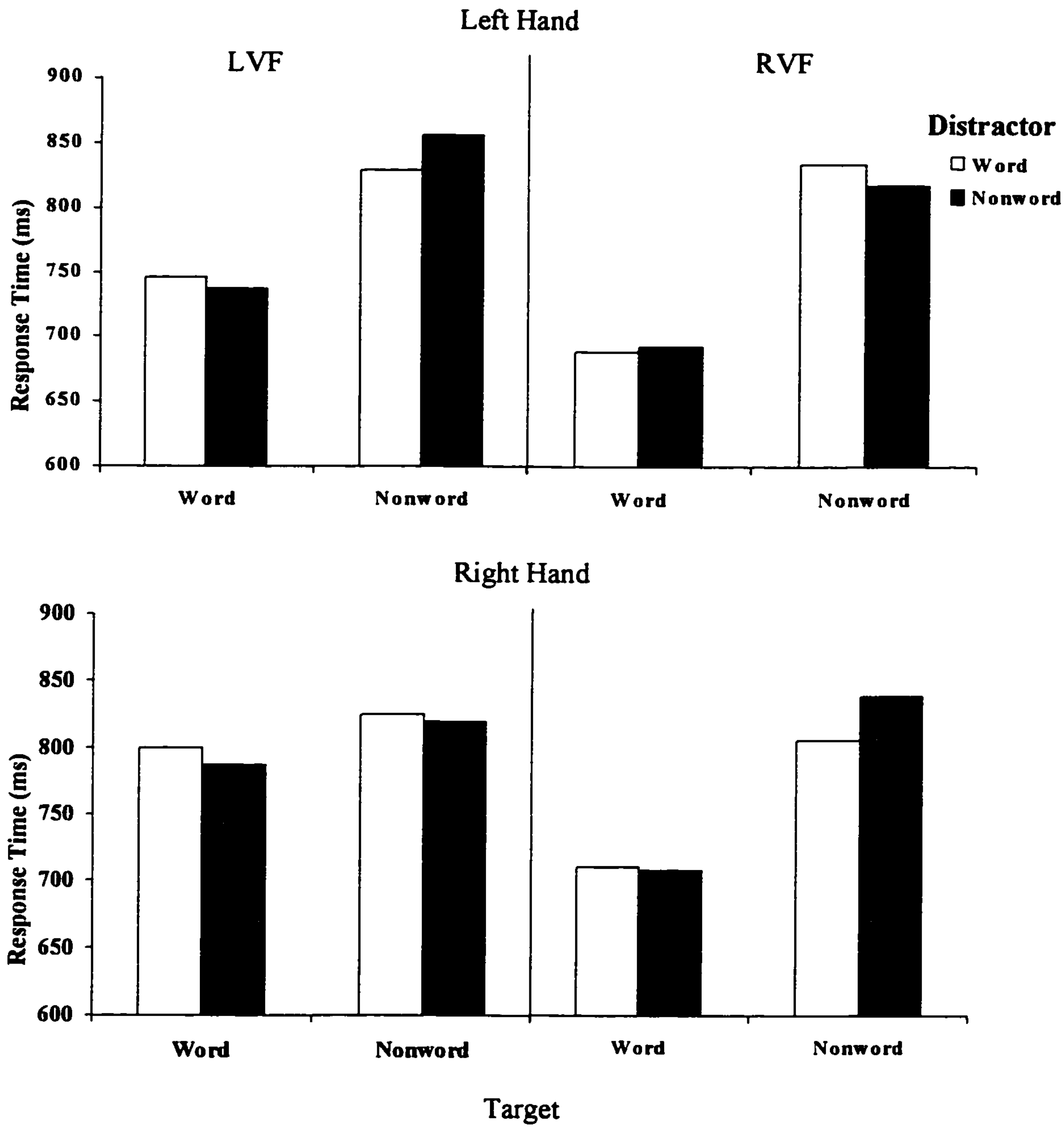


Figure 9. Experiment 2: Mean correct response time for women as a function of target type and distractor type.

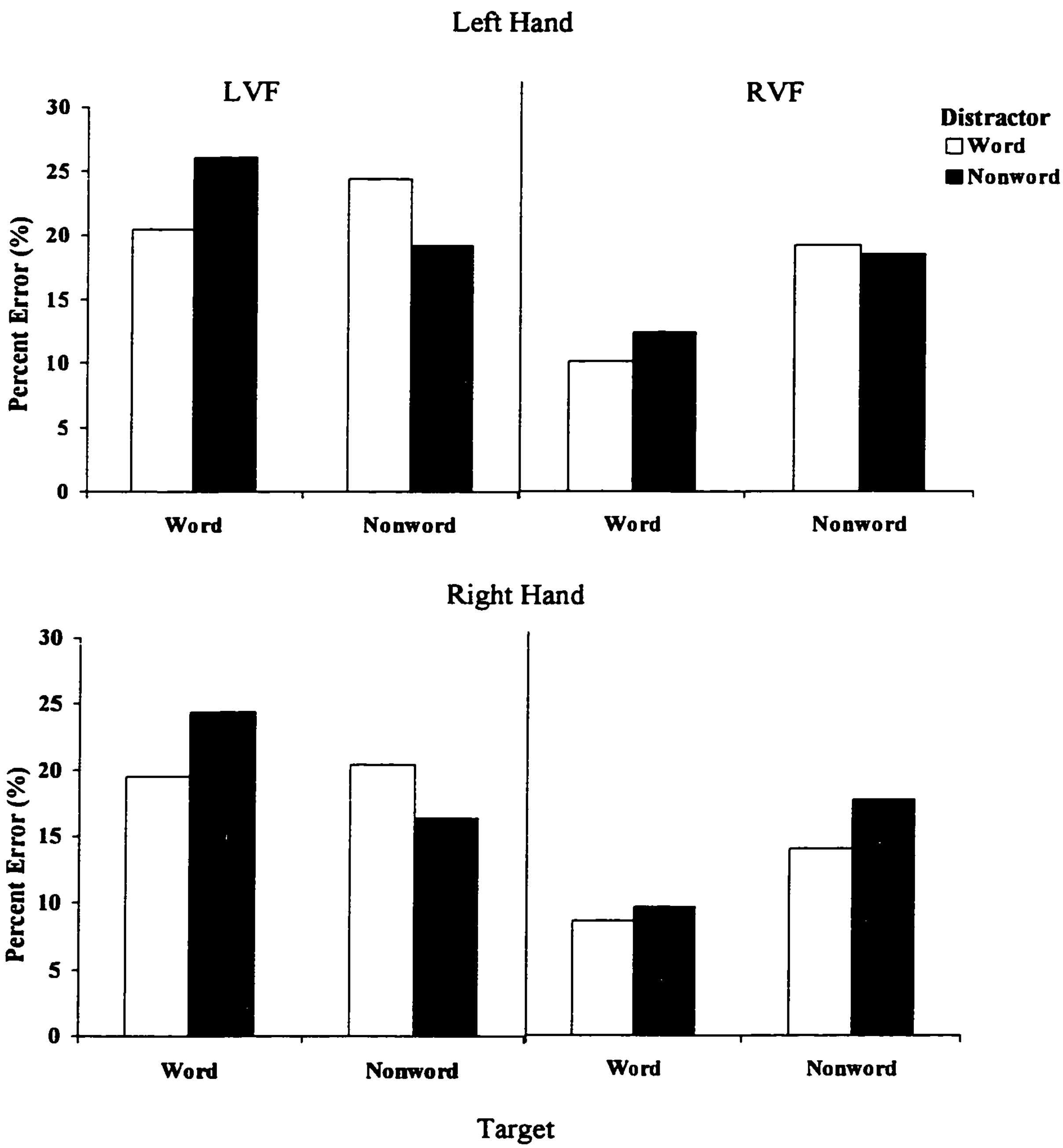


Figure 10. Experiment 2: Mean percent error for men as a function of target type and distractor type.

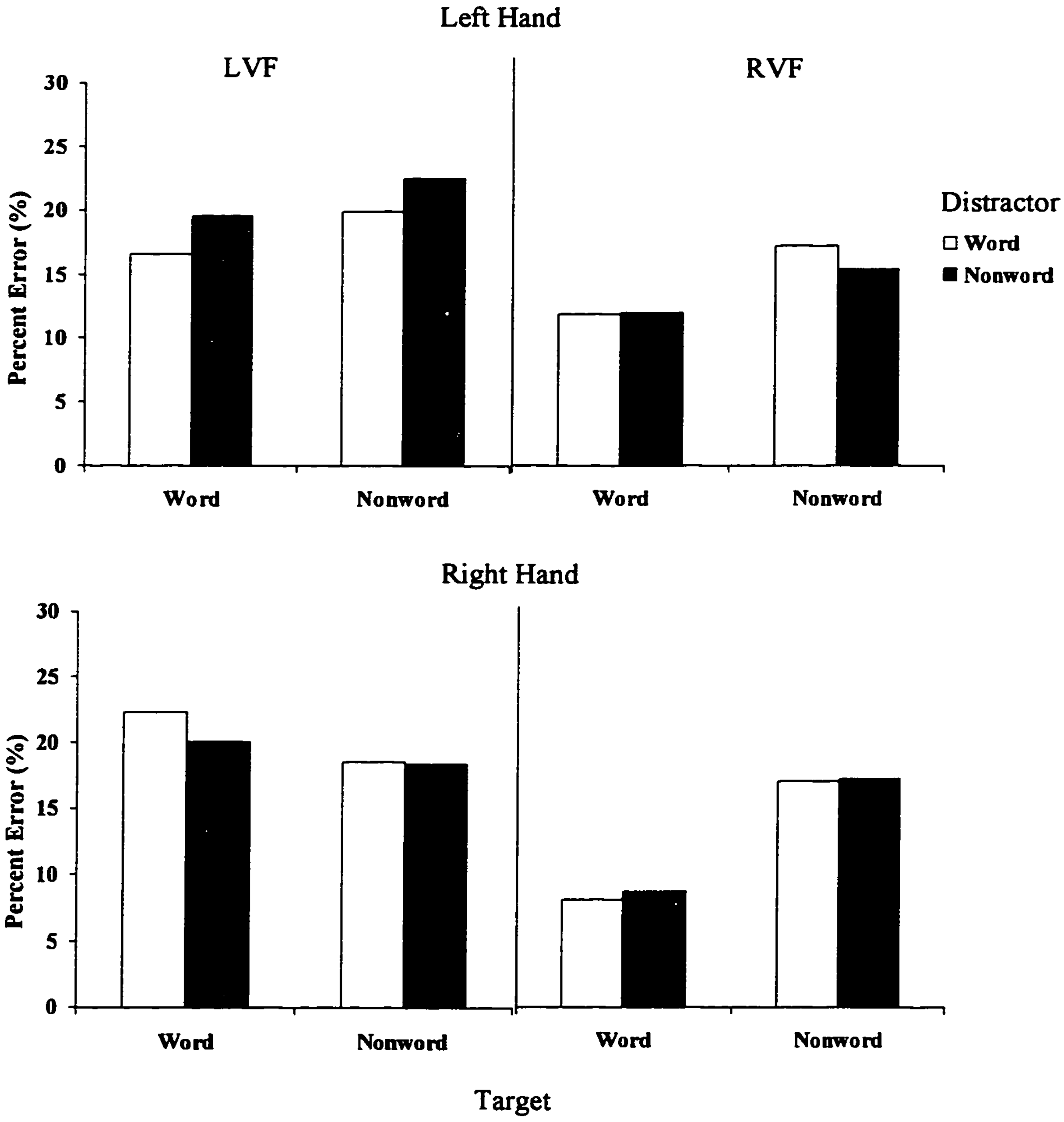


Figure 11. Experiment 2: Mean percent error for women as a function of target type and distractor type.

Pattern of Hemispheric Processing

Given that men demonstrated lexicality priming, then in order to demonstrate that this effect occurs in the context of direct access processing (as reported by Iacoboni and Zaidel, 1996), men must also demonstrate a hand by visual field interaction (an attenuation of the RVFA when responding with the left hand).

Response Times. Correct response times are plotted as a function of response hand and visual field in Figure 12 for men and in Figure 13 for women. Men showed no evidence of an interaction between response hand and visual field ($F<1$), suggesting that they performed the lexical decision using the left hemisphere in a callosal relay pattern of processing. In contrast, women demonstrated a larger RVFA with their right hand than with their left for word targets $F(1,33)=4.27$, $p=.047$, indicating a direct access pattern of hemispheric processing.

Error Rates. Percent error is plotted as a function of response hand and visual field in Figure 14 for men and in Figure 15 for women. Male subjects showed no evidence of an interaction between response hand and visual field ($F<1$), a finding that is consistent with the response time results and indicates a callosal relay pattern of hemispheric processing. In contrast, women demonstrated a larger RVFA with their right hand than their left for word targets $F(1,33)=12.52$, $p=.001$, indicating a direct access pattern of hemispheric processing.

In summary, without an analysis that included the sex of the subjects, the results of the present experiment appeared to replicate those of Iacoboni and Zaidel (1996), in that the overall results indicated lexicality priming in the presence of a direct access pattern of processing. However, the analyses of response time and error data for men and women revealed that men followed a callosal relay pattern of hemispheric processing and demonstrated lexicality priming, whereas women followed a direct access pattern of processing and did not demonstrate lexicality priming. This finding is consistent with the idea that women show less hemispheric specialization than men, and may therefore possess a right hemisphere that is more capable of carrying out a lexical decision (Bryden, 1989; McGlone, 1980). The results of Experiment 2 are consistent with those of Experiment 1; both sets of results indicate that lexicality priming is not an interhemispheric effect but rather an effect that occurs within the left hemisphere.

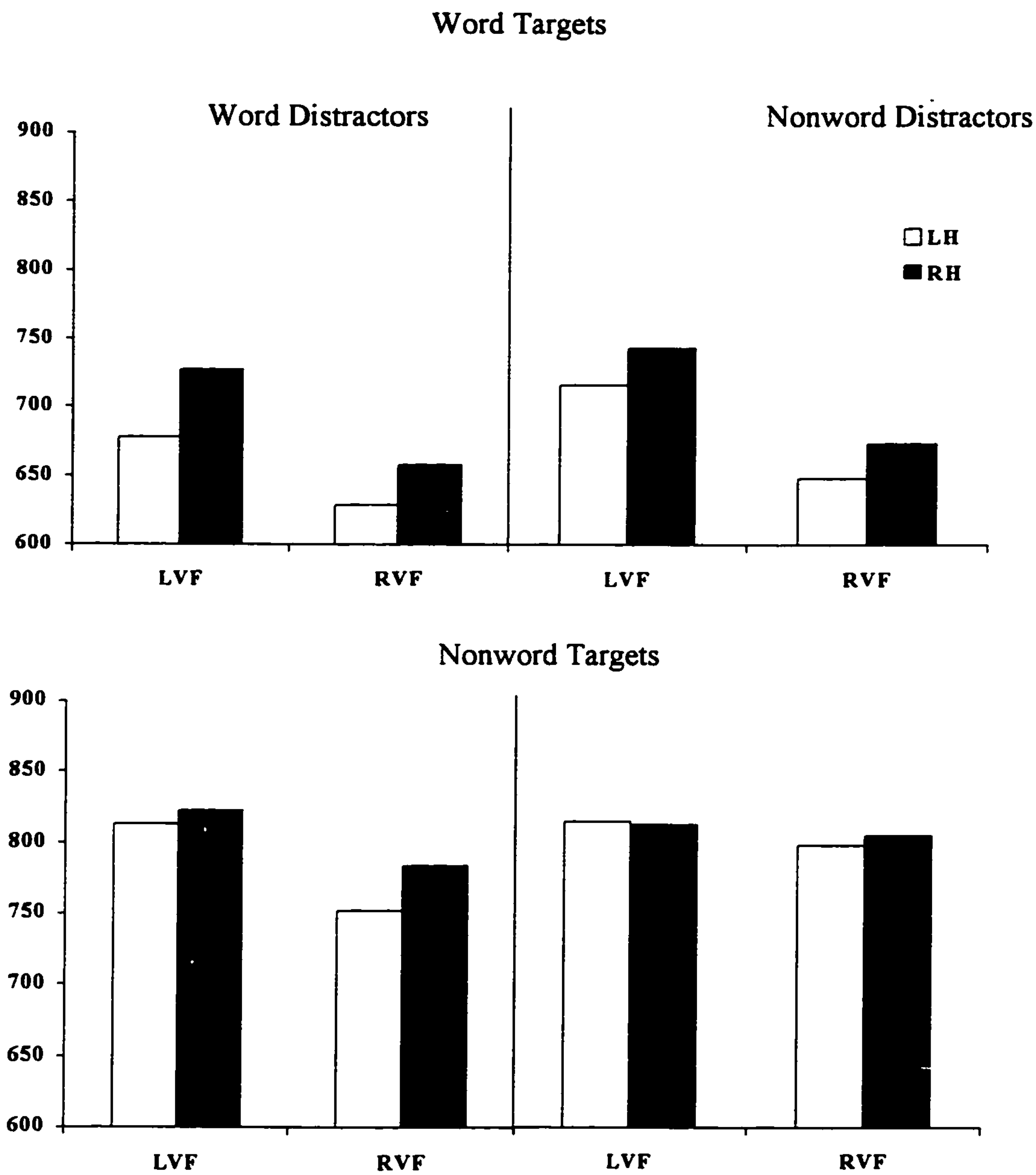


Figure 12. Experiment 2: Mean correct response time for men as a function of response hand and visual field.

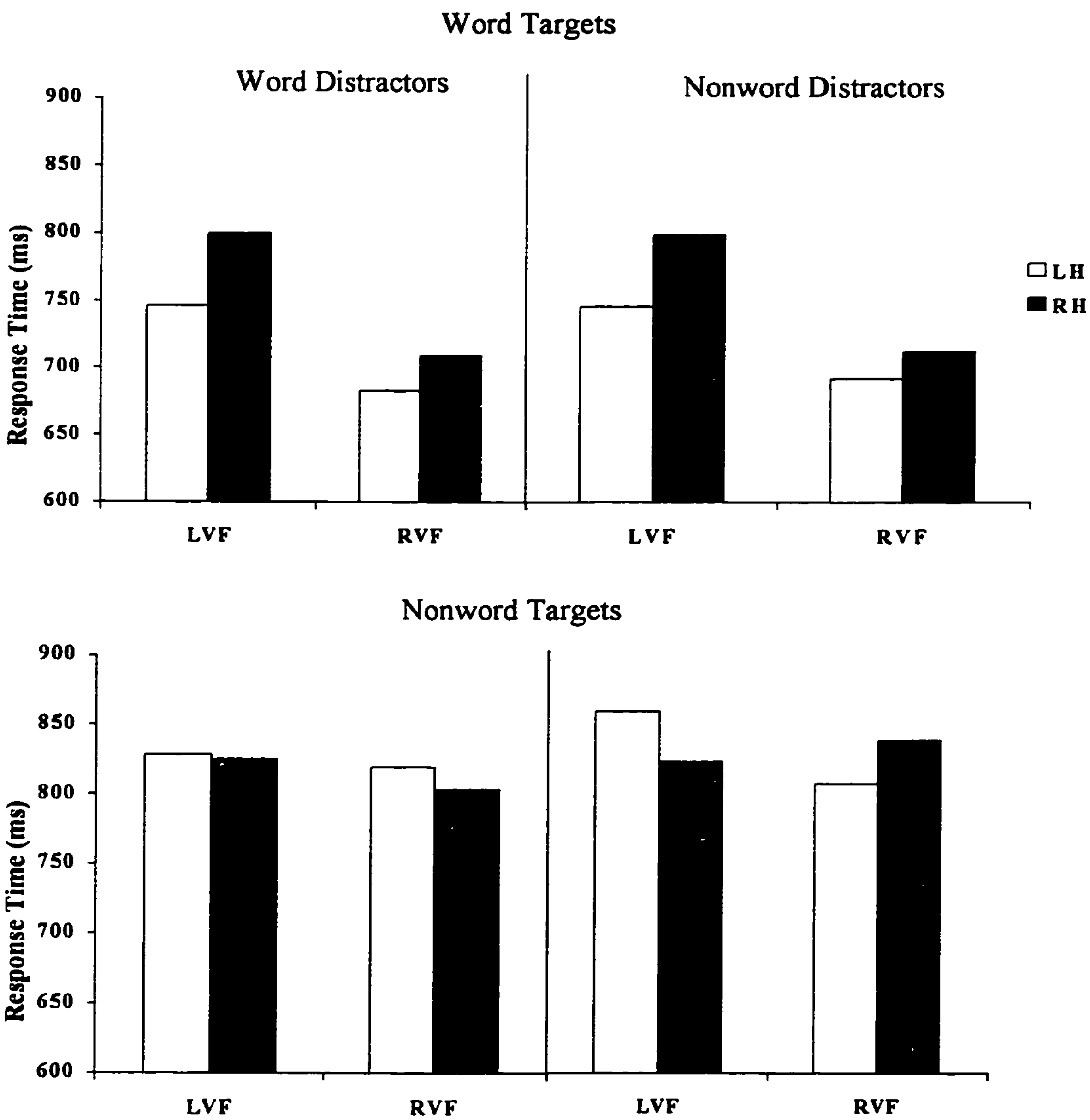


Figure 13. Experiment 2: Mean correct response time for women as a function of response hand and visual field.

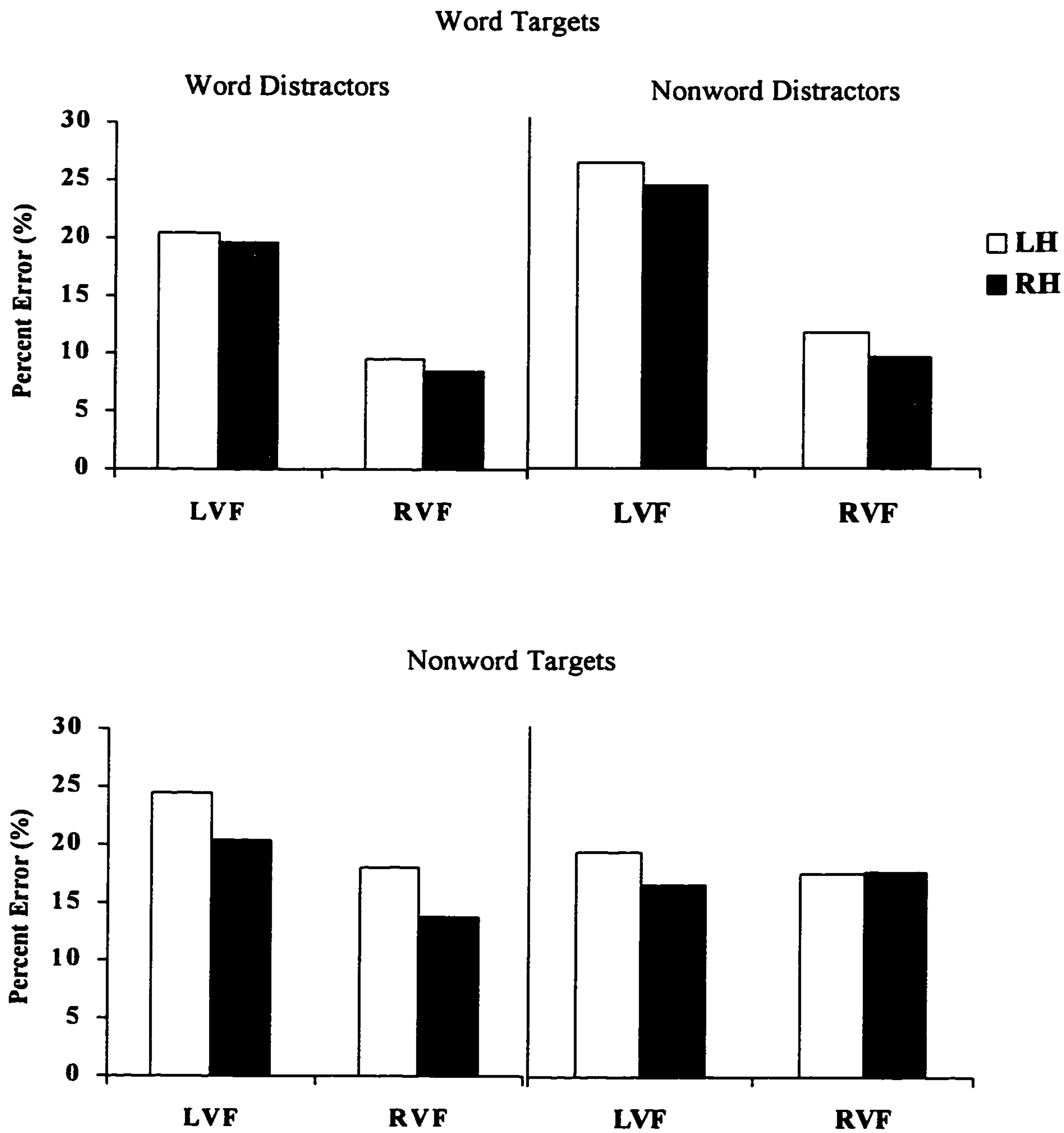


Figure 14. Experiment 2: Mean percent error for men as a function of response hand and visual field.

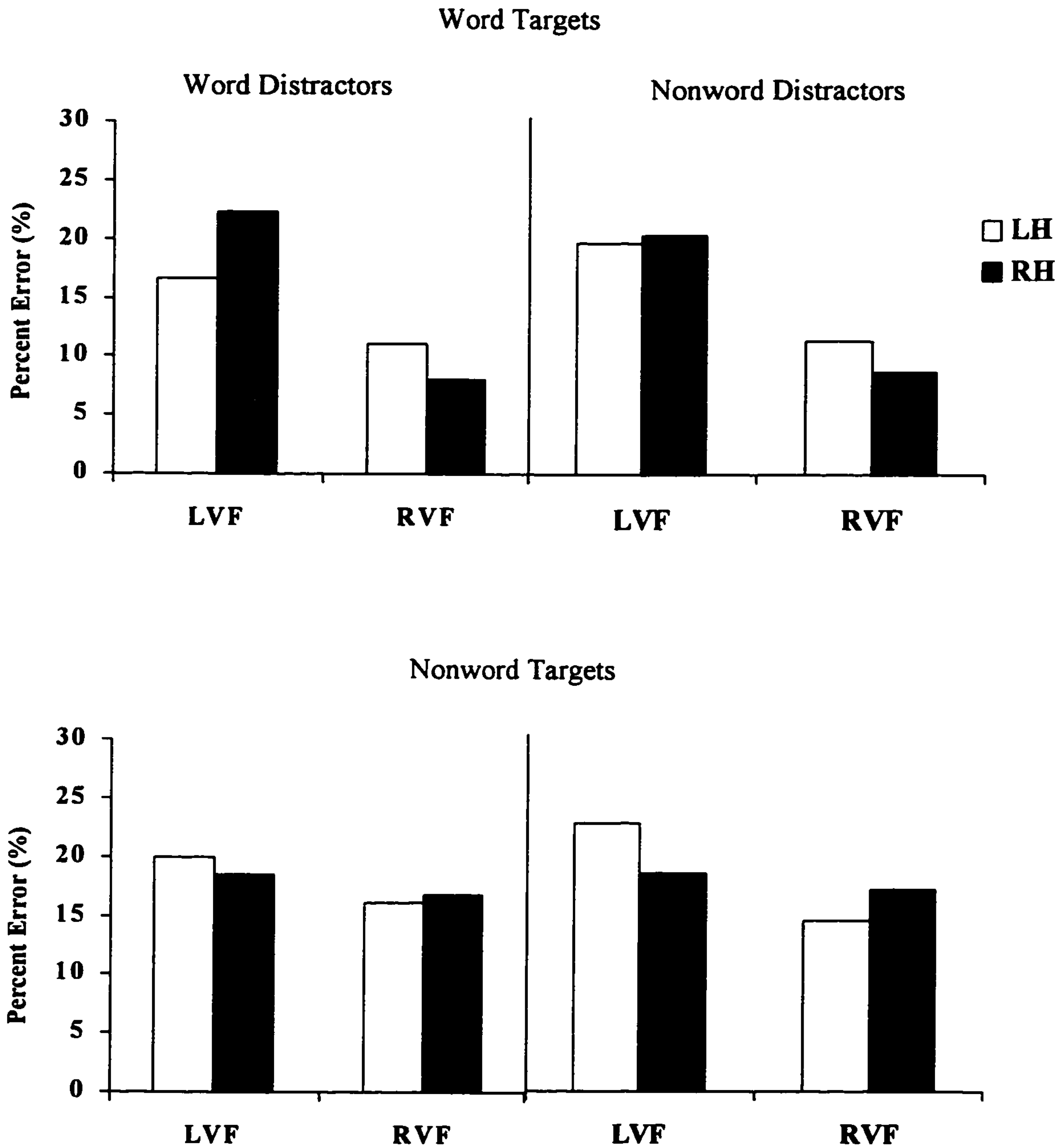


Figure 15. Experiment 2: Mean percent error for women as a function of response hand and visual field.

EXPERIMENT 3

Lexicality priming has not been investigated in central vision. In order to determine whether lexicality priming occurs when the stimuli are presented centrally, and whether the magnitude of the effect differs between central and bilateral lateralized presentations, Experiment 3 compared these two types of presentation. Given that the results of Experiments 1 and 2 indicate that lexicality priming is an effect that occurs within the left hemisphere, it follows that lexicality priming should be found using central presentations (for which lexical processing is thought to occur in the specialized hemisphere), and that the magnitude of the effect should be similar for central and lateralized presentations. Furthermore, it was expected that women would demonstrate lexicality priming when the stimuli were presented centrally, even if they exhibited a direct-access pattern of processing and did not demonstrate lexicality priming for the lateralized presentations.

Method

Participants

Participants were 72 right-handed undergraduate students (36 men and 36 women) who participated in the experiment for pay. All subjects had normal or corrected-to-normal vision and were native speakers of English.

Stimuli and Apparatus

The stimuli and computer equipment were the same as those described in Experiment 2. As in Experiment 2, stimuli were presented in a black courier font on a white background. Four-letter strings subtended 1.3° of visual angle, and five-letter strings subtended 1.5° of visual angle. In order to precue locations the same distance from fixation in both the above/below and left/right conditions, an asterisk was used instead of the underscore that was used in Experiments 1 and 2. The asterisk subtended 0.2° of visual angle and was centered in the target location 1.7° of visual angle away from fixation.

Procedure

Subjects were instructed that their task was to decide whether the cued string formed an English word or not, while ignoring the string in the opposite visual field. Each trial began with the presentation of a central fixation cross that remained in place throughout the trial. The location of the target was precued by a 30 ms presentation of an asterisk that began 800 ms after the onset of fixation. The offset of the precue was followed by a 30 ms ISI during which only the fixation cross remained on the screen. The pair of letter strings was then presented for 135 ms, followed by a blank white screen that remained in place until the subject responded.

Subjects were tested individually in a 30-minute session that consisted of two blocks of lateralized presentations and two blocks in which the letter strings were placed above and below fixation (each subject completed a block with each response hand for each condition). In addition, each subject completed a block of 60 practice trials for each presentation mode, just prior to completing the two blocks of experimental trials for that condition. All practice trials were completed with the right hand, and the same letter strings were used for both sets of practice trials. The response keys were the same as those used in Experiment 2; [m] and [k] for the right hand and [c] and [d] for the left hand. The order of the experimental blocks (presentation condition and right- and left-hand responses) was counterbalanced across subjects. Subjects were informed that for each condition targets appeared in each location with equal probability, and that 50% of targets were words and 50% were nonwords. Instructions emphasized both speed and accuracy of response. Targets were counterbalanced across subjects so that each target appeared in each location, paired with each type of distractor (word or nonword), and was responded to with each hand.

Results and Discussion

Data Reduction and Initial Analyses

Correct response times and percent errors were averaged across items for each visual field (left and right), presentation type (lateralized and central), response hand (left and right), target type (word and nonword), distractor type (word and nonword), and by subject. Outlying response times were identified using a simple recursive outlier procedure with a criterion of 3 standard deviations (Van Selst & Jolicoeur, 1994). Fewer than 1% of data points were excluded on this basis. Means for both dependent measures were submitted to separate mixed-design analyses of variance (ANOVAs) in which sex was a between-subjects factor and visual field, presentation type, response hand, target type, and distractor type were within-subjects factors. A source table for the response-time analysis is presented in Appendix W, and for the error analysis in Appendix X. Individual subject data are included as Appendices Y and Z.

In order to compare the results for lateralized presentations in the same format as that used for Experiments 1 and 2, the results of separate 2(sex) × 2(response hand) × 2(visual field) × 2(target type) × 2(distractor type) ANOVAs performed for the lateralized condition are reported first. Notably, a robust RVFA was observed for both correct response time

$F(1,70)=55.93$, $p<.001$, and for percent error $F(1,70)=55.93$, $p<.001$. The RVFA was larger for word targets in both response time $F(1,70)=8.17$, $p=.006$, and percent error $F(1,70)=56.31$, $p<.001$. Men responded more quickly than women overall $F(1,70)=8.59$, $p=.005$, but accuracy did not differ between men and women ($F<1$). The results for Experiment 3 were intended to mirror the evidence provided by Experiments 1 and 2 against Iacoboni and Zaidel's (1996) claim that lexicality priming in bilateral lexical decision results from interhemispheric interaction between stimuli that are processed independently in each hemisphere. Accordingly, the results for the lateralized presentations in Experiment 3 are presented in terms of the relation between target and distractor to reflect lexicality priming, and the relation between response hand and visual field, to reflect hemispheric processing pattern. ANOVA tables for these sex (2) × target (3) × distractor (2) × visual field (2) × response hand (2) analyses are presented as Appendix AA for response times and Appendix BB for errors.

Lexicality Priming

Response Times. Mean correct response times are plotted for all subjects as a function of target type and distractor type in Figure 16. There was no evidence for a lexicality priming effect in the response time data ($F<1$). However, there was a trend toward an interaction between sex, target, and distractor $F(1,70)=3.08$, $p=.084$. This result was consistent with the findings of Experiment 2 in that men showed evidence of a lexicality priming effect for this measure $F(1,35)=3.65$, $p=.064$, whereas women did not ($F<1$).

Error Rates. Mean percent errors are plotted for all subjects as a function of target type and distractor type in Figure 17. There was a robust lexicality priming effect in the form of a target type by distractor type interaction $F(1,70)=10.66$, $p=.002$, that did not differ for men and women $F(1,70)=1.47$, n.s. One-tailed t-tests revealed that responses to word targets were more accurate when the distractor item was a word $t(71)=2.67$, $p=.005$, and responses to nonword targets were more accurate when the distractor item was also a nonword $t(71)=2.33$, $p=.012$. It was not possible to examine response times for error trials to verify that this finding is not an artifact produced by subjects attending to the distractor rather than the target, because there were not enough errors in all cells to conduct this analysis. However, the results of this analysis for Experiments 1 and 2, and the fact that exogenous cues were used to orient the subjects' attention make this an unlikely explanation for the effect.

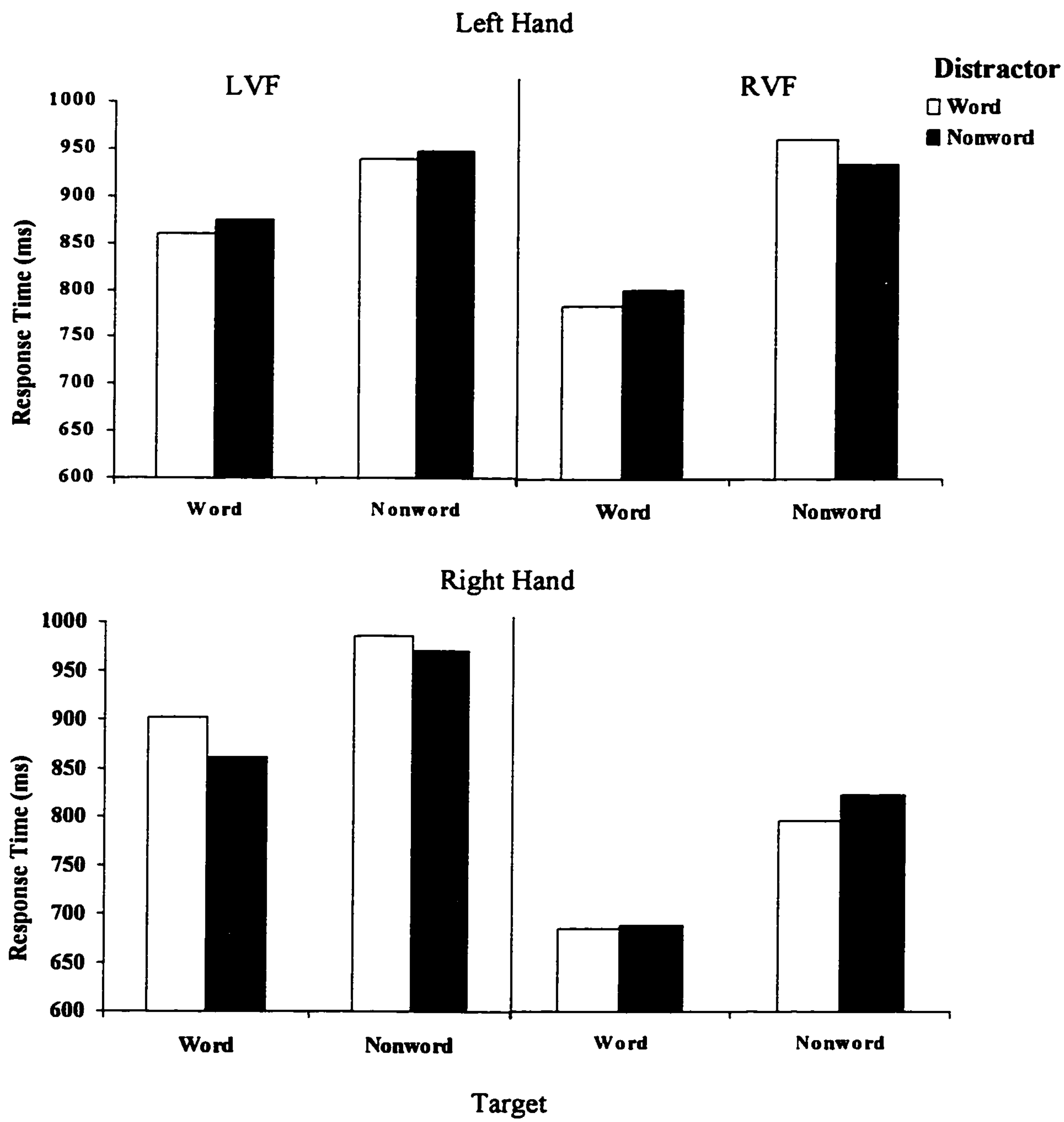


Figure 16. Experiment 3: Mean correct response time for all subjects as a function of target type and distractor type.

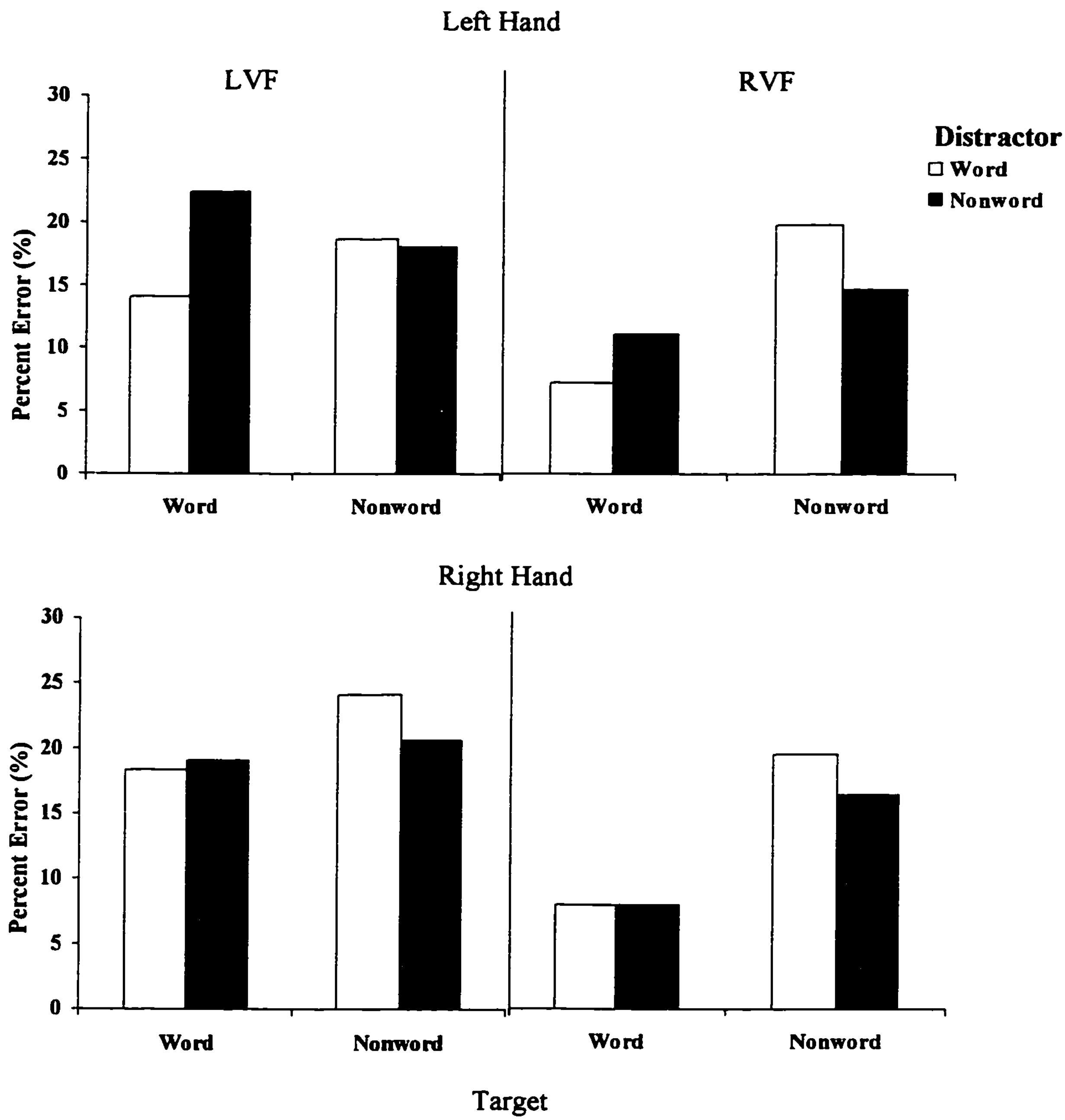


Figure 17. Experiment 3: Mean percent error for all subjects as a function of target type and distractor type.

Pattern of Hemispheric Processing

Given that both men and women demonstrated robust lexicality priming in the error data, a direct-access pattern of hemispheric processing would be expected for both men and women, (at least in the error data) if lexicality priming is to be considered an interhemispheric effect (Iacoboni & Zaidel, 1996). However, in order to be consistent with the results reported in Experiments 1 and 2, a callosal relay pattern of hemispheric processing would be predicted. Once again, a direct access pattern of hemispheric processing would be revealed by a hand by visual field interaction (an attenuation of the RVFA for left-hand responses), whereas a callosal relay pattern would result in main effects of both response hand and visual field but no interaction between these factors.

Response Times. Mean correct response times for all subjects are plotted as a function of response hand and visual field in Figure 18. Inspection of Figure 18 reveals that there was no interaction between the magnitude of the RVFA and response hand for either sex ($F<1$).

Error Rates. Mean percent error is plotted for all subjects as a function of response hand and visual field in Figure 19. There was no evidence for an attenuation of the RVFA with left-hand responses $F(1,70)=1.64$, n.s., reflecting a callosal-relay pattern of processing, and indicating that lexical decision was performed within the left hemisphere for both RVF and LVF stimuli.

In summary, both men and women demonstrated bilateral lexicality priming in Experiment 3. [Although this effect was significant only in the error data for women, the effect was robust in the error data and there was no evidence of a speed-accuracy tradeoff]. In addition, neither sex showed any evidence of a larger RVFA when responding with the right hand, which indicates that all subjects were performing the task within the left hemisphere, relying on a callosal-relay pattern of hemispheric processing. Thus, Experiment 3 provides strong evidence that when women demonstrate a callosal relay pattern of hemispheric processing, they also demonstrate lexicality priming. This bolsters the argument made in with respect to Experiment 2; when subjects show lexicality they are processing both stimuli within the left hemisphere through callosal relay.

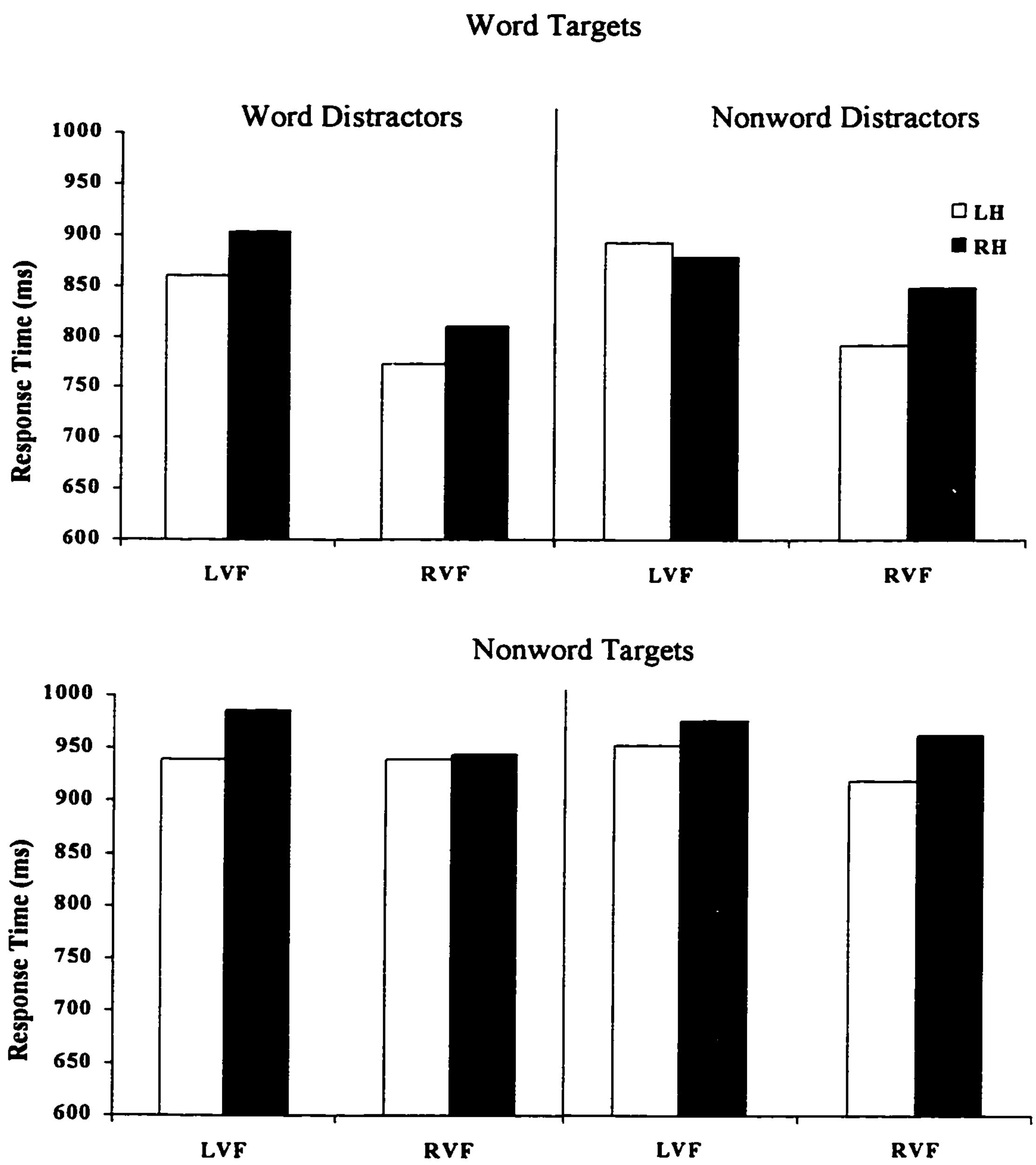


Figure 18. Experiment 3: Mean correct response time for all subjects as a function of response hand and visual field.

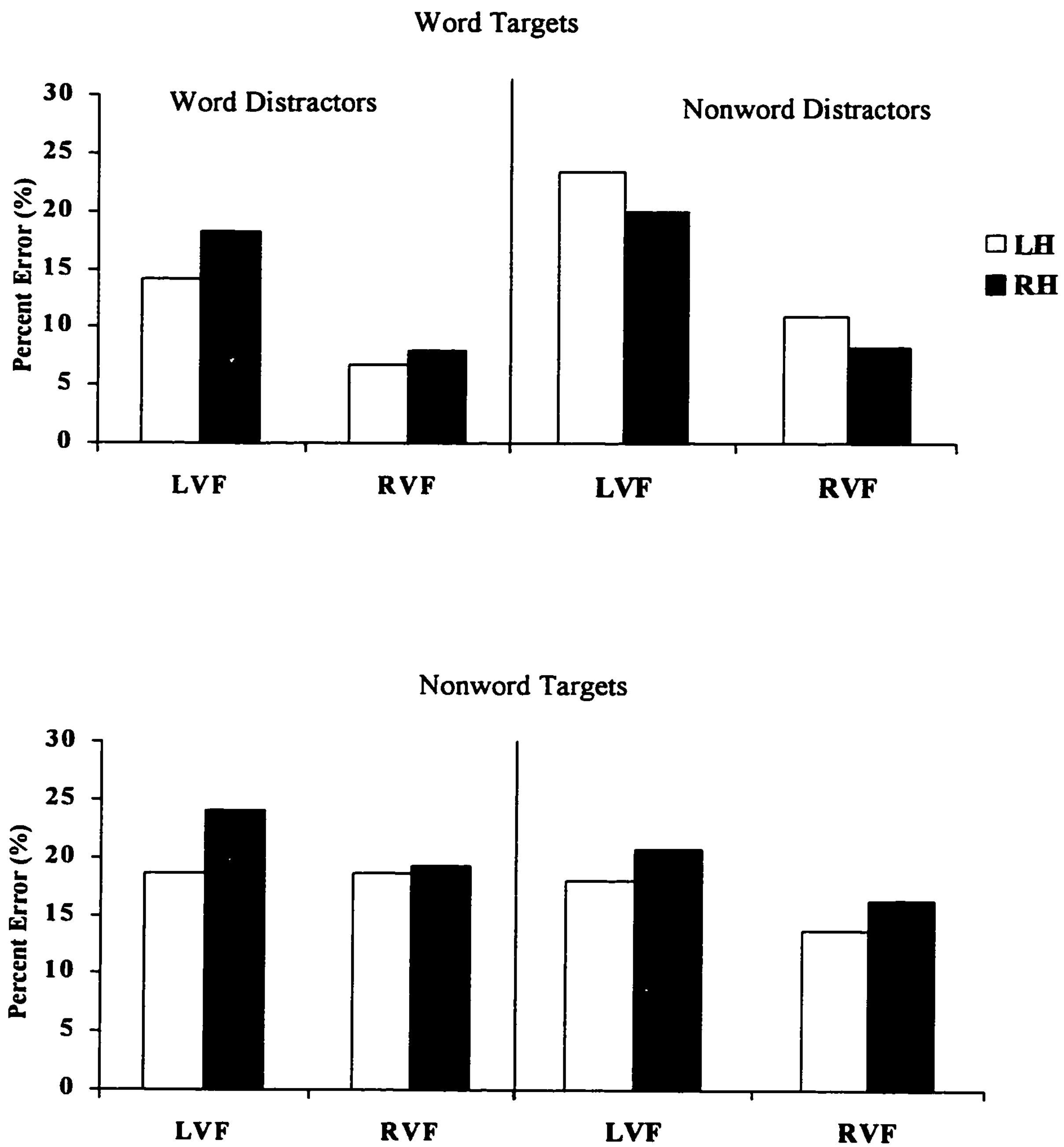


Figure 19. Experiment 3: Mean percent error for all subjects as a function of response hand and visual field.

Central Presentation Conditions

If lexicality priming results from processing within the left hemisphere, then it should be possible to find a lexicality priming effect of a similar nature when the letter strings are presented above and below the fixation cross as when they appear to the left and right. In both cases the left hemisphere is performing the processing of the stimuli.

Response Times. Mean response times are plotted as a function of target type and distractor type for the above/below manipulation in Figure 20 and an ANOVA table for this sex (2) × target (3) × distractor (2) × visual field (2) × response hand (2) analysis is presented as Appendix CC. [Individual subject data are presented in Appendix DD]. Lexicality priming was observed for central presentations in the form of a target by distractor interaction, $F(1,70)=5.16$, $p=.026$. Responses to word targets were faster when the distractor was also a word $t(71)=2.04$, p=.022. Lexicality priming effects in response time were somewhat larger for central as compared with lateralized presentations $F(1,70)=5.16$, $p=.026$ (partly due to nonsignificant effects opposite the predicted direction for the nonword targets). If lexicality priming were an effect that arises only from interaction across the cerebral hemispheres, a small or nonexistant effect would be predicted for central presentataions.

Error Rates. Mean percent error is plotted as a function of target type and distractor type in Figure 21 and an ANOVA table for this sex (2) × target (3) × distractor (2) × visual field (2) × response hand (2) analysis is presented as Appendix EE. [Individual subject data are included as Appendix FF]. There was a significant lexicality priming effect for central presentations $F(1,71)=9.17$, $p=.003$. One-tailed comparisons revealed that responses to word targets were more accurate when the distractor was also a word $t(71)=1.89$, $p=.032$. The magnitude of the lexicality priming effect for central presentations did not differ from that of lateralized presentations for men or women ($F<1$). The fact that central and lateralized presentations are similar in this regard suggests that lexicality priming is the result of similar processes in both presentation types. This finding is generally consistent with the idea that lexicality priming is the result of left-hemisphere processing of both the target and distractor items even for lateralized presentations, given that for central presentations both target and distractor would be expected to be processed by the specialized hemisphere.

In summary, both men and women demonstrated bilateral lexicality priming in Experiment 3, whereas neither sex showed any evidence of an interaction between visual field and response hand. This confirms that lexicality priming is an effect that occurs only when the lexical processing of the stimuli is accomplished through callosal-relay. That is, when women demonstrate a callosal relay pattern of processing they also demonstrate lexicality priming. It is unclear why the female subjects in Experiment 3 processed the stimuli according to a callosal-relay pattern whereas those in Experiment 2 processed the stimuli according to a direct-access pattern. Stimuli were presented for only 135 ms in Experiment 3, as compared with 165 ms in Experiment 2 (this change was required to accommodate the different cue and keep the duration short enough to prevent subjects from fixating the stimuli). Overall response times were longer for Experiment 3. It may be that exposure duration or overall processing time influences whether or not responses can be based on lexical decisions made within the right hemisphere.

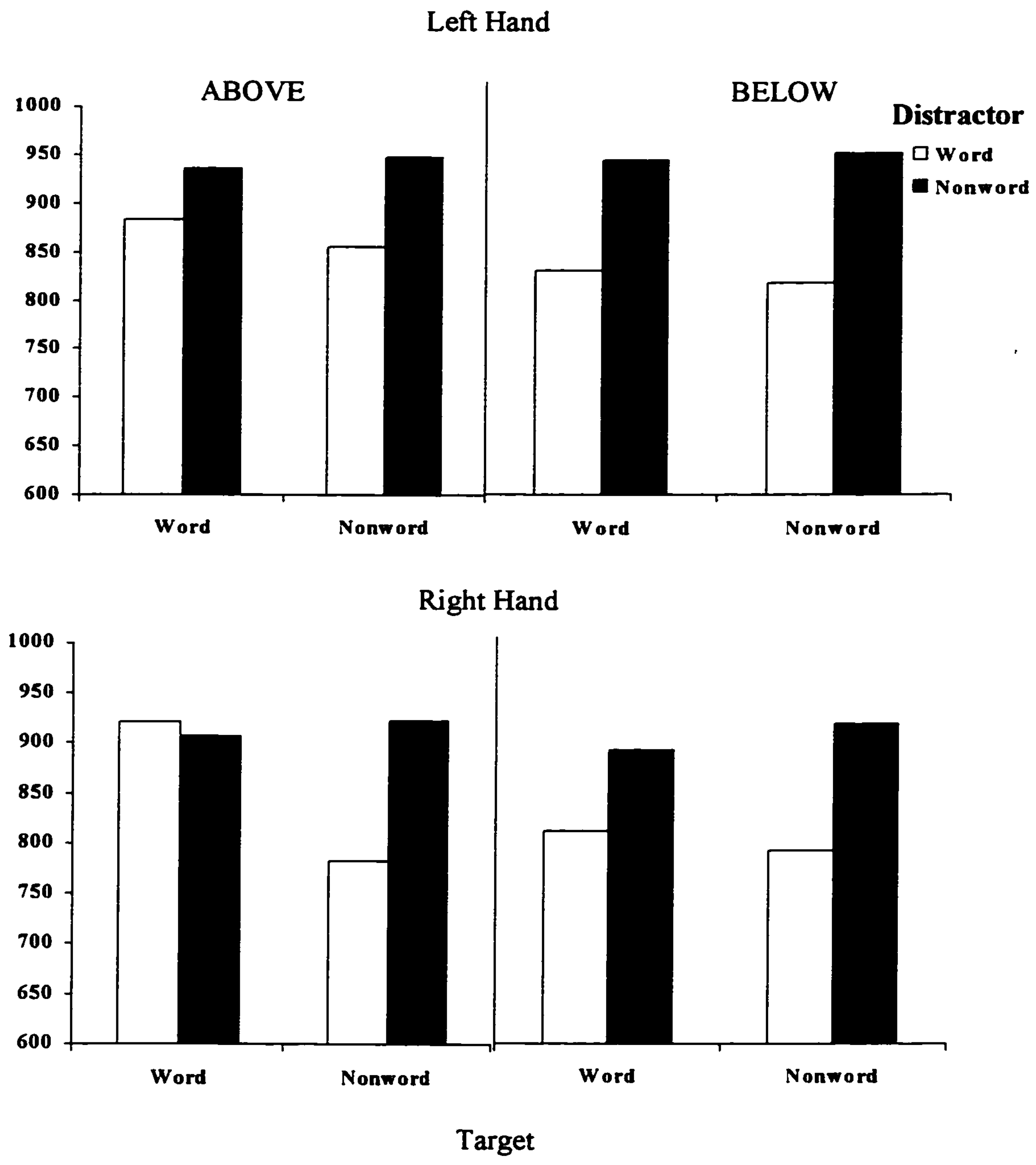


Figure 20. Experiment 3: Mean correct response time for the above/below conditions as a a function of target type and distractor type.

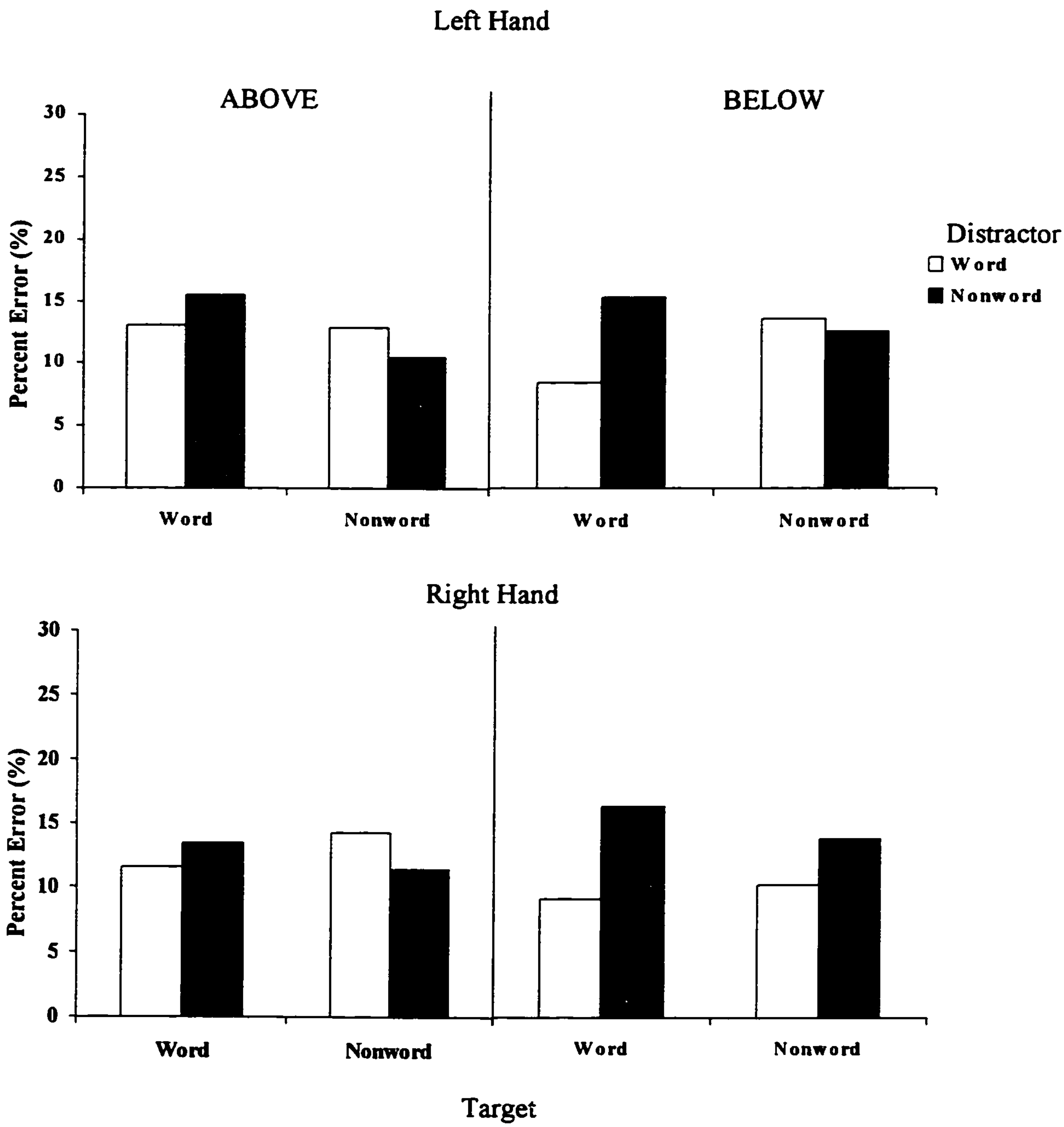


Figure 21. Experiment 3: Mean percent error for above/below conditions as a function of target type and distractor type.

GENERAL DISCUSSION

This series of experiments was designed to investigate the extent of hemispheric interaction in bilateral word recognition. Boles (1995) and Iacoboni and Zaidel (1996) have argued that bilateral presentations force the two hemispheres to process stimuli independently, in a "direct access" pattern of processing. Iacoboni and Zaidel reported a lexicality priming effect in a bilateral lexical decision experiment in which there was evidence for direct-access processing. They concluded that lexicality priming is a high-level interaction between stimuli that are processed independently in opposite hemispheres. The three experiments presented in this thesis used exogenous cues to ensure that subjects responded to the target item, and used stimulus and response manipulations to test the claim that lexicality priming can occur between stimuli processed independently in each hemisphere.

Experiment 1 tested for lexicality priming in the presence of direct access by using an imageability manipulation to determine whether stimuli that were initially presented to the right hemisphere were processed by the more competent left hemisphere (callosal relay) or within the right hemisphere (direct access). A callosal relay pattern of processing was inferred from the fact that imageability effects were not larger in the RVF. Lexicality priming was observed in the context of callosal relay and not direct access. In Experiment 2, a response-hand manipulation was used to evaluate the pattern of hemispheric processing. The results were superficially similar to those reported by Iacoboni and Zaidel (1996) in that both lexicality priming and a hand by visual-field interaction were observed. However, both of these effects interacted with sex such that only women demonstrated the visual-field by response hand interaction, and only men demonstrated lexicality priming. Therefore, lexicality priming was observed only in the presence of evidence for a callosal relay pattern, but not for a direct access one. Experiment 3 also used a response hand manipulation with slightly different stimulus parameters. Both men and women displayed lexicality priming, and both men and women also displayed callosal relay rather than direct access. Thus, the results of these three experiments indicate that lexicality priming is not a form of interhemispheric interaction between stimuli that receiving independent lexical processing in the two hemispheres. Rather, it a form of priming that occurs when both target and distractor are processed within the left hemisphere (through callosal relay).

This result differs from Iacoboni and Zaidel's (1996) report of lexicality priming in the context of direct-access processing. Iacoboni and Zaidel's result could have been an artifact produced by subjects responding to the distractor item on some trials, or could have been a consequence of combining men and women, who have different hemispheric-processing patterns. The sex differences observed in Experiment 2 are consistent with the idea that women are less lateralized than men (Bryden, 1989; McGlone, 1980), in that women demonstrated right-hemisphere (direct-access) processing of the LVF targets whereas men did not. Weekes and Zaidel (1996) examined lexicality priming at high- and low-estrogen phases of the menstrual cycle, using lexicality priming as a "measure of interhemispheric interaction"(p278), and concluded that lower estrogen levels are associated with greater interhemispheric interaction. Despite their questionable conclusion, Weekes and Zaidel's data are consistent with the literature on sex differences in lateralization, and with the results of the present experiments. Specifically they found that women demonstrated lexicality priming during the low-estrogen menstrual phase, but not during the high estrogen mid-luteal phase of the cycle. Women are less lateralized during the high estrogen phase of the menstrual cycle (see Mead and Hampson, 1996, for a review), reflecting greater right hemisphere involvement in language processing and therefore a greater probability of direct access. So, the phase at which women are most likely to have a callosal-relay pattern of processing is also the phase of the cycle in which Weekes and Zaidel found that women showed lexicality priming. This is consistent with the findings of the three experiments reported here in that lexicality priming was not observed under a direct-access pattern but was observed under callosal-relay pattern. Differences in levels of endogenously cycling ovarian hormones among participants not taking birth-control medication might therefore be an important factor influencing individual differences in the patterns of hemispheric processing that are likely to be present in this task. Other sources of individual differences in pattern of hemispheric processing could result from strategic differences as well as degree of lateralization. That is, it is likely that people who have a more bilateral linguistic processing are more predisposed to accomplish linguistic tasks through direct access and would accordingly be less likely to demonstrate callosal relay. In addition, strategic differences such as how long a search for a lexical match is carried out before a no response may also underlie individual differences in patterns of hemispheric processing. Therefore, an experiment that estimates the degree of direct access processing across many trials and relates that estimate to the amount of lexicality priming observed for individuals with varying degrees of language lateralization would further contribute to the study of interhemispheric interaction.

An assumption that underlies the use of bilateral presentations is that it forces a direct-access pattern of processing (Boles, 1995; Hines, 1975; Iacoboni and Zaidel, 1996). The present series of experiments suggests that this assumption is invalid. Clearly a callosal relay pattern of hemispheric processing can be observed with bilateral presentation. Conflicting accounts of the dynamics of hemispheric processing may result from simplistic models in which the LVF stimulus is processed *either* entirely within the right hemisphere *or* is sent to the left hemisphere for lexical processing. Perhaps a more realistic view is that the LVF stimulus is available to both hemispheres and is therefore processed in parallel. A response may then be determined by the hemisphere that first arrives at a solution. This type of horse race model implies that a callosal relay pattern will be observed when the left hemisphere wins, and a direct access pattern will be observed when the right hemisphere wins. Because a left visual field stimulus is delayed in reaching the left hemisphere a callosal-relay pattern of processing may only be observed when the right hemisphere is relatively incompetent at the task. This mechanism does not require a callosal gate that is closed under direct access but open under callosal relay (cf. Banich, in press). Instead, both hemispheres process the stimuli on every trial. However, whether a direct access or a callosal relay pattern of processing is observed depends on relative speed of processing. This model is testable through the use of stimulus and SOA manipulations that either degrade or delay the onset of RVF stimuli. That is, by independently manipulating the amount of time each hemisphere has to process the stimuli it may be possible to shift processing from a callosal relay pattern to a direct access pattern for the same stimuli. Such a finding would indicate that there is no early decision mechanism responsible for deciding whether a stimulus should be shuttled to the left-hemisphere for processing based on the type of stimulus presented, as Banich (in press) has suggested.

The laterality literature is rife with studies in which LVF presentation is assumed to reflect right-hemisphere processing. The findings reported here underscore the importance of testing assumptions about locus of processing before drawing conclusions about the nature of interhemispheric interaction.

Appendix A

Experiment 1: Stimuli

Targets				Distractors			
HIGH	LOW	NON	NON	HIGH	LOW	NON	NON
ankle	above	alipe	magar	apple	adage	aisen	mabor
arrow	abuse	arpow	mants	apron	alias	angim	malex
bible	allow	bause	maves	bloat	amaze	apens	mally
black	aside	befts	mebal	blood	ample	bapet	mears
bread	audit	blape	merst	bloom	apply	beals	melly
burst	avoid	bobep	mirls	board	arbor	binko	menra
camel	aware	boist	mival	bosom	ardor	binse	mesly
candy	below	boody	moxic	boxer	arise	bloam	molks
chair	bonus	brime	munce	brain	array	bokes	morma
check	break	cates	nalon	bunny	await	boose	mugal
chick	carry	chunt	nerms	canoe	basis	cails	naise
chief	civil	cober	nings	clock	began	clany	nalpo
child	crime	coink	norry	coast	blunt	clisa	nelsa
cigar	delay	colks	numps	doors	cache	clite	nilla
dress	entry	crail	nunge	flesh	cause	codge	norat
flask	event	creck	oches	floor	cited	coise	nuggy
flood	exact	croll	ortan	fruit	claim	creal	obelm
grass	exist	crowl	palon	heart	clung	crids	ofert
horse	extra	cuzzy	peset	honey	comes	croom	oflat
jelly	fault	dafes	pinor	hotel	deity	dable	pakes
judge	folly	daisk	pives	house	dogma	daiky	piery
lunch	guess	daltz	ploss	layer	equal	dalls	pinat
money	ideal	dirpy	poans	lemon	error	dapra	pises
mouse	idiom	dramp	pofes	light	faked	doots	plang
night	irony	drusk	poose	lover	false	drofe	pober
nurse	issue	elest	prano	mucus	favor	droxe	pooms
onion	livid	evane	prids	naked	fixed	duppy	prain
penny	logic	fagle	quare	noose	fraud	evilt	proat
piano	loyal	fandy	ralty	ocean	given	falet	pulbs
pilot	minor	farna	ritty	opera	giver	fanct	queln
plant	moral	feads	roins	paper	gloom	fanit	rebes
puppy	noble	ferpy	salls	peach	going	fenge	rount
queen	noisy	fleak	scoke	pupil	inner	finam	sawls
radio	occur	floak	screl	rifle	limit	fings	scalt
river	often	fosty	serby	salad	lithe	flamp	scord
robin	order	freck	sholy	sauce	loose	fleal	serla
shave	owner	froin	silad	skirt	maker	frade	sheel
sheep	oxide	geard	smone	skull	maybe	frint	shreg
shirt	plead	gevil	soats	smile	mercy	frote	sifla
shoes	proxy	glane	spoes	snake	offer	gelar	skems

shore	quick	goids	stips	spray	pause	gevip	sloam
slate	ready	gring	suffy	steak	prior	glome	staps
slave	refer	grock	tapel	steam	proof	grafe	stoil
slush	reign	hamps	tatch	stone	quiet	gunch	taple
storm	scorn	heach	tenim	swamp	realm	hapes	teign
stove	stoic	hetch	tinen	table	relax	heeks	thase
strip	style	hises	trask	toast	reply	hepit	tinem
sugar	taken	hules	triat	towel	shall	hotor	treak
thorn	topic	jamps	trool	tower	skill	idalt	trefa
tiger	trade	jends	tupil	truck	smart	iroat	trobe
tooth	truly	klags	vears	uncle	sober	jatch	truit
trunk	trust	krade	vibal	wagon	tried	koist	varem
twist	usual	labit	virso	whale	truth	labes	vesps
water	vista	lepon	wrint	woman	vague	lasps	vinom
white	witty	lings	wurge	women	value	lexot	waily
witch	worth	lusky	zoats	woods	wrong	loppy	yases

Appendix B

Experiment 1: Omnibus Analysis of Variance of Response Times

Sex (2) × Target (3) × Distractor (3) × Visual Field (2)

Source	df	MS	F	p
Sex	1	523425.39	.58	.449
within	62	900100.49		
VF	1	3013838.20	45.85	.000
Sex × VF	1	200.43	.00	.956
within	62	65737.10		
Target	2	5236872.50	65.12	.000
Sex × Target	2	8934.82	.11	.895
within	12	80420.85		
Distractor	2	11324.34	.62	.540
Sex × Distractor	2	64617.18	1.77	.175
within	12	18292.92		
VF × Target	2	154493.97	5.85	.004
Sex x VF × Target	2	34815.59	1.32	.271
within	124	25421.26		
Distractor × VF	2	5637.07	.29	.747
Sex × Distractor × VF	2	28714.24	1.49	.230
within	124	19288.01		
Target × Distractor	4	43880.15	2.27	.063
Sex × Target × Distractor	4	1409.37	.07	.990
within	248	19353.68		
VF × Target × Distractor	4	13796.57	.63	.639
Sex × VF × Target × Distractor	4	61818.45	2.84	.025
within	248	21788.13		

Appendix C

Experiment 1: Omnibus Analysis of Variance of % Error

Sex (2) × Target (3) × Distractor (3) × Visual Field (2)

Source	df	MS	F	p
Sex	1	2839.25	3.92	.052
within	62	724.51		
VF	1	50365.12	113.52	.000
Sex × VF	1	86.13	.19	.661
within	62	443.66		
Target	2	8028.17	20.21	.000
Sex × Target	2	467.84	1.18	.311
within	124	397.24		
Distractor	2	6.80	.04	.958
Sex × Distractor	2	97.59	.61	.544
within	124	159.59		
VF × Target	2	12300.53	47.90	.000
Sex × VF × Target	2	367.37	1.43	.243
within	124	256.80		
Distractor × VF	2	49.55	.35	.705
Sex × Distractor × VF	2	208.19	1.47	.233
within	124	141.45		
Target × Distractor	4	64.47	.40	.805
Sex × Target × Distractor	4	93.39	.59	.673
within	248	159.43		
VF × Target × Distractor	4	179.92	1.03	.392
Sex × VF × Target x Distractor	4	100.74	.58	.680
within	248	174.63		

Appendix D

Experiment 1: Individual Subject Data for Response Times

Image:			LVF Targ. Hi		Low		Non-Word		RVF Targ Hi		Low		Non-Word	
Dist:			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	Mean RT												
1	M	692	613	698	618	667	710	743	692	689	682	619	795	822
2	F	888	781	1085	934	1066	1056	939	718	797	789	1029	786	934
3	M	808	808	880	784	822	874	903	773	719	686	694	931	816
4	M	1075	1260	1570	1125	1170	1435	1208	655	629	780	899	1034	1294
5	F	742	805	751	700	694	762	694	686	815	720	754	760	779
6	F	826	939	727	985	759	885	894	659	587	748	724	925	894
7	F	1025	843	909	1019	1143	1197	1389	922	919	969	886	1091	1129
8	M	578	563	526	593	535	636	631	500	554	532	607	634	639
9	F	617	630	613	598	630	635	662	577	587	589	601	646	660
10	M	1247	1233	1475	1308	1428	1766	1588	856	695	1006	700	1368	1487
11	F	798	796	773	873	773	825	783	727	770	828	799	782	812
12	F	724	685	760	761	675	889	837	612	551	586	718	839	747
13	F	723	625	624	660	692	930	883	683	676	642	639	772	888
14	F	608	542	577	663	533	657	685	529	575	521	533	759	707
15	M	967	744	689	1100	1107	1133	1146	722	680	1111	771	1156	1082
16	F	860	835	789	1092	818	997	959	770	638	689	838	918	847
17	M	875	919	988	842	847	945	882	804	665	849	762	1036	825
18	M	775	1978	761	646	647	697	627	513	573	533	497	727	662

19	M	1007	1055	1085	970	833	1258	1227	776	834	830	1007	1089	1183
20	M	827	732	784	836	883	1000	1076	659	662	702	648	970	1029
21	M	655	646	619	718	763	669	738	549	600	621	560	710	694
22	F	629	646	785	681	711	659	652	574	523	507	492	667	687
23	F	706	705	679	712	690	816	735	670	636	612	675	742	788
24	F	819	797	821	937	750	891	863	686	745	690	733	970	896
25	F	841	1242	775	917	805	876	813	765	691	697	802	748	770
26	F	1381	1584	1137	1448	1388	1794	1547	1097	994	1174	1153	1552	1347
27	F	791	735	766	689	769	923	885	715	760	737	802	873	921
28	M	712	627	616	685	732	892	748	566	561	616	692	935	821
29	M	962	1002	1041	1015	1099	1207	1193	647	654	838	779	954	1219
30	M	662	553	599	594	631	812	829	564	537	636	617	825	730
31	F	589	635	578	583	586	625	646	494	516	539	565	679	606
32	M	872	898	820	736	786	1264	1265	692	882	620	963	867	836
33	M	758	685	738	844	854	781	815	616	815	714	806	764	811
34	F	705	728	681	727	790	825	710	607	608	660	621	750	695
35	F	803	816	807	776	781	910	809	706	861	679	698	936	862
36	M	664	689	647	592	658	765	775	575	601	591	647	736	731
37	M	1044	1091	834	927	827	1384	1468	692	812	960	868	1417	1041
38	M	1049	963	695	854	1127	1644	1062	892	826	854	738	1448	1123
39	F	1333	1115	1033	1622	2071	1454	1602	805	935	1115	1152	1605	1775
40	M	577	462	543	510	595	696	561	543	529	508	498	780	660
41	M	552	468	400	525	495	589	627	569	518	652	489	630	542
42	M	946	939	845	1018	864	1028	934	821	888	1072	894	972	907
43	F	845	700	760	737	733	984	911	775	806	842	984	984	971
44	F	940	798	802	734	775	1360	1257	904	645	752	682	1212	1246
45	F	1496	1169	1628	1350	1098	1939	1709	1442	1197	1227	1779	1800	1665
46	M	780	789	784	786	790	858	957	691	684	692	770	828	763
47	M	956	1033	885	968	941	864	1025	841	854	1028	880	1137	878
48	M	1050	1073	1140	1043	915	1467	1097	856	816	790	1180	1108	1069
49	M	1005	974	1038	1138	1061	1318	1191	819	898	860	729	994	968
50	M	831	838	881	739	726	1111	1151	646	621	770	686	979	739

51	F	862	695	750	835	789	1165	1036	775	698	771	832	978	968
52	F	702	705	685	742	657	786	836	559	539	632	671	790	820
53	M	1132	1109	1035	1056	1285	1433	1483	933	912	870	857	1293	1420
54	M	759	632	740	703	698	902	888	606	628	686	777	959	955
55	F	757	821	898	746	844	908	747	571	585	656	582	903	759
56	M	917	887	900	957	1153	995	946	870	770	813	803	977	937
57	F	1073	1076	928	1022	1681	1446	1373	653	802	820	718	1251	1269
58	F	1168	1049	1222	1068	1393	1529	1426	922	1133	769	1238	1317	1311
59	F	790	695	705	764	858	895	874	655	674	769	848	905	905
60	M	834	759	976	674	866	1090	968	643	662	719	683	1045	1002
61	M	867	986	664	779	850	1045	1140	751	862	668	994	878	885
62	M	789	711	763	747	612	923	861	689	706	843	833	846	907
63	F	1683	1528	2833	1371	1105	2451	2684	1099	783	1025	1254	2329	2028
64	F	1107	992	1127	1338	1195	1233	1392	864	1056	850	1128	1221	1027
overall mean RT		875.799												

Appendix E

Experiment 1: Individual Subject Data for Error Rates

			LVF Targ.						RVF Targ.					
Image.			Hi		Low		Non-Word		Hi		Low		Non-Word	
Dist:			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	Mean Err												
1	M	29	64	42	36	71	11	10	21	7	43	14	25	10
2	F	30	28	42	35	64	39	25	28	7	21	7	53	14
3	M	15	7	14	28	21	25	14	0	7	21	0	21	17
4	M	19	7	42	35	42	32	17	0	0	21	7	14	10
5	F	29	21	28	28	57	46	17	21	14	50	14	25	32
6	F	26	14	14	43	35	28	42	7	21	28	7	32	46
7	F	22	28	14	14	42	28	28	14	7	14	14	25	32
8	M	17	0	7	21	28	28	32	0	14	14	14	25	17
9	F	19	28	28	50	28	25	14	7	0	0	21	21	10
10	M	34	36	71	50	78	43	32	0	0	0	7	50	42
11	F	24	7	28	50	14	35	21	7	14	21	28	32	35
12	F	31	43	42	43	35	42	25	21	0	21	7	46	50
13	F	24	7	14	50	21	39	32	21	7	21	21	35	25
14	F	26	28	35	57	35	28	25	14	14	0	7	25	42
15	M	8	0	7	7	7	28	3	0	0	7	7	25	3
16	F	21	21	57	43	28	25	7	7	7	21	7	14	14
17	M	25	50	28	36	57	32	17	7	7	14	14	21	17
18	M	29	28	50	57	50	25	21	0	7	28	7	39	35
19	M	21	14	35	28	7	25	35	0	0	28	35	21	25
20	M	14	7	14	7	28	32	17	7	0	7	7	25	14
21	M	19	0	21	14	28	35	35	7	0	21	0	28	39

22	F	27	21	35	57	50	32	35	0	7	0	7	50	28
23	F	25	36	28	36	28	39	39	14	0	21	21	14	21
24	F	26	36	21	28	35	42	39	0	0	21	28	25	35
25	F	33	71	57	57	78	21	14	7	7	28	21	14	17
26	F	25	21	42	29	28	28	39	14	0	7	7	39	50
27	F	18	21	0	21	21	18	32	0	21	7	0	32	46
28	M	8	14	7	7	0	11	3	7	0	0	7	14	21
29	M	26	21	21	57	42	39	25	7	7	7	0	46	39
30	M	18	21	14	21	35	25	28	7	7	14	0	18	28
31	F	24	21	28	64	57	28	17	0	0	0	21	32	21
32	M	8	7	7	21	7	11	10	0	0	0	0	18	21
33	M	22	42	50	43	50	14	14	0	0	14	14	7	14
34	F	13	14	14	28	28	4	10	0	14	7	21	4	10
35	F	18	14	35	21	28	25	21	7	14	14	21	4	14
36	M	34	57	57	28	71	35	42	7	7	14	0	39	46
37	M	19	21	7	14	14	32	35	7	7	14	21	32	28
38	M	23	7	28	28	42	50	25	14	0	14	28	18	21
39	F	27	50	28	43	50	25	28	7	0	14	0	25	50
40	M	28	35	28	43	50	11	21	28	7	21	21	32	35
41	M	32	14	21	28	28	53	50	28	21	14	57	35	32
42	M	22	21	28	21	50	25	10	14	14	21	28	11	25
43	F	16	7	28	28	35	0	14	21	7	21	14	14	7
44	F	25	28	14	7	7	54	35	7	21	14	7	46	64
45	F	28	57	28	43	14	28	35	14	7	0	7	54	50
46	M	22	29	14	28	50	25	14	14	14	14	7	32	21
47	M	15	21	7	14	28	18	21	0	0	35	7	7	17
48	M	18	14	21	7	28	25	7	7	14	21	28	18	25
49	M	28	50	50	50	28	46	50	0	14	7	7	14	21
50	M	22	21	50	50	50	18	28	7	0	7	21	7	10
51	F	20	21	14	14	21	35	39	21	14	0	7	35	21
52	F	20	7	42	35	21	14	14	14	21	0	28	28	14
53	M	21	35	50	57	28	4	21	14	0	21	7	0	21

54	M	20	21	21	14	35	25	35	7	7	14	7	39	21
55	F	22	50	28	42	7	50	25	0	0	0	7	28	25
56	M	15	28	42	28	21	18	7	0	0	0	7	14	10
57	F	22	14	21	14	35	35	42	7	7	14	0	39	39
58	F	34	50	35	57	28	21	64	7	7	14	7	61	53
59	F	15	14	7	42	7	21	17	0	7	7	21	18	14
60	M	28	50	14	43	21	25	28	36	21	14	35	35	17
61	M	28	28	35	35	28	18	35	14	21	7	35	39	42
62	M	25	71	35	50	71	4	14	7	0	0	28	14	7
63	F	34	57	57	71	78	21	32	7	14	14	21	21	10
64	F	32	43	21	36	50	50	42	7	7	21	21	46	46
overall mean RT		23												

Appendix F

Experiment 1: Analysis of Variance of Response Times (Word/Nonword)

Sex (2) × Target (2) × Distractor (2) × Visual Field (2)

Source	df	MS	F	p
Sex	1	291975.35	.60	.442
within	62	488234.52		
VF	1	1065830.9	42.32	.000
Sex × VF	1	1248.41	.00	.825
within	62	25187.96		
Target	1	4741592.8	86.55	.000
Sex × Target	1	1348.22	.02	.876
within	62	1348.22		
Distractor	1	14077.31	1.46	.231
Sex × Distractor	1	14518.93	1.51	.224
within	62	9615.91		
VF × Target	1	109296.99	8.53	.005
Sex x VF × Target	1	3449.61	.27	.606
within	62	12820.13		
Distractor × VF	1	1757.78	.23	.630
Sex × Distractor × VF	1	358.12	.05	.828
within	62	7513.41		
Target × Distractor	1	81340.42	12.30	.001
Sex × Target × Distractor	1	2560.41	.39	.536
within	62	6614.95		
VF × Target × Distractor	1	51.09	.01	.935
Sex × VF × Target × Distractor	1	.01	.00	.999
within	62	7677.42		

Appendix G

Experiment 1: Analysis of Variance of Response Times for Error Trials

Sex (2) × Target (3) × Distractor (3) × Visual Field (2)

Source	df	MS	F	p
Sex	1	481620.90	.23	.630
within	60	2059627.8		
VF	1	18949190	53.34	.000
Sex × VF	1	73938.95	.21	.650
within	60	355273.54		
Target	2	2934593.2	6.17	.003
Sex × Target	2	224190.50	.47	.625
within	120	475534.40		
Distractor	2	1219077.0	3.65	.029
Sex × Distractor	2	1219077.0	1.49	.229
within	120	334377.49		
VF × Target	2	4234087.8	11.30	.000
Sex × VF × Target	2	242323.43	.65	.526
within	120	374722.29		
Distractor × VF	2	341809.54	.97	.383
Sex × Distractor × VF	2	401975.17	1.14	.324
within	120	353530.79		
Target × Distractor	4	311718.06	1.00	.407
Sex × Target × Distractor	4	90149.29	.29	.884
within	240	311027.75		
VF × Target × Distractor	4	95047.58	.27	.897
Sex × VF × Target x Distractor	4	167734.17	.48	.753
within	240	352055.24		

Appendix H

Experiment 1: Analysis of Variance of Errors

Sex (2) × Target (2) × Distractor (2) × Visual Field (2)

Source	df	MS	F	p
Sex	1	1714.08	4.47	.039
within	62	383.66		
VF	1	10154.35	81.12	.000
Sex × VF	1	4.49	.04	.850
within	62	125.17		
Target	1	4741592.8	7.56	.008
Sex × Target	1	603.95	1.91	.172
within	62	316.34		
Distractor	1	290.22	4.82	.032
Sex × Distractor	1	38.96	.65	.424
within	62	60.23		
VF × Target	1	10402.85	68.35	.000
Sex x VF × Target	1	104.94	.69	.410
within	62	152.20		
Distractor × VF	1	181.47	3.21	.078
Sex × Distractor × VF	1	79.00	1.40	.242
within	62	56.52		
Target × Distractor	1	16.55	.19	.662
Sex × Target × Distractor	1	123.05	1.43	.236
within	62	86.01		
VF × Target × Distractor	1	548.80	7.30	.009
Sex × VF × Target × Distractor	1	69.83	.93	.339
within	62	75.19		

Appendix I

Experiment 1: Analysis of Variance of Response Times for High and Low Imageability Targets

Sex (2) × Target (2) × Distractor (2) × Visual Field (2)

Source	df	MS	F	p
Sex	1	253642.52	.89	.350
within	62	286052.87		
VF	1	1857746.7	36.95	.000
Sex × VF	1	547.58	.01	.917
within	62	50278.55		
Target	1	122706.30	4.70	.034
Sex × Target	1	8090.89	.31	.580
within	624	26085.63		
Distractor	1	27740.43	1.71	.195
Sex × Distractor	1	29273.50	1.81	.183
within	624	16176.60		
VF × Target	1	68255.66	2.69	.106
Sex x VF × Target	1	13441.75	.53	.469
within	624	25341.47		
Distractor × VF	1	2408.19	.16	.692
Sex × Distractor × VF	1	361.14	.02	.878
within	624	15176.75		
Target × Distractor	1	14388.94	1.40	.242
Sex × Target × Distractor	1	.01	.00	.999
within	62	10292.59		
VF × Target × Distractor	1	3637.92	.15	.701
Sex × VF × Target × Distractor	1	70576.01	2.88	.095
within	628	24513.07		

Appendix J

Experiment 1: Analysis of Variance of % Error for High and Low Imageability Targets

Sex (2) × Target (2) × Distractor (2) × Visual Field (2)

Source	df	MS	F	p
Sex	1	470.05	.52	.472
within	62	246.54		
VF	1	51731.96	119.36	.000
Sex × VF	1	85.56	.20	.658
within	62	433.39		
Target	1	5368.14	55.86	.000
Sex × Target	1	16.04	.17	.684
within	62	96.10		
Distractor	1	12.81	.14	.708
Sex × Distractor	1	262.76	2.89	.094
within	62	90.77		
VF × Target	1	47.09	.58	.450
Sex x VF × Target	1	156.66	1.93	.170
within	62	81.38		
Distractor × VF	1	149.18	1.06	.307
Sex × Distractor × VF	1	337.44	2.40	.126
within	62	140.32		
Target × Distractor	1	6.74	.06	.805
Sex × Target × Distractor	1	119.68	1.09	.300
within	62	109.44		
VF × Target × Distractor	1	36.40	.27	.607
Sex × VF × Target × Distractor	1	74.02	.54	.464
within	62			

Appendix K

Experiment 2: Stimuli

Targets: Words		Targets: Nonwords		Distractors: Words		Distractors: Nonwords	
angel	lump	aisen	palo	apron	king	avor	meas
ankle	male	avip	piery	arch	knee	bargs	mesly
arrow	math	binse	pise	baby	lake	blan	misky
aunt	maze	blad	plown	bite	lamp	bobes	mugal
barn	meat	bloam	pober	blood	land	bokes	nads
bath	metal	blog	poug	bloom	layer	boose	nait
bear	mist	canf	prap	body	lens	boro	nawl
beast	money	carg	prawl	boot	lice	bren	neafy
bible	motor	cavin	pulbs	boss	lily	bres	nilla
bird	movie	cheb	raif	bowl	limb	brin	norp
black	mule	clany	reas	brain	lime	buel	nuggy
bloat	nail	codge	reng	bread	lion	cati	nunch
blue	navy	coise	roba	cabin	lock	clor	obelm
board	noose	creal	roca	cage	love	cotly	odea
bosom	oats	crids	roder	cake	menu	creo	opio
boxer	ocean	croom	rofe	candy	monk	crou	ouca
brick	palm	dila	roga	cane	moss	curpe	pake
bunny	party	dort	scaf	cart	mucus	dable	pells
burn	peach	drel	scorp	cell	nose	dace	phop
burst	pipe	drib	seag	chick	oven	daiky	plang
bush	pony	drofe	shal	chief	park	dapts	plis
camel	port	duppy	shan	cider	piano	dran	poad
camp	rock	duts	sheel	cigar	plant	dreb	prain
cars	room	evilt	shib	clay	pole	droe	quat
chair	rope	fanit	shil	cliff	pond	duar	queln
child	rust	fenge	shreg	coach	pool	eboy	rawl
chin	salad	fevy	slak	coal	post	elige	reen
chop	sand	fings	slea	coat	pupil	fanct	rewe
city	scale	frint	slen	cock	queen	farne	rilg
coin	shed	frote	sloc	cone	rain	fleal	rish
cold	ship	fwit	slon	cream	ride	foint	roat
cord	shore	gami	smer	crow	ring	frade	roke
corn	skin	geap	smop	deck	river	fron	rount
cube	skull	gedal	snar	deep	salt	geal	ruce
dark	slave	glan	snick	deer	sauce	gevip	salg
dawn	slush	gowa	snig	devil	seal	girk	sate
dead	snow	grafe	snog	dial	seat	glaf	scalt
dirt	soil	gwin	snop	dive	shave	glit	sedic

disc	song	hapes	sode	dock	sheep	glome	shar
doll	spot	hese	span	door	shoes	glon	skems
fire	star	hilks	spla	doors	shop	groak	slaf
flag	steam	hira	srap	dove	sink	gunch	slel
flood	storm	huna	sroc	drug	slate	heeks	slet
fork	sugar	jatch	stoil	duck	soap	hotor	smet
fort	table	kabe	sumi	dusk	sock	hurp	sorn
frog	tent	karb	tafa	dust	soft	idalt	sowt
gift	tide	kesp	taple	earth	spin	jait	srag
glove	tomb	koist	tase	face	stain	jarn	srag
goal	tool	lant	telt	fawn	stew	jense	staps
guns	tree	lavo	thase	fight	stone	jerd	stiv
hall	trip	lerms	theb	flask	stove	jusp	sund
head	truck	lesp	thep	flesh	suds	kami	tagon
herd	trunk	leta	tilo	floor	suit	kirt	teign
hill	turf	lipo	tove	foam	swamp	kunk	tert
honey	twist	mabor	tran	foot	tank	lasps	tilf
horn	ugly	mally	treak	fruit	thorn	lesa	toab
iron	vest	meav	trobe	girl	toast	lide	tolb
jail	vine	melly	trup	gold	towel	lind	torm
jelly	wall	milt	tulf	golf	tower	lisk	trab
kick	whale	murd	twirn	hard	wand	lome	truit
lady	wheat	nace	veah	harp	water	loppy	twep
lamb	wine	nago	vige	heat	whip	lort	vaik
lane	wolf	naib	ving	hell	white	lote	vorg
lark	woman	naise	vinom	hive	wife	lurt	waily
lawn	wood	norat	voba	hoof	world	lysh	woan
lemon	woods	ocks	wrop	hose	worm	matal	wonk
light	wool	ofert	yamb	house	yacht	meap	yoal
lover	work	opan	yora	judge	yard	mears	zead

Appendix L

Experiment 2: Omnibus Analysis of Variance of Response Times

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	66	272812.98		
Sex	1	397111.94	1.46	.232
Within	66	23726.67		
Hand	1	91544.49	3.86	.054
Sex × Hand	1	2581.78	.11	.743
Within	66	13345.45		
VF	1	557389.59	41.77	.000
Sex × VF	1	360.18	.03	.870
Within	66	4882.61		
Distractor	1	18168.12	3.72	.058
Sex × Distractor	1	9924.44	2.03	.159
Within	66	25796.44		
Target	1	2994391.60	116.08	.000
Sex × Target	1	43531.18	1.69	.198
Within	66	4511.87		
Hand × VF	1	2.12	.00	.983
Sex × Hand × VF	1	280.06	.06	.804
Within	66	3658.79		
Hand × Distractor	1	3720.72	1.02	.317
Sex × Hand × Distractor	1	4930.01	1.35	.250
Within	66	6608.72		
Hand × Target	1	70853.31	10.72	.002

Sex × Hand × Target	1	9224.47	1.40	.242
Within	66	6260.12		
VF × Distractor	1	7031.94	1.12	.293
Sex × VF × Distractor	1	3200.30	.37	.546
Within	66	7415.97		
VF × Target	1	121257.53	16.35	.000
Sex × VF × Target	1	10167.53	1.37	.246
Within	66	4718.25		
Distractor × Target	1	2051.50	.43	.512
Sex × Distractor × Target	1	6241.94	1.32	.254
Within	66	6231.69		
Hand × VF × Distractor	1	7288.47	1.17	.283
Sex × Hand × VF × Distractor	1	5544.06	.89	.349
Within	66	6235.54		
Hand × VF × Target	1	28905.94	4.64	.035
Sex × Hand × VF × Target	1	4240.72	.68	.413
Within	66	3944.83		
Hand × Distractor × Target	1	525.31	.13	.716
Sex × Hand × Distractor	1	1152.94	.29	.591
Within	66	3412.46		
VF × Distractor × Target	1	3938.33	1.15	.287
Sex × VF × Distractor × Target	1	13398.09	3.93	.052
Within	66	5056.02		
Hand × VF × Distractor × Target	1	2643.76	.52	.472
Sex × Hand × VF × Distractor ×Targ.	1	14559.19	2.88	.094

Appendix M

Experiment 2: Omnibus Analysis of Variance of Errors

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	66	805.41		
Sex	1	252.09	.31	.578
Within	66	86.49		
Hand	1	364.25	4.21	.044
Sex × Hand	1	240.72	.278	.100
Within	66	244.66		
VF	1	15186.59	62.07	.000
Sex × VF	1	110.68	.45	.504
Within	66	55.84		
Distractor	1	96.30	1.72	.194
Sex × Distractor	1	23.19	.42	.521
Within	66	498.95		
Target	1	2035.20	4.08	.047
Sex×target	1	70.25	.14	.709
Within	66	59.47		
Sex × VF	1	.29	.00	.945
Sex × Hand × VF	1	34.60	.58	.488
Within	66	71.91		
Hand × Distractor	1	5.36	.07	.786
Sex × Hand × Distractor	1	82.73	1.15	.287
Within	66	100.60		
Hand × Target	1	58.81	.58	.447
Sex × Hand × Target	1	3.86	.04	.845

Within	66	83.11		
VF × Distractor	1	1.56	.02	.891
Sex × VF × Distractor	1	82.68	.99	.322
Within	66	190.01		
VF × Target	1	4053.19	21.33	.000
Sex × VF × Target	1	169	.89	.348
Within	66	77.18		
Distractor × Target	1	435.32	5.64	.020
Sex × Distractor × Target	1	377.90	4.90	.030
Within	66	78.34		
Hand × VF × Distractor	1	198.47	2.53	.166
Sex × Hand × VF × Distractor	1	53.47	.68	.412
Within	66	90.54		
Hand × VF × Target	1	597.05	6.59	.013
Sex × Hand × VF × Target	1	337.52	3.73	.058
Within	66	74.10		
Hand × Distractor × Target	1	142.85	1.93	.170
Sex × Hand × Distractor × Target	1	16.84	.23	.635
Within	66	70.77		
VF × Distractor × Target	1	240.86	3.40	.070
Sex × VF × Distractor × Target	1	579.55	8.19	.006
Within	66	61.51		
Hand × VF × Distractor × Target	1	3.86	.06	.803
Sex × Hand × VF × Distractor ×	1	16.85	.27	.602

Appendix N

Experiment 2: Individual Subject Data for Response Time

			Left Hand								Right Hand							
			LVF Targ				RVF Targ				LVF Targ				RVF Targ			
Targ:			W		NW		W		NW		W		NW		W		NW	
Dist:			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	RT																
1	F	1061	739	926	789	813	802	902	789	904	1199	1328	1570	1345	1174	1315	1108	1275
2	F	1063	1030	1146	1148	1194	886	1188	1023	1074	1209	1054	957	1068	916	1076	863	1177
3	F	728	829	811	862	717	730	693	894	757	657	651	705	681	639	667	687	669
4	M	555	518	621	495	574	439	521	517	639	572	580	567	624	514	623	520	555
5	M	1078	1598	1190	890	1028	1106	1172	1290	1456	1035	1002	933	859	885	923	856	1023
6	M	690	624	721	685	804	658	790	677	743	644	741	655	668	635	654	690	656
7	M	577	508	641	542	627	510	602	522	579	603	586	653	562	522	631	556	587
8	F	864	906	1023	731	811	767	950	740	904	944	1006	948	881	781	895	710	820
9	M	986	890	1357	875	1374	699	914	801	1338	1039	1225	796	1152	725	864	716	1004
10	M	920	914	1008	978	1340	926	960	848	1084	689	1084	748	1022	638	871	623	994
11	F	667	624	691	554	643	589	738	649	744	655	666	715	755	682	710	569	691
12	M	1039	776	1608	881	1075	700	945	703	1567	914	1284	851	1501	802	1095	848	1068
13	F	1019	936	1051	1028	1323	700	1300	662	1126	995	928	1046	1011	742	1090	861	1500
14	F	779	723	815	621	850	814	839	762	881	695	824	867	762	738	811	610	847
15	M	651	569	687	605	760	609	704	636	710	577	674	612	668	550	682	590	779
16	F	795	857	922	729	848	709	940	722	893	808	868	729	794	736	749	741	667
17	M	699	735	737	804	870	608	677	677	739	614	809	605	731	588	681	573	732
18	F	723	643	879	717	849	647	738	719	720	673	712	806	733	583	713	676	755
19	F	876	870	910	737	1050	871	928	721	1027	1094	762	1027	877	715	984	619	831
20	M	763	636	868	763	770	651	789	735	874	745	894	650	816	736	761	716	811
21	F	972	948	1173	943	1032	965	1152	894	1040	917	901	881	973	1008	871	925	928
22	F	686	727	772	667	780	676	704	585	739	665	782	663	723	629	606	567	684
23	M	640	570	680	632	733	521	787	555	738	708	663	598	615	596	631	549	663
24	F	481	300	438	342	409	2078	423	281	312	436	495	262	397	355	425	347	395
25	F	651	590	640	691	682	561	756	634	658	608	682	616	622	593	675	733	668
26	F	725	766	765	618	993	746	670	672	645	695	722	687	742	646	752	706	769
27	M	799	784	838	735	916	747	818	665	889	795	862	748	951	728	820	663	832

28	F	762	714	916	814	878	692	854	635	756	718	813	652	815	703	748	634	845
29	F	715	693	822	611	900	550	823	547	666	728	806	668	965	610	715	601	738
30	M	778	764	901	823	990	646	821	699	920	621	806	673	820	687	764	799	721
31	M	541	428	546	536	539	477	504	520	537	515	586	620	592	543	604	515	586
32	M	969	1062	1480	867	1201	900	973	970	1246	906	766	889	753	676	921	899	1001
33	M	701	694	732	860	636	604	844	613	774	636	807	742	722	582	656	641	675
34	M	649	662	637	602	587	583	726	664	664	642	605	690	705	598	752	581	680
35	M	628	551	657	562	620	528	645	508	638	665	740	701	735	543	694	552	712
36	M	186	195	233	175	209	208	153	190	219	162	247	191	127	178	152	177	153
37	F	737	668	743	742	771	645	814	631	772	771	751	798	803	687	731	720	751
38	M	823	697	799	839	873	640	785	587	710	833	1017	778	901	751	1109	706	1136
39	M	750	593	826	588	703	635	676	662	741	843	1082	761	756	711	930	579	912
40	M	815	691	844	731	953	694	881	636	879	777	855	808	1001	727	854	765	936
41	F	709	655	657	733	583	596	625	564	639	898	773	712	733	888	697	831	765
42	F	770	745	828	726	816	621	760	656	710	922	790	831	814	747	809	780	765
43	F	707	687	836	667	869	612	834	652	689	672	799	639	671	624	689	596	780
44	F	885	792	847	750	996	777	924	716	855	901	1004	981	1047	771	1087	732	984
45	F	749	827	852	697	824	642	703	591	776	691	962	785	839	598	749	585	857
46	M	620	519	609	529	526	433	585	553	552	641	693	649	691	711	768	766	688
47	F	684	718	693	620	706	632	694	560	722	669	762	635	759	600	764	588	825
48	M	995	809	1022	1074	1119	770	1004	802	906	1061	1307	1133	1197	824	936	905	1053
49	F	739	615	686	712	919	600	714	625	741	831	846	786	852	649	831	610	808
50	F	736	634	727	662	832	630	728	635	774	874	736	728	800	753	672	767	828
51	F	1050	1041	1216	811	1417	732	945	793	1073	1297	1370	1145	1132	812	1090	791	1133
52	F	860	703	819	793	771	811	973	771	1102	799	789	883	817	827	825	952	1125
53	F	889	728	827	999	824	672	860	823	835	904	913	1058	980	853	1086	944	924
54	M	600	597	673	681	567	495	618	578	641	620	538	642	721	550	590	536	559
55	M	900	809	855	766	1076	796	861	700	779	924	996	1011	1013	863	1134	917	900
56	M	824	675	846	967	867	621	769	562	774	884	896	941	1019	715	964	674	1013
57	F	643	576	697	607	696	599	677	580	672	661	708	630	653	558	647	605	721
58	M	580	594	557	567	541	522	518	504	595	605	630	677	604	559	649	592	573
59	F	833	862	869	803	815	623	803	664	799	912	1008	942	918	745	994	720	848
60	F	617	575	649	612	624	578	620	652	624	580	630	562	609	599	617	587	751
61	F	816	672	770	757	875	732	840	781	865	817	936	770	865	782	905	798	894
62	F	521	521	587	492	577	484	592	506	528	502	493	481	557	471	510	466	563
63	F	835	802	913	790	963	714	875	746	894	818	1005	776	898	751	869	708	842
64	F	653	680	645	619	681	636	635	557	662	632	612	663	731	676	660	706	655
65	M	804	687	728	732	824	707	819	755	792	805	941	778	887	874	800	729	1002
66	M	651	571	764	607	803	599	709	553	636	617	706	573	613	602	722	573	769

67	M	826	751	869	700	868	693	848	680	801	836	934	853	818	763	941	778	1077
68	M	575	503	595	538	626	531	601	482	604	537	605	609	698	504	591	544	626
69	M	695	597	636	628	745	567	686	591	763	757	792	736	765	679	749	720	709
70	M	688	635	787	627	798	608	666	598	749	685	700	701	782	593	694	650	734
71	M	788	707	955	686	788	717	933	709	794	765	935	775	830	704	794	709	810
72	M	639	923	571	600	509	561	594	672	645	639	613	727	620	585	689	578	705
Overall Mean		756																

Appendix O

Experiment 2: Individual Subject Data for Errors

			Left Hand								Right Hand							
			LVF Targs				RVF Targs				LVF Targs				RVF Targs			
Targ			Word		Non-Word		Word		Non-Word		Word		Non-Word		Word		Non-Word	
Dist			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	x																
1	F	38	24	59	29	41	0	53	24	71	82	12	53	41	12	53	6	53
2	F	20	41	18	35	12	24	6	18	12	35	18	35	18	18	6	24	0
3	F	16	18	18	18	12	29	6	35	6	6	18	18	6	12	6	24	24
4	M	10	18	12	24	6	0	24	6	24	12	12	6	0	0	6	0	18
5	M	36	88	0	94	12	18	35	29	24	94	6	94	0	12	12	24	29
6	M	12	6	6	12	18	6	18	12	6	12	12	12	12	12	24	18	6
7	M	14	12	18	29	24	6	29	0	18	12	6	18	12	6	18	0	18
8	F	26	12	35	12	47	18	47	6	35	24	35	29	29	6	47	6	29
9	M	19	29	35	41	29	0	24	6	12	12	41	29	24	6	12	0	12
10	M	17	24	35	41	24	6	6	0	0	35	41	24	6	12	12	0	12
11	F	14	6	12	6	6	12	12	35	6	18	12	18	29	12	35	0	12
12	M	15	29	18	24	6	18	18	6	24	24	6	12	6	18	6	6	18
13	F	23	29	35	29	29	6	29	6	24	24	41	29	24	0	29	12	24
14	F	12	12	18	12	29	0	12	24	12	6	12	12	12	0	6	12	18
15	M	32	0	71	18	65	12	29	24	47	24	71	24	53	6	24	12	29
16	F	12	12	12	18	12	6	18	0	6	29	12	24	0	12	12	0	24
17	M	12	6	24	24	12	0	18	0	12	0	18	18	18	18	6	12	6
18	F	18	12	35	24	47	12	6	18	24	12	12	18	12	12	29	6	18
19	F	9	6	12	6	6	6	12	0	6	18	18	0	18	0	12	0	24
20	M	8	6	6	18	12	6	6	0	6	0	6	12	6	12	24	6	6
21	F	9	0	29	0	24	6	18	0	6	12	6	0	12	0	12	12	6
22	F	11	6	18	12	18	0	12	12	6	6	12	29	18	6	6	18	6
23	M	28	65	35	41	47	0	35	0	29	35	12	65	6	6	12	18	47
24	F	47	24	65	18	41	47	53	29	47	71	71	59	41	35	53	24	71
25	F	10	12	0	12	12	0	6	12	6	18	12	24	0	18	12	6	12
26	F	19	18	24	24	29	29	6	18	6	29	6	29	12	6	12	41	12

27	M	15	6	41	24	18	6	29	0	6	35	18	24	6	0	0	6	24
28	F	15	18	0	18	12	18	12	6	18	29	6	35	6	18	18	12	24
29	F	19	12	24	24	41	0	53	0	18	6	41	6	29	6	18	6	18
30	M	24	24	29	12	24	18	18	47	18	18	29	29	29	24	29	24	12
31	M	15	18	24	12	0	12	18	24	24	0	29	6	0	18	12	12	35
32	M	16	24	6	59	6	12	29	0	12	24	12	41	0	6	12	18	0
33	M	12	24	18	41	12	0	18	0	12	12	18	18	12	0	0	6	12
34	M	27	59	24	41	35	24	24	29	24	29	12	59	0	6	29	12	24
35	M	17	59	29	24	6	6	6	0	12	29	24	18	35	0	6	0	18
36	M	54	24	82	12	82	35	76	35	82	29	88	29	76	29	76	18	82
37	F	12	24	0	24	24	0	12	18	0	24	24	6	24	0	12	0	6
38	M	11	12	12	24	12	0	24	12	18	0	12	0	18	0	24	0	18
39	M	9	0	18	6	6	24	0	0	12	35	29	6	6	0	0	0	0
40	M	21	24	29	29	18	18	18	24	24	6	18	41	29	0	24	6	24
41	F	13	29	0	24	6	18	12	6	6	24	12	12	24	18	6	12	6
42	F	17	18	18	41	12	0	6	24	6	35	12	41	12	6	12	6	24
43	F	13	6	12	12	29	6	0	6	6	41	24	18	12	6	12	12	6
44	F	36	35	41	35	59	35	35	35	35	35	41	12	53	12	41	12	53
45	F	20	29	47	12	6	12	24	6	29	18	29	24	29	0	24	0	29
46	M	29	12	59	35	53	29	47	29	35	18	24	24	24	24	12	24	24
47	F	19	12	41	24	18	18	35	6	35	24	29	12	6	12	18	0	18
48	M	13	18	24	24	6	0	6	0	0	18	35	29	35	0	6	0	6
49	F	11	18	24	18	18	12	0	0	18	12	18	12	12	0	6	0	12
50	F	13	18	6	24	24	6	24	6	12	29	6	29	0	12	6	12	0
51	F	15	29	12	12	18	0	12	0	24	35	24	24	18	0	12	0	18
52	F	16	6	18	12	6	29	29	12	24	6	6	24	6	12	29	12	29
53	F	14	6	18	24	35	0	29	0	0	12	24	24	35	0	18	0	6
54	M	29	35	35	47	24	6	12	24	18	41	47	35	41	18	29	18	35
55	M	13	24	6	18	0	12	12	24	18	24	12	12	6	6	12	6	24
56	M	10	0	29	29	6	12	0	0	0	12	6	18	18	18	6	0	6
57	F	10	6	18	6	24	12	6	6	29	12	6	0	12	0	12	6	6
58	M	15	12	6	41	0	6	12	24	6	35	12	24	6	18	0	29	6
59	F	20	47	12	41	18	6	0	0	6	53	35	53	29	6	6	0	6
60	F	17	18	18	41	6	0	12	24	12	24	18	18	24	29	12	6	18
61	F	19	24	12	24	29	18	12	6	24	35	6	35	18	18	24	6	12
62	F	28	18	35	24	41	24	35	18	6	47	35	24	35	6	24	18	53
63	F	15	12	35	18	53	0	6	0	18	18	12	6	24	0	29	0	18
64	F	12	0	24	6	6	18	6	24	12	6	12	6	29	12	12	18	12
65	M	14	24	6	29	0	24	0	0	29	12	12	18	12	6	12	18	18

66	M	43	29	76	29	65	12	59	24	59	24	53	47	76	6	53	12	59
67	M	11	6	24	6	29	0	6	18	24	6	24	6	0	6	0	6	12
68	M	11	18	18	6	18	6	6	0	12	18	6	24	12	0	12	12	6
69	M	10	18	6	12	12	0	12	12	6	24	6	12	18	6	0	6	18
70	M	12	12	18	6	12	0	24	12	6	18	0	18	18	12	12	12	18
71	M	12	6	12	6	29	6	0	0	24	18	12	6	18	6	29	6	18
72	M	31	41	24	59	24	41	29	41	18	47	24	88	0	18	12	24	12
Overall Mean		18																

Appendix P

Experiment 2: Analysis of Variance of Response Times Without Sex as a Factor

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	67	23411.07		
Hand	1	91544.49	3.91	.052
Within	67	91544.49		
VF	1	557389.59	42.38	.000
Within	67	4957.86		
Distractor	1	18168.12	3.66	.060
Within	67	26061.14		
Target	1	2994391.6	114.90	.000
Within	67	4448.71		
Hand × VF	1	2.12	.00	.983
Within	67	3677.76		
Hand × Distractor	1	3720.72	1.01	.318
Within	67	6647.76		
Hand × Target	1	70853.31	10.66	.002

Within	67	6201.01		
VF × Distractor	1	7031.94	1.13	.291
Within	67	7457.04		
VF × Target	1	121257.53	16.26	.000
Within	67	4740.99		
Distractor × Target	1	2051.50	.43	.513
Within	67	6221.43		
Hand × VF × Distractor	1	7288.47	1.17	.283
Within	67	6205.76		
Hand × VF × Target	1	28905.94	4.66	.034
Within	67	3903.16		
Hand × Distractor × Target	1	525.31	.13	.715
Within	67	3561.50		
VF × Distractor × Target	1	3938.33	1.11	.297
Within	67	5197.86		
Hand × VF × Distractor × Target	1	2643.76	.51	.478

Appendix Q

Experiment 2: Analysis of Variance of Errors Without Sex as a Factor

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	67	88.79		
Hand	1	364.25	4.10	.047
Within	67	242.66		
VF	1	15186.59	62.58	.000
Within	67	55.35		
Distractor	1	96.30	1.74	.192
Within	67	492.56		
Target	1	2035.20	4.13	.046
Within	67	59.10		
Hand × VF	1	.29	.00	.945
Within	67	72.08		
Hand × Distractor	1	5.36	.07	.786
Within	67	99.16		
Hand × Target	1	58.81	.59	.444

Within	67	83.11		
VF × Distractor	1	1.56	.02	.891
Within	67	189.71		
VF × Target	1	4053.19	21.37	.000
Within	67	81.67		
Distractor × Target	1	435.32	5.33	.024
Within	67	77.96		
Hand × VF × Distractor	1	198.47	2.55	.115
Within	67	94.23		
Hand × VF × Target	1	597.05	6.34	.014
Within	67	73.25		
Hand × Distractor × Target	1	142.85	1.95	.167
Within	67	78.37		
VF × Distractor × Target	1	240.86	3.07	.084
Within	67	60.85		
Hand × VF × Distractor × Target	1	3.86	.06	.802

Appendix R

Experiment 2: Analysis of Variance Response Times for Errors

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	30	211985.83		
Hand	1	30980.65	.15	.705
Within	30	153279.13		
VF	1	605641.58	3.95	.056
Within	30	109799.54		
Distractor	1	41996.16	.38	.541
Within	30	169241.88		
Target	1	35125.56	.21	.652
Within	30	75024.88		
Hand × VF	1	7005.03	.09	.762
Within	30	108015.66		
Hand × Distractor	1	37695.52	.35	.559
Within	30	158299.55		
Hand × Target	1	1881.36	.01	.914

Within	30	123779.64		
VF × Distractor	1	42439.00	.34	.563
Within	30	126923.66		
VF × Target	1	12460.07	.10	.756
Within	30	99861.20		
Distractor × Target	1	752389.36	7.53	.010
Within	30	90408.72		
Hand × VF × Distractor	1	369838.58	4.09	.052
Within	30	117401.97		
Hand × VF × Target	1	1230617.8	10.48	.003
Within	30	106010.01		
Hand × Distractor × Target	1	27930.01	.26	.612
Within	30	112377.45		
VF × Distractor × Target	1	40.65	.00	.985
Within	30	84737.28		
Hand × VF × Distractor × Target	1	332079.75	3.92	.057

Appendix S

Experiment 2: Analysis of Variance of Response Time for Men

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	33	31780.81		
Hand	1	62436.74	1.96	.170
Within	33	11389.54		
VF	1	293043.89	25.73	.000
Within	33	3780.29		
Distractor	1	27474.18	7.27	.011
Within	33	33454.26		
Target	1	1880000.7	56.20	.000
Within	33	4732.76		
Hand × VF	1	165.44	.03	.853
Within	33	3643.48		
Hand × Distractor	1	8608.26	2.36	.134
Within	33	7968.71		
Hand × Target	1	14473.60	1.82	.187

Within	33	8898.59		
VF × Distractor	1	8688.01	.98	.330
Within	33	5383.28		
VF × Target	1	30600.00	5.68	.023
Within	33	4316.83		
Distractor × Target	1	568.26	.13	.719
Within	33	7705.04		
Hand × VF × Distractor	1	59.56	.01	.930
Within	33	6298.76		
Hand × VF × Target	1	5501.65	.01	.930
Within	33	3234.54		
Hand × Distractor × Target	1	60.89	.02	.892
Within	33	3730.38		
VF × Distractor × Target	1	15932.24	4.27	.047
Within	33	7636.59		
Hand × VF × Distractor × Target	1	2397.36	.31	.579

Appendix T

Experiment 2: Analysis of Variance of Response Time for Women

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	33	15672.53		
Hand	1	31689.53	2.02	.164
Within	33	15301.37		
VF	1	264705.88	17.30	.000
Within	33	5984.93		
Distractor	1	618.38	.10	.750
Within	33	18138.62		
Target	1	1157922.1	63.84	.000
Within	33	4290.98		
Hand × VF	1	116.74	.03	. 870
Within	33	3674.09		
Hand × Distractor	1	42.47	.01	.915
Within	33	5248.74		
Hand × Target	1	65604.18	12.50	.001

Within	33	3621.64		
VF × Distractor	1	644.24	.18	.676
Within	33	9448.66		
VF × Target	1	100825.07	10.67	.003
Within	33	5119.68		
Distractor × Target	1	7725.18	1.51	.228
Within	33	4758.35		
Hand × VF × Distractor	1	12772.97	2.68	.111
Within	33	6172.32		
Hand × VF × Target	1	27645.01	4.48	.042
Within	33	4655.13		
Hand × Distractor × Target	1	1617.36	.35	.560
Within	33	3094.54		
VF × Distractor × Target	1	1404.18	.45	.505
Within	33	2475.45		
Hand × VF × Distractor × Target	1	14805.60	5.98	.020

Appendix U

Experiment 2: Analysis of Variance of % Error for Men

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	33	97.01		
Hand	1	598.61	6.17	.018
Within	33	265.92		
VF	1	8945.09	33.64	.000
Within	33	57.65		
Distractor	1	107.01	1.86	.182
Within	33	563.46		
Target	1	674.60	1.20	.282
Within	33	72.51		
Hand × VF	1	14.30	.20	. 660
Within	33	77.50		
Hand × Distractor	1	22.98	.30	.590
Within	33	107.45		
Hand × Target	1	46.40	.43	.516

Within	33	98.85		
VF × Distractor	1	53.48	.54	.467
Within	33	248.10		
VF × Target	1	2940.33	11.85	.002
Within	33	90.28		
Distractor × Target	1	812.20	9.00	.005
Within	33	75.13		
Hand × VF × Distractor	1	22.96	.31	.584
Within	33	88.12		
Hand × VF × Target	1	18.38	.21	.651
Within	33	81.63		
Hand × Distractor × Target	1	128.89	1.58	.218
Within	33	74.10		
VF × Distractor × Target	1	783.82	10.58	003
Within	33	74.21		
Hand × VF × Distractor × Target	1	18.42	.25	.622

Appendix V

Experiment 2: Analysis of Variance of % Error for Women

Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	33	75.97		
Hand	1	6.37	.08	.774
Within	33	223.40		
VF	1	6352.18	28.43	.000
Within	33	54.02		
Distractor	1	12.49	.23	.634
Within	33	434.45		
Target	1	1430.85	3.29	.079
Within	33	46.43		
Hand × VF	1	20.58	.44	. 510
Within	33	66.32		
Hand × Distractor	1	65.11	.98	.329
Within	33	93.75		
Hand × Target	1	16.27	.17	.680

Within	33	67.37		
VF × Distractor	1	30.76	.46	.504
Within	33	131.93		
VF × Target	1	1282.40	9.72	.004
Within	33	64.08		
Distractor × Target	1	1.02	.02	.901
Within	33	81.54		
Hand × VF × Distractor	1	228.98	2.81	.103
Within	33	92.97		
Hand × VF × Target	1	916.19	9.86	.004
Within	33	66.57		
Hand × Distractor × Target	1	30.80	.46	.501
Within	33	67.45		
VF × Distractor × Target	1	36.59	.54	.467
Within	33	48.82		
Hand × VF × Distractor × Target	1	2.29	.05	.830

Appendix W

Experiment 3: Omnibus Analysis of Variance of Response Times

Hand (2) × Type (2) Visual Field (2) × Distractor (2) × Target (2)

Source	df	MS	F	p
Within	70	1106125.4		
Sex	1	10533541	9.52	.003
Within	70	51267.80		
Hand	1	30450.25	.59	.443
Sex × Hand	1	3.36	.00	.994
Within	70	244909.75		
Type	1	109285.34	.45	.506
Sex × Type	1	66478.03	.27	.604
Within	70	49787.64		
VF	1	1047637.50	21.04	.000
Sex × VF	1	14570.50	.29	.590
Within	70	27359.80		
Distractor	1	26814.06	.98	.326
Sex × Distractor	1	24727.56	.90	.345
Within	70	61964.52		
Target	1	5514082.40	88.99	.000
Sex × Target	1	4516.96	.07	.788
Within	70	41624.95		
Hand × Type	1	289937.38	6.97	.010
Sex × Hand × Type	1	37297.27	.90	.347
Within	70	25197.05		
Hand × VF	1	502.51	.02	.888

Sex × Hand × VF	1	1178.78	.05	.829
Within	70	17968.96		
Hand × Distractor	1	13898.52	.77	.382
Sex × Hand × Distractor	1	3901.04	.22	.643
Within	70	25551.24		
Hand × Target	1	20235.06	.79	.377
Sex × Hand × Target	1	86681.17	3.39	.070
Within	70	28069.27		
Type × VF	1	24206.17	.86	.356
Sex × Type × VF	1	12045.06	.43	.515
Within	70	23118.34		
Type × Distractor	1	12609.42	.55	.463
Sex × Type × Distractor	1	63651.09	2.75	.102
Within	70	24790.25		
Type × Target	1	123259.51	4.97	.029
Sex × Type × Target	1	5550.25	.22	.638
Within	70	28790.41		
VF × Distractor	1	33886.67	1.18	.282
Sex × VF × Distractor	1	82273.36	2.86	.095
Within	70	36566.20		
VF × Target	1	348837.89	9.54	.003
Sex × VF × Target	1	296.13	.01	.929
Within	70	27824.89		
Distractor × Target	1	80561.36	2.90	.093
Sex × Distractor × Target	1	3154.69	.11	.737
Within	70	30957.18		
Hand × Type × VF	1	18371.54	.59	.444

Sex × Hand × Type × VF	1	3505.63	.11	.737
Within	70	18992.70		
Hand × Type × Distractor	1	1495.11	.08	.780
Sex × Hand × Type × Distractor	1	30771.01	1.62	.207
Within	70	27158.74		
Hand × Type × Target	1	17501.09	.64	.425
Sex × Hand × Type × Target	1	10876.75	.40	.529
Within	70	28602.88		
Hand × VF × Distractor	1	130471.46	4.56	.036
Sex × Hand × VF × Distractor	1	9.25	.00	.986
Within	70	25895.46		
Hand × VF × Target	1	1018.67	.04	.843
Sex × Hand × VF × Target	1	12996.00	.50	.481
Within	70	16772.15		
Hand × Distractor × Target	1	53226.34	3.17	.079
Sex × Hand × Distractor × Target	1	7274.67	.43	.512
Within	70	23436.64		
Type × VF × Distractor	1	618.77	.03	.869
Sex × Type × VF × Distractor	1	20724.00	.92	.340
Within	70	30225.77		
Type × VF × Target	1	2500.00	.08	.775
Sex × Type × VF × Target	1	1613.36	.05	.818
Within	70	24763.23		
Type × Distractor × Target	1	127716.89	5.16	.026
Sex × Type × Distractor × Target	1	113092.09	4.57	.036
Within	70	26544.83		
VF × Distractor × Target	1	30247.01	1.14	.289

Sex × VF × Distractor × Target	1	18952.11	.71	.401
Within	70	13298.22		
Hand × Type × VF × Distractor	1	1757.01	.13	.717
Sex × Hand × Type × VF × Distractor	1	26433.34	1.99	.163
Within	70	32805.99		
Hand × Type × VF × Target	1	45386.75	1.38	.243
Sex × Hand × Type × VF × Target	1	9352.50	.29	.595
Within	70	20488.32		
Hand × Type × Distractor × Target	1	4378	.21	.645
Sex × Hand × Type × Dist. × Target	1	8296.17	.40	.527
Within	70	20757.34		
Hand × VF × Distractor × Target	1	15365.67	.74	.393
Sex × Hand × VF × Dist. × Target	1	9112.29	.44	.510
Within	70	20121.04		
Type × VF × Distractor × Target	1	37.52	.00	.966
Sex × Type × VF × Dist. × Target	1	52269.39	2.60	.112
Within	70	20120.10		
Hand × Type × VF × Dist. × Target	1	9280.11	.46	.499
Sex × Hand × Type × VF × Dis. × Tar	1	39402.25	1.96	.166

Appendix X

Experiment 3: Omnibus Analysis of Variance of Errors

Hand (2) × Type (2) × Visual Field (2) × Distractor (2) Target (2)

Source	df	MS	F	p
Within	70	1602.08		
Sex	1	69.48	.04	.836
Within	70	163.93		
Hand	1	268.20	1.64	.205
Sex × Hand	1	469.70	3.03	.086
Within	70	353.56	20.81	
Type	1	7355.96	20.81	.000
Sex × Type	1	7.69	.02	.883
Within	70	342.17		
VF	1	8480.22	24.78	.000
Sex × VF	1	28.52	.08	.774
Within	70	161.58		
Distractor	1	24.69	.15	.697
Sex × Distractor	1	4.20	.03	.872
Within	70	559.95		
Target	1	7332.60	13.10	.001
Sex × Target	1	758.51	1.35	.248
Within	70	237.23		
Hand × Type	1	240.14	1.01	.318
Sex × Hand × Type	1	245.33	1.03	.313
Within	70	93.64		
Hand × VF	1	44.05	.47	.495

Sex × Hand × VF	1	143.41	1.53	.220
Within	70	144.16		
Hand × Distractor	1	218.34	1.51	.223
Sex × Hand × Distractor	1	95.53	.66	.418
Within	70	149.86		
Hand × Target	1	575.45	3.84	.054
Sex × Hand × Target	1	157.44	1.05	.309
Within	70	207.14		
Type × VF	1	5019.52	24.23	.000
Sex × Type × VF	1	443.48	2.14	.148
Within	70	167.99		
Type × Distractor	1	43.61	.26	.612
Sex × Type × Distractor	1	65.21	.39	.535
Within	70	157.09		
Type × Target	1	1647.77	10.49	.002
Sex × Type × Target	1	2.26	.01	.905
Within	70	128.39		
VF × Distractor	1	33.70	.26	.610
Sex × VF × Distractor	1	102.85	.80	.374
Within	70	308.70		
VF × Target	1	43.94	14.24	.000
Sex × VF × Target	1	109.87	.36	.553
Within	70	313.96		
Distractor × Target	1	4580.27	.14.59	.000
Sex × Distractor × Target	1	260.28	.83	.366
Within	70	160.95		
Hand × Type × VF	1	211.26	1.31	.256

Sex × Hand × Type × VF	1	11.75	.07	.778
Within	70	143.65		
Hand × Type × Distractor	1	489.12	3.40	.069
Sex × Hand × Type × Distractor	1	151.17	1.05	.308
Within	70	168.97		
Hand × Type × Target	1	122.39	.72	.398
Sex × Hand × Type × Target	1	585.45	3.46	.067
Within	70	149.68		
Hand × VF × Distractor	1	2.73	.02	.893
Sex × Hand × VF × Distractor	1	.08	.00	.982
Within	70	152.11		
Hand × VF × Target	1	24.44	.16	.690
Sex × Hand × VF × Target	1	323.27	2.13	.149
Within	70	164.97		
Hand × Distractor × Target	1	408.28		
Sex × Hand × Distractor × Target	1	14.70	.09	.766
Within	70	156.11		
Type × VF × Distractor	1	482.21	3.09	.083
Sex × Type × VF × Distractor	1	475.63	3.05	.085
Within	70	306.27		
Type × VF × Target	1	253.49	.83	.366
Sex × Type × VF × Target	1	8.77	.03	.866
Within	70	147.96		
Type × Distractor × Target	1	39.16	.26	.609
Sex × Type × Distractor × Target	1	128.54	.87	.355
Within	70	172.26		
VF × Distractor × Target	1	.06	.00	.986

Sex × VF × Distractor	1	58.27	.34	.563
Within	70	102.67		
Hand × Type × VF × Distractor	1	743.39	7.24	.009
Sex × Hand × Type × VF × Distractor	1	108.31	1.05	.308
Within	70	161.26		
Hand × Type × VF × Target	1	176.51	1.09	.299
Sex × Hand × Type × VF × Target	1	16.89	.10	.747
Within	70	171.34		
Hand × Type × Distractor × Target	1	88.42	.52	.475
Sex × Hand × Type × Dist. × Target	1	198.01	1.16	.286
Within	70	117.85		
Hand × Type × Distractor × Target	1	54.30	.46	.500
Sex × Hand × VF × Dist. × Target	1	195.05	1.66	.203
Within	70	167.32		
Type × VF × Distractor × Target	1	17.37	.10	.748
Sex × Type × VF × Dist. × Target	1	274.49	1.64	.204
Within	70	155.28		
Hand × Type × VF × Dist. × Target	1	20.62	.13	.717
Sex × Hand × Type × VF × Dis. ×	1	6.61	.04	.837

Appendix Y

Experiment 3: Individual Subject Data for Response Times (Lateralized Presentations)

			Left Hand								Right Hand							
			LVF Targs				RVF Targs				LVF Targs				RVF Targs			
Targ:			Word		Non-Word		Word		Non-Word		Word		Nonword		Word		Non-Word	
Dist:			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	Mean																
1	M	1180	967	1028	944	1212	769	1322	1160	1090	1102	1084	1497	1315	905	1315	1625	1431
2	F	949	954	877	847	959	673	878	610	953	886	1046	841	1013	873	1039	761	959
3	M	831	960	1017	1559	966	695	913	694	876	609	804	606	694	538	733	524	735
4	M	766	775	689	652	794	647	750	525	690	700	888	697	891	734	916	780	896
5	M	766	785	982	748	707	646	788	653	760	701	827	668	793	836	781	730	729
6	M	673	584	653	538	617	532	749	565	666	800	806	866	956	628	694	720	761
7	F	646	683	721	687	682	671	733	733	903	605	678	573	574	510	609	547	660
8	F	776	1040	848	671	703	621	729	703	637	1008	768	1127	728	727	783	781	851
9	M	902	807	1034	908	1062	809	1027	830	967	825	828	799	943	833	848	700	983
10	M	821	651	718	840	713	745	635	753	725	848	865	817	792	893	834	922	754
11	F	1139	872	1437	1413	1399	895	1058	765	970	1294	1756	971	1755	684	778	1218	714
12	M	787	639	793	586	1008	809	808	667	956	723	705	848	755	856	942	849	798
13	M	778	883	910	745	833	637	739	748	697	763	846	715	999	908	657	615	693
14	M	675	603	769	587	734	588	835	547	707	648	717	623	697	703	706	776	879
15	F	779	822	820	802	857	909	733	746	800	869	825	691	838	650	885	704	775
16	F	892	1084	979	1175	1164	1045	909	1251	1143	704	761	739	798	648	0	989	993
17	F	1182	1032	1063	1034	1608	777	1471	1006	1235	1326	901	871	1020	1235	2207	605	863
18	M	844	693	860	762	804	633	819	864	689	646	838	910	1017	817	1094	784	959
19	M	810	704	1091	714	1121	654	804	657	917	743	912	688	802	550	837	622	923
20	M	785	756	781	596	812	498	1021	511	780	611	883	606	992	732	745	636	754
21	M	947	997	767	739	877	600	997	692	765	941	1081	958	965	917	862	826	1353
22	M	695	731	671	692	763	609	764	572	659	695	660	749	710	601	618	547	700
23	M	655	616	735	650	875	664	843	555	660	704	565	761	693	522	659	577	629
24	F	702	570	688	691	659	585	704	629	684	734	767	840	711	647	765	659	755
25	F	907	871	964	953	949	1012	908	999	1027	820	851	743	825	959	909	884	851
26	M	701	824	705	736	723	648	676	705	746	662	721	688	630	604	690	621	724
27	M	1288	2263	1087	2035	1633	910	1807	1026	1242	792	1216	868	1899	1215	1347	855	1463

28	M	613	513	592	552	603	529	655	536	657	670	716	608	727	606	623	551	620
29	M	732	797	1701	878	806	596	719	658	832	697	707	713	796	723	721	515	846
30	M	862	845	924	685	903	712	1063	698	894	746	838	830	982	760	832	702	802
31	F	1023	1128	1354	1699	1352	799	1050	1218	1489	908	1463	937	855	801	980	960	976
32	F	984	978	1195	1059	835	685	707	705	1059	758	1539	899	1086	879	1181	1319	937
33	F	1486	1395	1682	1584	1680	1345	1639	1380	1509	1532	1309	1069	1470	1441	1593	1954	1582
34	F	886	797	876	696	1053	803	808	708	978	792	842	934	917	679	1155	806	865
35	F	829	814	1107	733	970	743	806	757	865	934	809	881	848	675	771	645	896
36	F	730	684	915	648	706	628	675	652	596	804	818	766	794	809	716	681	839
37	F	836	815	910	1019	856	967	955	740	881	736	812	899	787	704	708	686	748
38	F	811	842	750	779	776	692	702	814	802	781	932	1014	1151	752	726	731	912
39	M	934	1047	1002	946	833	925	941	594	817	755	767	790	722	1147	830	784	860
40	M	804	875	826	744	819	752	900	836	954	859	749	736	853	771	907	601	915
41	M	756	845	917	865	917	643	797	661	845	703	677	674	857	598	648	728	686
42	F	1331	1156	908	857	1038	951	782	884	1044	1674	1718	1763	1425	1456	1581	1124	2380
43	M	622	489	698	551	679	495	615	528	602	726	1203	702	773	525	585	572	711
44	M	651	665	641	613	663	644	703	672	710	771	1012	620	841	559	730	612	644
45	F	818	668	947	685	877	766	1008	732	982	697	779	775	823	755	1129	795	813
46	M	842	635	738	599	765	696	741	732	659	781	895	870	948	663	1166	723	1003
47	M	677	701	795	700	803	635	787	603	882	633	677	646	725	608	696	599	727
48	F	849	725	762	759	977	664	765	743	990	763	921	762	863	825	811	862	872
49	M	772	673	747	826	689	672	608	673	736	706	622	685	710	976	686	698	715
50	M	740	578	746	637	974	700	763	583	675	766	853	819	810	587	831	589	852
51	M	748	763	911	614	1087	541	873	720	996	760	843	567	709	535	677	501	723
52	F	934	865	812	996	838	634	796	647	983	994	1056	870	936	1021	1086	1000	966
53	F	918	672	879	953	1260	1152	1021	916	907	780	694	941	1020	647	743	660	715
54	F	969	957	816	1002	726	924	794	670	904	964	1080	1236	1246	1086	1381	951	999
55	M	767	703	896	687	1009	763	1124	774	873	622	678	707	683	612	672	534	656
56	F	867	714	720	705	866	611	773	727	957	719	988	907	868	693	1269	694	1178
57	F	1378	1110	1199	1420	1349	2058	1295	1030	1580	1263	918	1742	1161	1247	1001	1038	1220
58	F	678	590	708	610	671	548	718	572	713	661	706	637	726	519	845	611	746
59	M	1156	1010	1512	850	1480	1022	1264	1347	1322	1145	1321	797	1013	986	979	877	1098
60	F	955	1319	1076	2103	940	883	898	1011	878	1499	856	988	1179	990	1010	787	946
61	F	1013	998	1183	954	1352	1002	1261	919	1195	1001	1142	874	1064	894	918	838	913
62	F	777	773	689	689	750	610	898	672	782	761	835	680	754	787	787	681	978
63	F	1177	1605	1383	1292	1134	1243	1119	1099	1301	865	827	908	999	886	1315	834	1226
64	M	888	832	911	943	966	728	932	627	1111	781	950	811	1198	720	799	756	1091
65	F	1055	1274	1027	893	972	891	1359	1220	1546	694	1161	843	721	978	1466	1597	1002
66	F	855	649	797	682	827	770	854	659	830	1050	903	834	1028	792	894	838	767

67	F	902	849	846	1045	930	692	899	978	834	859	855	709	848	819	868	910	821
68	M	650	347	387	426	538	434	1890	278	499	776	736	780	790	580	755	722	751
69	F	1025	1082	1322	846	1091	826	1257	1065	976	1393	1161	1142	973	1057	1253	723	980
70	F	1064	848	1049	710	890	566	975	993	1115	1015	1799	1227	1758	1083	1001	982	1626
71	F	1212	1135	1736	1294	1584	991	1383	946	1206	907	1142	818	1008	1389	1006	1032	1037
72	M	1351	969	1344	835	1113	1424	1600	1016	862	2040	1453	1427	1959	2435	1899	1240	1759

Appendix Z

Experiment 3: Individual Subject Data for Errors (Lateralized Presentations)

			Left Hand								Right Hand							
Target:			Left Targs. Word		Nonword		Right Targs. Word		Non-Word		Left Targs. Word		Non-Word		Right Targs. Word		Non-Word	
Distractor:			W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID	Sex	Mean Err																
1	M	15	0	78	11	33	0	13	0	25	11	44	0	11	13	13	25	25
2	F	25	11	22	56	22	13	75	25	63	11	22	22	44	13	25	38	25
3	M	10	22	0	33	11	0	13	0	50	0	11	0	0	13	13	25	13
4	M	10	0	0	0	11	0	13	13	0	0	11	11	22	25	13	13	13
5	M	15	11	11	22	11	13	25	0	0	33	11	22	0	13	0	25	0
6	M	6	0	0	11	0	13	0	0	0	11	22	22	0	0	13	13	0
7	F	13	22	22	22	11	13	0	38	25	11	22	11	11	0	25	13	13
8	F	10	0	11	11	0	13	13	0	0	22	56	44	11	0	0	0	0
9	M	4	0	0	0	33	0	0	0	13	0	0	0	13	0	0	0	0
10	M	9	44	0	11	11	13	0	13	13	0	0	0	11	25	0	13	0
11	F	7	0	11	0	44	13	0	0	0	11	0	0	0	0	0	0	13
12	M	18	11	11	0	56	13	25	13	38	11	0	0	22	0	25	0	38
13	M	10	11	11	0	0	13	25	0	38	22	33	0	0	25	13	13	0
14	M	26	44	22	33	11	0	25	0	13	33	44	44	0	0	38	13	13
15	F	7	0	11	11	11	0	13	13	0	0	11	11	0	0	0	13	0
16	F	22	11	67	33	22	25	38	13	13	11	0	0	0	0	100	88	0
17	F	12	0	22	11	0	0	38	13	0	0	44	11	11	13	25	13	13
18	M	13	22	11	11	0	0	0	25	0	0	11	0	11	25	0	13	25
19	M	13	0	33	11	33	13	13	0	0	11	22	22	0	0	0	0	13
20	M	11	11	0	11	44	0	13	25	13	22	0	0	0	0	13	13	13
21	M	18	44	0	56	11	13	38	0	25	11	11	33	22	0	0	13	0
22	M	19	33	11	33	0	0	13	13	25	33	0	11	33	0	38	38	0
23	M	7	11	22	22	11	13	0	0	0	0	0	11	0	13	0	0	0
24	F	10	11	11	11	22	0	13	0	0	11	11	11	0	0	13	0	25
25	F	17	11	11	56	22	0	38	13	0	11	22	22	11	0	25	25	13
26	M	20	44	11	33	0	0	25	0	13	22	0	33	11	25	50	50	13
27	M	15	33	11	44	0	0	50	0	25	22	11	11	22	38	25	0	13

28	M	10	0	11	0	11	13	13	13	13	0	22	22	11	0	0	0	0
29	M	11	0	44	22	22	0	13	0	0	0	0	0	11	13	0	0	13
30	M	4	0	0	0	0	0	0	13	0	11	0	0	0	0	0	13	13
31	F	16	22	11	33	22	0	50	0	13	11	0	0	0	13	0	38	25
32	F	11	11	33	22	33	13	25	13	13	11	0	0	0	0	0	13	0
33	F	15	33	56	11	22	0	13	0	13	0	22	11	11	13	13	13	0
34	F	15	56	22	67	11	0	0	13	25	11	22	0	0	0	0	13	25
35	F	18	8	38	14	44	14	22	25	50	33	11	0	22	0	13	0	13
36	F	14	11	0	11	22	11	23	0	0	27	0	13	0	14	43	0	25
37	F	5	0	0	11	11	13	0	0	0	22	0	0	0	0	13	0	0
38	F	10	44	11	22	0	25	0	0	0	22	0	11	11	0	0	0	0
39	M	20	0	22	67	11	13	25	75	0	0	11	11	0	13	0	13	0
40	M	12	22	11	11	33	0	25	0	0	11	0	0	11	0	0	25	13
41	M	12	22	11	11	11	0	13	13	0	11	11	11	11	13	38	13	0
42	F	7	0	0	22	0	0	0	0	0	22	11	11	11	0	25	13	0
43	M	6	0	11	11	0	0	13	0	13	11	11	11	0	13	13	0	13
44	M	25	22	0	56	22	25	25	50	13	22	22	44	22	13	0	0	38
45	F	29	11	33	0	33	38	50	25	25	0	22	33	44	13	75	25	63
46	M	26	0	33	56	0	0	13	25	25	56	22	33	33	25	13	0	13
47	M	14	22	33	22	22	0	13	13	13	11	22	11	0	13	38	0	0
48	F	10	0	0	22	44	0	25	13	25	11	0	0	11	0	13	0	13
49	M	8	13	0	50	22	0	0	25	0	0	0	43	0	0	0	0	0
50	M	13	0	40	0	43	0	0	25	0	13	13	33	0	11	0	0	14
51	M	14	0	31	14	0	9	11	13	14	27	13	38	11	0	0	0	14
52	F	23	11	67	56	33	0	13	38	0	33	78	44	0	0	13	0	25
53	F	17	22	22	44	0	0	38	13	0	0	11	11	11	0	25	25	0
54	F	7	0	0	22	11	0	0	0	0	22	11	11	22	0	0	13	0
55	M	12	11	11	22	0	13	25	0	13	11	11	11	0	0	13	13	13
56	F	6	0	22	11	0	0	0	0	0	0	0	0	33	0	0	0	13
57	F	11	11	44	11	0	0	38	13	0	0	11	0	0	0	13	50	13
58	F	23	0	11	0	33	38	50	0	38	11	22	22	44	0	25	0	38
59	M	11	0	33	11	0	0	0	13	25	0	22	11	0	13	0	25	0
60	F	15	11	0	44	44	0	63	13	50	0	11	11	22	13	25	0	0
61	F	16	56	22	33	11	0	13	0	0	0	11	11	0	0	13	13	0
62	F	5	0	0	0	11	0	0	0	0	22	11	0	0	0	13	0	0
63	F	20	33	11	44	11	0	25	13	13	33	33	0	0	25	25	0	13
64	M	8	11	0	33	11	0	25	0	0	0	11	0	0	0	0	0	13
65	F	10	11	0	0	0	0	13	0	0	0	22	0	0	0	38	38	38
66	F	20	44	33	22	33	13	13	13	13	11	33	0	0	0	13	13	25

67	F	19	22	44	33	22	0	13	13	63	22	11	0	22	38	13	0	25
68	M	39	0	67	44	89	38	63	25	75	22	22	33	22	38	25	25	38
69	F	8	11	0	11	0	0	13	0	0	22	11	11	0	0	0	0	0
70	F	22	11	33	22	44	25	0	0	13	22	22	22	33	13	63	13	38
71	F	16	44	22	33	33	0	25	25	13	0	22	11	11	0	0	25	0
72	M	37	0	18	0	33	17	33	13	38	38	70	22	44	44	71	50	0

Appendix AA

Experiment 3: Analysis of Variance of Response Times for Lateralized Conditions

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	70	714542.30		
Sex	1	6136818.2	8.59	.005
Within	70	23726.67		
Hand	1	254154.79	4.52	.000
Sex × Hand	1	18296.25	.58	.570
Within	70	45502.72		
VF	1	695167.88	15.28	.000
Sex × VF	1	26555.52	.03	. 447
Within	70	17465.40		
Distractor	1	1323.98	.08	.000
Sex × Distractor	1	83862.19	4.80	.032
Within	70	43191.66		
Target	1	3643087.8	84.35	.000
Sex × Target	1	10040.63	.23	.631
Within	70	28882.44		
Hand × VF	1	6398.63	.22	.639
Sex × Hand × VF	1	4375.02	.15	.698
Within	70	18956.17		
Hand × Distractor	1	3136.98	.22	.685
Sex × Hand × Distractor	1	28292.26	.15	.226
Within	70	33571.77		
Hand × Target	1	49.58	.22	.685
Sex × Hand × Target	1	79484.17	2.37	.128

Within	70	6260.12		
VF × Distractor	1	7031.94	1.12	.293
Sex × VF × Distractor	1	3200.30	.37	.546
Within	70	25126.30		
VF × Target	1	205200.20	8.17	.006
Sex × VF × Target	1	1645.95	.07	.799
Within	70	12728.99		
Distractor × Target	1	2704.19	.21	.646
Sex × Distractor × Target	1	39235.01	3.08	.084
Within	70	25416.40		
Hand × VF × Distractor	1	81254.88	3.20	.078
Sex × Hand × VF × Distractor	1	12726.77	.50	.482
Within	70	28826.27		
Hand × VF × Target	1	30002.29	1.04	.311
Sex × Hand × VF × Target	1	149.50	.01	.943
Within	70	17891.06		
Hand × Distractor × Target	1	13536.98	.13	.716
Sex × Hand × Distractor	1	1152.94	.29	.591
Within	70	3412.46		
VF × Distractor × Target	1	3938.33	.76	.387
Sex × VF × Distractor × Target	1	16.77	.00	.976
Within	70	27017.59		
Hand × VF × Distractor × Target	1	16207.50	.52	.387
Sex × Hand × VF × Distractor ×Targ.	1	67084.79	2.48	.120

Appendix BB

Experiment 3: Analysis of Variance of % Error for Lateralized Conditions

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	70	1020.91		
Sex	1	15.49	.02	.902
Within	70	227.06		
Hand	1	507.95	2.24	.139
Sex × Hand	1	720.10	3.17	.079
Within	70	237.33		
VF	1	237.33	55.93	.000
Sex × VF	1	123.53	.52	. 473
Within	70	185.41		
Distractor	1	1.34	.01	.933
Sex × Distractor	1	51.25	.28	.601
Within	70	425.07		
Target	1	7966.16	18.74	.000
Sex × Target	1	338.95	.80	.375
Within	70	136.25		
Hand × VF	1	224.12	1.64	.204
Sex × Hand × VF	1	36.52	.27	.606
Within	70	141.35		
Hand × Distractor	1	680.53	4.81	.032
Sex × Hand × Distractor	1	243.52	1.72	.194
Within	70	203.59		
Hand × Target	1	614.31	3.02	.087

Sex × Hand × Target	1	67.84	.33	.566
Within	70	121.68		
VF × Distractor	1	385.42	3.17	.079
Sex × VF × Distractor	1	68.07	.56	.457
Within	70	400.25		
VF × Target	1	3379.65	8.44	.005
Sex × VF × Target	1	28.28	.07	.791
Within	70	256.33		
Distractor × Target	1	2733.25	10.66	.002
Sex × Distractor × Target	1	377.32	1.47	.229
Within	70	167.31		
Hand × VF × Distractor	1	328.04	1.96	.166
Sex × Hand × VF × Distractor	1	57.11	.34	.561
Within	70	219.09		
Hand × VF × Target	1	34.79	.16	.691
Sex × Hand × VF × Target	1	96.19	.44	.510
Within	70	178.25		
Hand × Distractor × Target	1	438.35	2.46	.121
Sex × Hand × Distractor × Target	1	160.31	.90	.346
Within	70	137.47		
VF × Distractor × Target	1	137.47	.07	.791
Sex × VF × Distractor × Target	1	39.91	.29	.592
Within	70	156.01		
Hand × VF × Distractor × Target	1	4.00	.03	.873
Sex × Hand × VF × Distractor ×Targ.	1	136.74	.88	.352

Appendix CC

Experiment 3: Analysis of Variance of Response Times for Above/Below Conditions

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	70	636492.88		
Sex	1	4463200.5	7.01	.010
Within	70	36696.46		
Hand	1	66232.83	1.80	.183
Sex × Hand	1	19004.38	.52	.474
Within	70	32354.19		
VF	1	376675.83	11.64	.001
Sex × VF	1	60.04	.00	.966
Within	70	33012.74		
Distractor	1	38099.50	1.15	.286
Sex × Distractor	1	4516.46	.14	.713
Within	70	43563.11		
Target	1	1994254.1	45.78	.000
Sex × Target	1	26.58	.00	.980
Within	70	27271.79		
Hand × VF	1	12475.42	.46	.501
Sex × Hand × VF	1	309.38	.01	.915
Within	70	18005.49		
Hand × Distractor	1	12252.65	.68	.412
Sex × Hand × Distractor	1	6379.79	.35	.554
Within	70	19138.21		
Hand × Target	1	37686.56	1.97	.165
Sex × Hand × Target	1	18073.76	.94	.335

Within	70	27089.80		
VF × Distractor	1	21831.79	.81	.372
Sex × VF × Distractor	1	92790.73	3.43	.068
Within	70	41665.67		
VF × Target	1	146137.70	3.51	.065
Sex × VF × Target	1	263.54	.01	.937
Within	70	39859.13		
Distractor × Target	1	205574.06	5.16	.026
Sex × Distractor × Target	1	77011.77	1.93	.169
Within	70	16484.71		
Hand × VF × Distractor	1	50973.58	3.09	.083
Sex × Hand × VF × Distractor	1	13715.82	.83	.365
Within	70	29875.18		
Hand × VF × Target	1	16403.13	.55	.461
Sex × Hand × VF × Target	1	22199.00	.74	.392
Within	70	19369.41		
Hand × Distractor × Target	1	44067.38	2.28	.136
Sex × Hand × Distractor × Target	1	15554.07	.80	.373
Within	70	19648.28		
VF × Distractor × Target	1	14077.02	.72	.400
Sex × VF × Distractor × Target	1	4136.71	.21	.648
Within	70	19968.11		
Hand × VF × Distractor × Target	1	24264.21	1.22	.274
Sex × Hand × VF × Distractor ×Targ.	1	5308.79	.27	.608

Appendix DD

Experiment 3: Individual Subject Data for Response Times (Above/Below Conditions)

	Left Hand								Right Hand							
	Above Targs.				Below Targs				Above Targs.				Below Targs			
Target:	Word		Non-Word		Word		Non-Word		Word		Nonword		Word		Non-Word	
Distractor	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
ID																
1	1168	1258	1264	1445	1090	1491	850	1129	1373	1154	879	1427	901	1327	1187	1053
2	1010	1107	1184	785	816	998	948	939	797	1111	962	1314	1131	1142	886	1074
3	900	1010	744	1001	830	1114	743	1195	670	926	663	970	614	761	686	828
4	657	817	537	812	592	791	606	768	775	726	764	868	718	1151	722	1178
5	822	760	679	771	819	807	781	1002	817	733	791	812	731	662	763	613
6	687	674	570	742	593	611	590	671	569	747	537	734	624	766	563	707
7	656	663	687	742	598	736	717	665	575	580	641	583	528	600	572	555
8	862	681	726	731	695	679	679	696	835	728	807	733	649	895	743	973
9	823	993	908	971	773	936	823	957	880	874	1035	1124	806	946	879	923
10	794	913	771	778	892	735	916	711	923	1013	943	820	1004	833	862	871
11	1151	1969	1437	2028	745	906	726	1009	1269	957	918	1235	756	1184	958	1225
12	670	768	615	915	575	866	1281	1121	567	740	541	936	579	849	579	828
13	971	1003	732	700	688	818	1078	992	713	705	654	743	711	629	726	654
14	555	688	523	621	602	632	505	567	680	797	848	776	646	763	577	705
15	770	833	726	687	704	705	666	878	936	811	720	848	669	827	635	775
16	1125	1015	905	1235	952	991	919	916	738	998	724	857	727	0	1268	782
17	1679	1344	1305	1034	955	1225	1428	1858	1725	1012	1011	1314	978	948	715	1052
18	838	810	732	677	654	801	682	703	950	1022	916	1017	959	1019	996	1055
19	820	1283	1267	1129	689	900	691	1093	567	697	621	688	635	708	673	707
20	722	976	757	964	698	762	665	795	687	1097	735	959	722	1195	717	953

21	956	1163	1147	1009	819	1325	1037	1081	765	1187	1076	1180	791	909	761	768
22	1150	804	700	658	652	818	687	702	691	733	660	676	589	691	522	769
23	581	708	603	630	625	702	632	671	629	590	690	658	588	647	571	715
24	648	666	608	674	749	679	641	685	699	727	709	810	697	918	672	805
25	1008	991	888	1091	824	898	855	1022	928	911	807	975	800	806	864	846
26	730	764	719	714	712	777	719	755	629	711	693	669	668	731	609	716
27	1378	1245	1191	1654	1079	1574	1402	1200	1244	977	921	1118	1261	1301	895	1102
28	681	610	616	591	560	595	543	611	613	718	604	687	581	674	539	627
29	692	765	608	754	620	767	719	787	589	634	577	633	662	683	580	650
30	830	934	1053	940	905	1118	992	1026	750	844	812	746	781	783	868	981
31	1038	1204	849	1116	675	929	828	811	1025	1205	770	908	731	834	880	968
32	708	1197	955	876	718	918	802	974	1005	1252	721	1487	952	822	1014	1264
33	2579	1550	1410	1384	1428	1481	1622	1419	1714	1316	1446	1093	1001	1131	1471	1337
34	927	923	880	926	753	787	863	767	1153	963	917	919	847	1059	893	1052
35	734	896	978	911	978	839	636	958	851	1038	808	724	690	696	735	811
36	651	773	689	693	630	769	552	686	832	928	665	977	573	741	655	812
37	909	893	956	970	844	985	863	911	685	785	745	836	805	703	736	915
38	910	699	774	1009	637	822	685	768	904	793	864	887	780	768	784	718
39	964	1362	858	965	976	1184	795	1045	1602	760	763	1162	1015	1106	818	749
40	1078	744	858	888	685	706	679	693	797	703	779	714	799	815	657	1040
41	898	683	840	842	640	1059	612	931	653	782	739	816	487	731	546	884
42	859	1148	881	1633	1130	1676	1069	1853	2079	1355	1248	1602	1088	1320	1276	1634
43	519	689	626	669	457	635	510	689	574	646	569	672	527	533	576	572
44	467	483	396	577	461	552	431	600	827	761	845	586	710	796	571	684
45	841	928	733	1111	709	913	719	816	685	772	678	691	1076	763	669	831
46	804	733	674	828	609	827	651	839	972	880	862	1577	945	839	1255	1032
47	653	718	632	876	691	748	619	710	556	651	606	618	542	628	535	655
48	621	682	796	839	586	808	759	771	986	1175	1082	910	873	1221	955	1033
49	1077	955	839	1103	728	1085	739	820	943	738	668	664	690	664	774	786
50	713	689	627	817	563	748	598	740	901	807	867	855	714	776	656	849
51	969	894	908	861	766	758	793	767	731	947	729	706	465	513	536	765
52	944	925	850	880	959	873	858	884	1150	1038	1110	1053	852	1001	850	1149
53	980	1036	1260	1238	1053	1226	1174	1214	730	967	674	690	975	825	605	784
54	707	1297	771	1110	759	924	969	913	1206	920	842	811	964	1242	849	990
55	741	901	791	1154	871	1225	831	1109	636	589	654	610	616	707	478	653
56	716	993	734	1077	703	1022	665	912	680	1402	774	974	857	1069	763	1010

57	1512	1813	1439	1960	1528	1680	1860	1723	1445	1234	1134	1096	1441	1233	1276	1087
58	633	606	640	717	575	900	533	670	607	709	720	751	644	778	733	899
59	1047	1607	1343	1009	1587	1124	1478	1548	1213	1142	899	1350	1069	996	651	913
60	923	893	730	1060	805	719	786	1021	675	936	980	757	694	848	673	706
61	1002	1352	1047	1140	833	1102	962	1239	871	1026	839	941	810	955	815	972
62	686	775	625	800	729	824	592	806	727	765	736	850	862	1191	749	1015
63	1516	1569	1465	1278	1287	1079	1441	1628	1008	1269	983	1040	1085	1006	941	1034
64	828	1712	686	754	783	908	707	847	1011	931	906	1081	765	827	660	851
65	1007	1244	918	1364	1488	860	1011	1209	858	973	793	812	708	880	925	1071
66	861	857	655	760	648	943	790	805	1136	1089	759	1047	923	898	880	1132
67	1075	1008	1052	1058	1136	844	1071	909	808	1005	854	1090	774	825	789	808
68	542	526	485	642	474	526	429	528	730	883	807	725	828	721	610	644
69	1145	1007	1059	1076	795	1173	847	1190	1016	858	1014	1084	635	1082	787	890
70	801	1281	776	1158	859	1454	678	1146	981	1027	854	1302	1035	1105	973	996
71	1088	1651	1386	1312	1411	1883	1015	1804	853	969	907	941	992	1448	1159	1343
72	1006	887	965	891	866	648	920	990	2829	803	1498	1029	1891	1475	1127	2028
mean RT	886															

Appendix EE

Experiment 3: Analysis of Variance of % Errors for Above/Below Conditions

Sex (2) × Target (2) × Distractor (2) × Visual Field (2) × Hand (2)

Source	df	MS	F	p
Within	70	934.73		
Sex	1	61.66	.07	.798
Within	70	174.10		
Hand	1	.39	.00	.963
Sex × Hand	1	21.94	.13	.724
Within	70	311.99		
VF	1	225.56	.72	.398
Sex × VF	1	348.47	1.12	. 294
Within	70	144.16		
Distractor	1	66.97	.46	.498
Sex × Distractor	1	18.16	.13	.724
Within	70	291.96		
Target	1	1014.21	3.47	.067
Sex × Target	1	421.82	1.44	.233
Within	70	118.34		
Hand × VF	1	31.19	.26	.609
Sex × Hand × VF	1	118.64	1.00	.320
Within	70	146.45		
Hand × Distractor	1	26.93	.18	.669
Sex × Hand × Distractor	1	3.18	.02	.883
Within	70	115.24		
Hand × Target	1	83.53	.72	.397
Sex × Hand × Target	1	675.05	5.86	.018

Within	70	162.81		
VF × Distractor	1	130.49	.80	.374
Sex × VF × Distractor	1	510.41	3.13	.081
Within	70	214.73		
VF × Target	1	1268.67	5.91	.018
Sex × VF × Target	1	90.37	.42	.519
Within	70	205.59		
Distractor × Target	1	1886.18	9.17	.003
Sex × Distractor × Target	1	11.50	.06	.814
Within	70	85.04		
Hand × VF × Distractor	1	418.07	4.92	.030
Sex × Hand × VF × Distractor	1	51.28	.60	.440
Within	70	94.28		
Hand × VF × Target	1	166.16	1.76	.189
Sex × Hand × VF × Target	1	243.97	2.59	.112
Within	70	158.06		
Hand × Distractor × Target	1	58.35	.37	.545
Sex × Hand × Distractor × Target	1	52.40	.33	.567
Within	70	202.11		
VF × Distractor × Target	1	7.72	.04	.846
Sex × VF × Distractor × Target	1	292.85	1.45	.233
Within	70	117.12		
Hand × VF × Distractor × Target	1	70.93	.61	.439
Sex × Hand × VF × Distractor ×Targ.	1	64.92	.55	.459

Appendix FF
Experiment 3: Individual Subject Data for % Errors (Above/Below)

Left Hand								Right Hand							
Above Targs Word		Non-Word		Below Targs Word		Non-Word		Above Targs Word		Non-Word		Below Targs Word		Non-Word	
W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW	W	NW
11	22	22	33	0	38	0	25	0	0	11	11	0	0	0	13
22	11	44	11	0	38	13	25	0	11	0	11	50	25	13	38
22	11	11	11	13	13	0	0	11	0	0	0	0	13	0	0
0	11	11	22	0	13	0	13	0	22	0	22	0	38	0	13
44	33	33	22	0	13	13	0	22	11	33	0	25	0	13	13
0	0	0	0	13	25	0	0	0	11	0	0	13	13	0	13
0	11	44	11	13	25	13	25	0	11	11	0	0	0	0	0
44	22	22	0	0	0	0	0	22	11	11	11	0	0	0	0
0	15	11	11	0	0	0	25	0	0	0	0	0	0	0	13
33	0	11	0	13	13	0	0	0	0	11	0	25	13	13	0
0	11	11	33	0	0	0	13	11	11	22	11	0	0	0	0
22	22	11	56	38	0	13	25	0	56	0	22	0	13	0	25
22	0	11	22	13	13	0	0	11	11	0	0	0	0	0	25
22	67	11	33	13	38	0	38	22	56	67	56	0	50	0	25
22	11	0	0	13	13	0	0	11	11	0	22	0	0	0	13
0	11	11	22	0	13	0	13	0	33	0	0	0	100	88	0
11	33	0	0	0	13	0	38	0	0	33	0	0	0	25	25
22	11	44	0	0	0	0	25	44	22	11	33	13	25	0	0
44	33	22	22	13	25	13	38	0	0	11	11	0	0	0	13
22	11	11	22	0	25	0	0	0	22	0	0	13	25	13	0
56	11	78	22	0	13	0	25	22	0	33	11	0	13	13	0
44	33	33	0	13	38	13	0	44	0	44	11	0	50	0	0
22	0	0	0	0	13	0	0	11	0	22	0	0	0	0	38
11	22	22	0	13	50	0	0	11	11	0	11	0	13	25	0
11	33	22	33	13	25	13	13	0	22	33	0	0	13	25	0
22	22	33	0	13	13	25	0	22	11	22	0	50	38	0	25
44	0	0	0	0	25	13	38	0	11	0	11	13	13	13	0

22	22	33	0	0	0	13	0	11	11	11	22	0	0	0	38
0	11	33	11	0	0	0	25	11	11	22	11	13	50	13	13
0	0	11	0	0	0	13	0	22	0	22	11	0	0	0	0
22	11	11	33	0	38	0	13	22	33	11	11	38	13	13	13
11	22	22	11	0	13	0	0	0	0	0	22	0	25	13	13
22	11	22	11	0	13	13	13	11	44	11	22	38	0	13	0
0	33	44	0	13	13	0	0	11	11	22	11	0	0	25	25
6	50	22	25	0	29	33	0	0	11	11	33	0	25	13	25
18	11	22	0	13	9	0	63	11	31	13	11	0	25	0	25
0	0	0	44	0	0	0	13	11	0	22	0	0	0	0	0
11	56	33	11	13	13	13	0	0	0	0	0	0	38	0	0
56	11	56	11	0	0	0	25	67	0	33	0	38	13	75	13
0	33	22	22	13	0	13	13	0	22	0	11	25	0	13	25
11	56	0	44	0	38	0	13	0	0	22	0	0	0	0	13
0	22	0	0	0	25	0	0	0	0	22	11	0	13	13	13
0	0	11	11	0	0	0	0	11	11	22	0	0	13	0	0
33	56	11	56	13	50	50	63	11	11	11	11	0	13	0	25
44	44	11	44	0	25	13	50	11	11	0	22	50	50	13	38
56	33	56	44	25	38	50	25	11	33	44	11	0	38	13	0
11	44	11	33	13	13	0	25	22	0	0	11	13	13	0	13
0	78	11	11	0	13	0	13	11	0	0	0	0	13	0	0
0	11	0	0	8	27	0	0	14	0	29	0	0	18	0	0
9	40	29	33	25	20	0	13	0	14	14	14	0	0	13	14
14	25	0	44	9	25	0	40	0	42	33	0	0	17	0	13
11	67	11	11	13	25	25	0	33	33	33	11	13	25	0	0
33	22	56	22	0	25	0	25	11	11	22	33	13	38	13	13
11	22	22	11	13	13	13	0	11	0	0	0	0	0	0	0
44	11	11	11	13	63	25	13	0	0	11	0	0	13	0	13
0	22	0	0	0	0	0	25	0	11	0	11	0	25	13	0
22	0	22	11	0	13	0	0	0	0	22	11	13	13	25	13
33	11	11	33	0	50	0	25	22	22	11	11	38	38	13	75
22	11	0	22	25	25	0	25	0	22	22	11	0	0	0	0
0	33	0	33	25	0	13	25	22	0	0	0	13	13	0	0
56	33	56	22	13	50	13	25	22	0	11	22	0	0	0	13
11	22	0	11	0	0	0	13	0	11	0	0	0	13	13	13
22	44	44	22	0	13	63	25	22	11	56	11	13	0	0	13
11	56	22	11	0	13	0	0	0	0	0	0	0	13	13	13
11	0	0	11	0	25	13	0	0	0	0	0	25	13	25	25
22	22	22	44	0	38	0	13	33	33	11	22	25	38	0	50

11	22	33	44	25	0	0	38	22	22	11	0	0	13	0	38
33	44	11	89	50	25	38	38	33	33	11	56	38	25	25	63
11	33	0	22	25	13	13	25	0	11	11	0	0	13	13	0
0	44	0	67	0	25	0	13	22	33	0	22	13	50	25	13
11	22	22	44	13	25	0	13	11	0	11	22	13	13	25	0
14	38	22	44	30	67	25	50	29	67	33	78	23	83	63	25

14 overall

References

Aboitiz, A., Scheibel, A.B., Fisher, R.S., (1992). Individual differences in brain asymmetries and fiber composition in the human corpus callosum. *Brain Research, 598,* 154-161.

Banich, M.T. (in press). The missing link: The role of interhemispheric interaction in attentional processing. *Brain and Cognition.*

Banich, M.T. (1995). Interhemispheric processing: Theoretical considerations and empirical approaches. (pp. 427-450). In R.J. Davidson and K. Hughdal (Eds.), *Brain Asymmetry* Cambridge, M.A.: M.I.T. Press.

Benjafield, J. & Muckenheim, R. (1989). Dates of entry and measures of imagery, concreteness, goodness, and familiarity for 1,046 words sampled from the *Oxford English Dictionary. Behavior Research Methods, Instruments, & Computers, 21*, 31-52.

Bogen, J.E., Fisher, E.D., & Vogel, P.J. (1965). Cerebral commissurotomy: A second case report. *Journal of the American Medical Association, 194,* 1328-1329.

Boles, D.B. (1983). Hemispheric interaction in visual field asymmetry. *Cortex, 19*, 99-114.

Boles, D.B. (1987). Reaction time asymmetry through bilateral vs. unilateral stimulus presentation. *Brain and Cognition, 6,* 321-333.

Boles, D.B.(1990). What bilateral displays do. *Brain and Cognition, 12*, 205-228.

Boles, D.B. (1995). Parameters of the bilateral effect. In F.L.Kitterle (Ed.), *Hemispheric Communication: Mechanisms and Models,* (pp.211-230). New Jersey: Erlbaum.

Bradshaw, J.L., & Gates, A. (1978). Visual field differences in verbal tasks: Effects of task familiarity and sex of subject. *Brain and Language, 5,* 166-187.

Broca, P. (1861). Remarques sur le siege de la faculte du langage articule, suivies dun observation d'aphemie (perte de la parole). *Bulletins de la Societe Anatomique de Paris, 2,* 333-357.

Bryden, M.P. (1982). *Laterality: Functional asymmetry in the intact brain.* New York: Academic Press.

Bryden, M.P. (1989). Dichotic listening and cerebral asymmetry. In K.Hughdahl (Ed.), Handbook of Dichotic Listening: Theory, Methods, and Research, New York: Wiley & Sons.

Bryden, M.P., & Bulman-Fleming, M.B. (1994). Laterality effects in normal subjects: evidence for interhemispheric interactions. *Behavoural Brain Research, 64,* 119-129.

Chiarello, C., & Maxfield, L. (1996). Varieties of interhemispheric inhibition, or how to keep a good hemisphere down. *Brain and Cognition, 30,* 81-108.

Coltheart, M. (1981). Disorders of reading and their implications for models of normal reading. *Visible Language, 15,* 245-286.

Cohen. J.D. MacWhinney, B. Flatt, M. & Provost, J. (1993). PsyScope: A new graphic interactive environment for designing psychology experiments. *Behavioral Research Methods, Instruments, & Computers, 25,* 257-271.

Day, J. (1979). Visual half-field word recognition as a function of syntactic class and imageability. *Neuropsychologia, 17,* 515-519.

Ellis, A.W., & Shepherd, J.W. (1974). Recognition of abstract and concrete words presented in left and right visual fields. *Journal of Experimental Psychology, 103,* 1035-1036.

Ely, P., Graves, R. & Potter, S. (1989). Dichotic listening indices of right hemisphere semantic processing. *Neuropsychologia,* 27, 1007-1015.

Friendly, M. Franklin, P.E., & Hoffman, D. (1982). The Toronto word pool: Norms for imagery, concreteness, orthographic variables and grammatical usage for 1,800 words. *Behavior Research Methods and Instrumentation, 14*, 375-399.

Gilhooly, K.J., & Logie, R.H. (1980). Age-of-acquisition, imagery, concreteness, familiarity, and ambiguity measures for 1,944 words. *Behavior Research Methods and Instrumentation, 12*, 395-427.

Gazzaniga, M.S. (1983). Right hemisphere language following brain bisection: A 20-year perspective. *American Psychologist, 38*, 525-537.

Gazzaniga, M.S., & Sperry, R.W. (1967). Language after section of the cerebral commissures. *Brain, 90*, 131-138.

Glass, A.S., Gazzaniga, M.S., & Premack, D. (1973). Artificial language training in global aphasics. *Neuropsychologia, 11*, 95-103.

Hines, D. (1976). Recognition of verbs, abstract nouns and concrete nouns from the left and right visual half-fields. *Neuropsychologia, 14*, 211-216.

Hines, D. (1977). Differences in tachistoscopic recognition between abstract and concrete words as a function of visual half-field and frequency. *Cortex, 13*, 66-73.

Iacoboni, M., & Zaidel, E. (1996). Hemispheric independence in word recognition: Evidence from unilateral and bilateral presentations *Brain and Language, 53*, 121-140.

Kinsbourne, M. (1975). The mechanisms of hemispheric control of the lateral gradient of attention. In P.M.A. Rabbitt & S. Dornic (Eds.), *Attention and Performance*. New York: Academic Press.

Kücera H., & Francis W.N., (1967). *Computational Analysis of Present-Day American English*. Providence, R.I.: Brown University Press.

McGlone, J. (1980). Sex differences in human brain organization: A critical survey. *The Behavioral and Brain Sciences, 3,* 215-227.

McKeever, W.F. (1971). Lateral word recognition effects of unilateral and bilateral presentation, asynchrony of bilateral presentation and forced order of report. *Quarterly Journal of Experimental Psychology, 23,* 410-416.

Mead, L.A., & Hampson, E. (1996). Asymmetric effects of ovarian hormones on hemispheric activity: Evidence from dichotic and tachistoscopic tests. *Neuropsychology 10,* 578-587.

Measso, G., & Zaidel, E. (1990). Effect of response programming on hemispheric differences in lexical decision. *Neuropsychologia, 28,* 635-646.

Müller, R. (1996). Innateness, autonomy, universality? Neurobiological approaches to language. *Behavioral and Brain Sciences, 19,* 611-675.

Patterson, K., & Besner, D. (1984). Is the right hemisphere literate? *Cognitive Neuropsychology, 4,* 315-341.

Pavio, A. (1982). *Imagery and familiartiy ratings for 2448 words: Unpublished norms.* Department of Psychology, University of Western Ontario.

Pavio, A., Yuille, J.C., & Madigan, S.A. (1968). Concreteness, imagery and meaningfulness values of 925 nouns. *Journal of Experimental Psychology Monograph Supplement, 76,* 1-25.

Poffenberger, A.T. (1912). Reaction time to retinal stimulation with special reference to the time lost in conduction through nerve centres. *Archives of Psychology, 23,* 1-73.

Rasmussen, T. & Milner, B. (1977). The role of early left-brain injury in determining lateralization of cerebral speech functions. *Annals of the New York Academy of Sciences, 299,* 335-369.

Sperry, R.W. (1974). Lateral specialization in the surgically separated hemispheres. In F.O. Schmitt and F.G. Worden (Eds.), *The Neurosciences: Third Study Program*. Cambridge, MA: MIT Press.

Van Selst, M., & Jolicoeur, P. (1994). A solution to the effect of sample size on outlier elimination. *The Quarterly Journal of Experimental Psychology, 47,* 631-650.

Wernicke, C. (1874). *Der Aphasische Symptomenkomplex.* Breslau, Poland: M.Cohn and Weigert.

Weekes, N.Y., & Zaidel, E. (1996). The influence of menstrual stage on hemispheric specialization and interhemispheric interactions. *Brain and Cognition, 32,* 278-282.

Zaidel, E. (1989). Hemispheric independence and interaction in word recognition. In C. von Euler, I. Lundbreg, & G. Lennerstrand (Eds.), *Brain and Reading* (pp. 77-97). Hampshire: Macmillan.

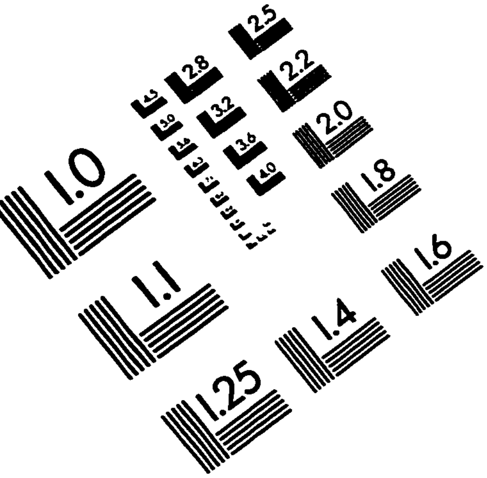
Zaidel, E. (1990). The saga of right-hemisphere reading. In C. Trevarthen (Ed.), *Brain circuits and functions of the mind: Essays in honor of Roger W. Sperry* (pp. 304-319). Cambridge, England: Cambridge University Press.

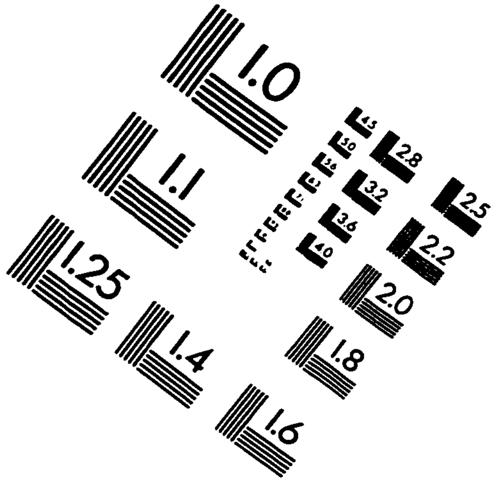
Zaidel, E., Clarke, J.M., & Suyenobu, B. (1990). Hemispheric independence: A paradigm case for cognitive neuroscience. In A.B. Scheibel & A.F. Wechsler (Eds.), *Neurobiology of Higher Cognitive Function,* (pp.237-355). New York: Guilford.

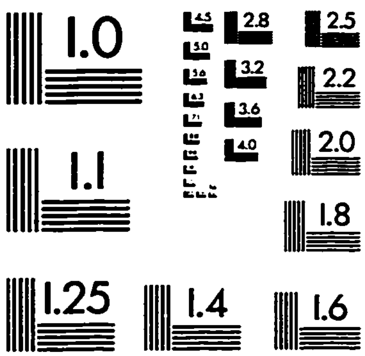
Zaidel, E., & Rayman, J. (1994). Hemispheric control in the normal brain: Evidence from redundant bilateral presentations. In C. Umilta & M. Moscovitch (Eds.), *Attention and Performance XV: Conscious and Nonconscious Information Processing,* (pp 477-504). Cambridge: MIT Press

Zaidel, E., White, H., Sakurai, E., & Banks, W. (1988). Hemispheric locus of lexical congruity effects: Neuropsychological reinterpretation of psycholinguistic results. In C. Chiarello (Ed.), Right Hemisphere Contributions to Lexical Semantics: Berlin: Springer-Verlag.

IMAGE EVALUATION TEST TARGET (QA-3)

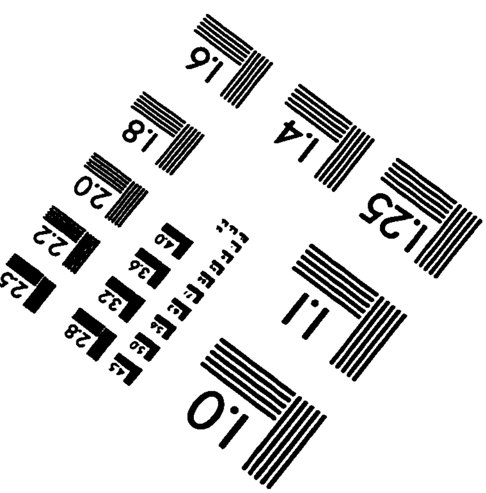


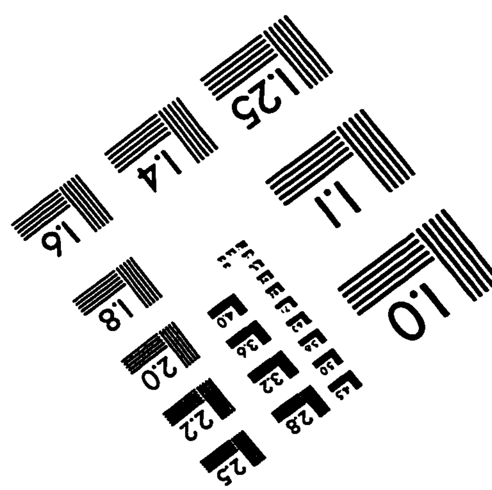




150mm

6"





APPLIED IMAGE . Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989