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Word-Type Effects in the Lexical Processing of Russian-English and French-English Bilinguals

by

Marina Blekher 

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of **Doctor of Philosophy.**

in

Psycholinguistics

Department of Linguistics

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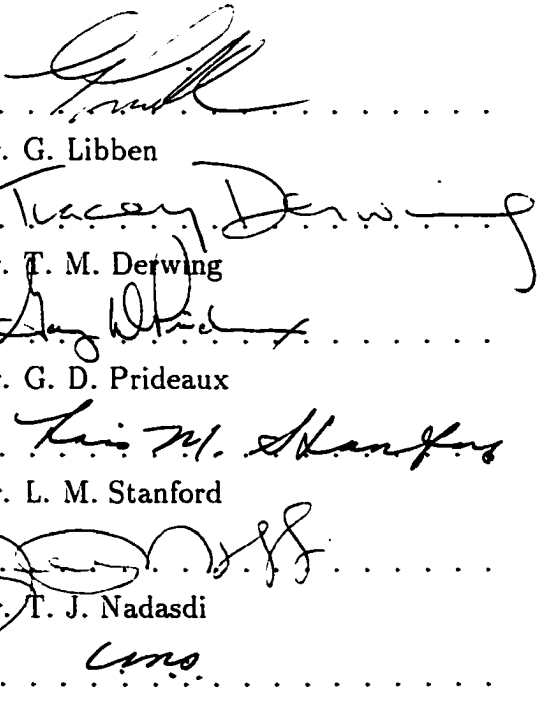

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To my parents and grandparents

Word-Type Effects in the Lexical Processing of Russian-English and French-English Bilinguals

Abstract

This study of the bilingual lexicon investigates word-type effects in the lexical processing of different-script and same-script advanced bilinguals.

Two response time tasks were administered to 38 Russian-English and 35 French-English bilinguals. These tasks included a number of word type pairs with various form-to-meaning mapping combinations across L1 and L2, such as translation equivalents, cognate translations, non-translations, false friends, and ambiguous words that have two possible translations. Stimuli were presented in triplets such that each interlingual pair was preceded by an L1 pre-prime to bias the reading of ambiguous words. On the first task, cross-linguistic priming with lexical decision, bilinguals had to determine whether L2 target items (English for both groups) were real English words. On the second task, translation recognition, they were asked to decide whether the L1 and L2 words that constituted a stimulus pair were translations of each other.

The results reveal that bilingual lexical representations vary both within bilinguals, depending on word type, and across bilinguals, depending on whether they belong to the same- or different-script group. For the first type of variation, it was found that in most cases, the more conceptual or lexical elements an interlingual word pair shares, the greater facilitation is. Activation based on shared lexical features only (e.g., false friends) is automatic and cannot be suppressed by parallel conceptual-based activation or by

explicit knowledge. This leads to inhibition on the translation task. For ambiguous items, both of their meanings are activated, which in turn results in multiple L2 lemma activation and slows down processing. As for the across-group differences, although the Russian-English and French-English groups demonstrated similar word-type patterns and both showed a lot of interlingual facilitation, overall response times were much faster for the French-English group. This combination of results may suggest that even though script does not seem to be a basis for language separation in bilinguals, lexical representations of same-script bilinguals are shared to a greater extent compared to those of different-script bilinguals. Overall, the results support a view of the bilingual lexicon as containing both L1 and L2 lexical items, with representations varying both within and across lexicons.

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CHAPTER ONE

INTRODUCTION

1.1 Preliminaries

Anyone who has taught or learnt a second language knows that mastery of second language vocabulary plays a central role in successful L2 acquisition. A bilingual's[1] proficiency in his or her non-dominant language is often judged by how fast and how appropriately he or she can understand and produce L2 words. The higher an individual's second language proficiency, the more automatic his or her lexical access. However, even for advanced and near-native second language speakers, L2 word processing does not always proceed in a smooth fashion. In fact, even language professionals such as conference interpreters are known to experience minor processing difficulties with words in their second language.

Instructors and experienced language learners also know that not all words are the same in terms of the degree of difficulty they may present in acquisition and real-time processing. Among the major factors contributing to such variation in processing difficulty are word meaning and the way a word is pronounced and spelt in the two languages. The combination of these factors is commonly referred to as "form-to-meaning mapping", and the consistency of such mapping between L1 and L2 is a major source of positive transfer and interference. For example, language instructors know that learners encounter relatively little difficulty with cognates, words that share form in

[1] Following what has become a common practice in this research domain, the term "bilingual" is used throughout this thesis to include individuals who are not equally proficient in two languages.

addition to having similar meanings in the two languages (e.g., *table* in English and *table* in French). On the other hand, a situation in which perceptually similar items have completely different meanings in L1 and L2 ('false friends') often results in interference errors (e.g., *pain* in English and *pain* meaning 'bread' in French).

The present thesis explores the effect of such word-type variation caused by different form-to-meaning mappings in on-line bilingual processing. Its major purpose is to uncover word types, or combinations of conceptual and lexical representational elements, that are conducive to interlingual facilitation or, vice versa, inhibition in advanced bilinguals.

The architecture of the bilingual lexicon has traditionally occupied a central place in the study of bilingual cognitive organization and processing. However, the focus of this research is very different from that in the domain of the monolingual lexicon. Whereas monolingual lexical research explores the role of semantic, phonological, orthographic, morphological and other variables in lexical organization, bilingual literature has, until recently, viewed the language barrier as the major determiner of bilingual word organization. The debate about whether words of two languages are stored in common or separate stores dominated bilingual research for many years. Ample evidence was produced in favor of both views, until the issue was finally pronounced indeterminable (see Durgonoglu & Roediger, 1987). In the meanwhile, little attention was given to examining more universal structural principles that may be involved in bilingual word organization.

More recently, the common/separate dichotomy has started to give way to the view of the bilingual lexicon as a non-uniform structure that varies across as well as within

individuals. According to this view, L1 and L2 lexical representations may be shared to different degrees, depending on a variety of factors (De Groot, 1993, 1995). For instance, it has been shown that word organization varies across bilinguals depending on their L2 proficiency level (e.g., Potter et al., 1984). To account for the within-individual variation in the bilingual lexicon, researchers have turned to the study of word characteristics in order to uncover the effects of various types of words and combinations of word properties on bilingual processing. It is within this domain of research that the current study is situated.

This thesis examines aspects of both within- and across-individual variation in bilingual lexical organization, and thus has a two-fold purpose:

First, as has been mentioned above, it seeks to uncover form-to-meaning mapping combinations that are conducive to interlingual facilitation or inhibition in bilinguals. This is the within-individual dimension of the investigation.

Second, the above issue is examined for two bilingual groups: (1) Russian-English bilinguals whose languages employ different orthographic systems and (2) French-English bilinguals whose languages employ the same orthography. This cross-group comparison makes it possible to zero in on the role of shared orthography and overall language distance in bilingual lexical processing. This is the across-individual dimension of the study.

The contribution of the first aspect of this investigation consists of informing current models of bilingual word organization by addressing the issue of mixed representations within a bilingual's lexicon. In addition, it results in a taxonomy of conceptual and lexical feature combinations that cause interlingual facilitation or inhibition. As will be discussed

below, individual word-type effects in bilinguals have been examined in a variety of studies. In this thesis, my goal was to contribute to this body of knowledge by conducting a comprehensive, multi-faceted investigation that brings under one umbrella a variety of word-types resulting from different form-to-meaning mapping combinations. Furthermore, it investigates several potentially interesting word types that have thus far not been the subject of any bilingual psycholinguistic studies, such as ambiguous words that have two different L2 translations.

The contribution of the second, cross-group aspect of the present thesis is to determine whether the lexicons of bilinguals whose two languages use different scripts are qualitatively different from those whose languages employ the same script. An affirmative answer to this question would provide evidence for mixed representations across bilingual lexicons. This is achieved by having two bilingual groups, Russian-English and French-English bilinguals, perform the same kinds of on-line tasks using the identical methodology and stimulus types. The above arrangement allowed me to target the role of shared orthography in bilingual lexical processing. Most bilingual studies to date have focused on the cognitive organization of same-script bilinguals, and very few have chosen to look at different-script bilinguals. Furthermore, none of the previous investigations have examined two different bilingual groups within the framework of a single study using experimental controls to assure group comparability. Having bilinguals from two different populations participate in the study increases the generalizability of the results. Given the variety of bilingual populations in North America and the growing proportion of different-script bilinguals, it is important that results of psycholinguistic experimentation be generalizable across various bilingual groups.

1.2 Thesis Outline

The remaining chapters of this thesis are organized as follows:

In Chapter 2, I present the theoretical background for the present investigation, starting with a discussion of major principles in the organization of monolingual word architecture. This is followed by a review of dominant theories of the bilingual lexicon. The developments in this area are traced, starting with the common/separate store dilemma which gave rise to the concept-mediation versus word-association debate and, finally, to the mixed-representational view of bilingual word organization. The emphasis of the latter framework on word-type effects, in particular, those effects resulting from various form-to-meaning mapping combinations, is discussed. The framework is illustrated using Kroll and De Groot's (1997) distributed lexical/conceptual feature model of bilingual representation. This theoretical discussion is followed by a review of experimental studies dealing with individual word-type effects, such as translation equivalents, cognates, and false friends. Previous results for different-script bilinguals are also discussed. Studies of ambiguous word processing by monolinguals are reviewed, since no such results are available for bilinguals. Finally, based on all the above, the rationale for the present study is given, emphasizing its comprehensiveness and the within- as well as across-individual dimensions. This final part also describes the word types to be examined and outlines research questions and hypotheses, along with the experimental paradigms used to address them.

The following two chapters, Chapter 3 and Chapter 4, are parallel in structure. Chapter 3 describes the experimental methodology and results for the Russian-English

participant group, while Chapter 4 provides the same information for the French-English group. As has been mentioned above, to ensure between-group comparability, identical stimulus types and experimental paradigms were used in both cases. Each of the two chapters is broken down into three major parts by experimental task: the cross-linguistic primed lexical decision task, the translation recognition task and, finally, the offline translation task that served as a proficiency test. In each part, the experimental methodology is presented, along with the results obtained on the task in question. This is followed by a discussion of word-type effects in relation to the research questions and hypotheses formulated in the final part of Chapter 2. Chapters 3 and 4 are each concluded with a general discussion of the Russian-English and French-English experiments respectively, incorporating the results obtained on both on-line tasks. Preliminary conclusions regarding word-type effects and the involvement of conceptual- and lexical-level features in bilingual lexical processing are offered.

The final chapter summarizes and compares the results across the Russian-English and French-English participant groups. Overall response patterns for the two groups are examined, followed by a detailed comparison across various word types, according to the questions and hypotheses formulated in Chapter 2. Similarities and differences revealed in the processing of the two bilingual groups are pointed out, explanations that may account for them are proposed, and implications for bilingual lexicon models are suggested. In addition, the relative involvement of conceptual and lexical features in bilingual lexical processing is discussed and feature combinations that typically lead to interlingual facilitation or inhibition are listed. The chapter concludes with a discussion

of the effect of script and overall language distance on bilingual lexical representation and processing. Suggestions for future research are also made.

CHAPTER TWO

LITERATURE REVIEW AND RATIONALE FOR THE STUDY

2.1 Semantics, Phonology and Orthography as Major Factors in the Organization of the Monolingual Mental Lexicon

In almost every model of word organization, it is assumed that semantics, phonology, and orthography (i.e., word meaning and form) play a major role in structuring the lexicon, along with several other factors, such as word frequency, morphological structure, and grammatical class. The commonly held view is that semantic relations between lexical items are represented by links in a cross-referenced network (e.g., Collins & Loftus, 1975; Forster, 1979). A distinction is usually drawn between such a semantically-based network and a lexical network which is largely phonemically-based. Robust experimental evidence has been produced to show that lexical items are stored and processed along the lines of their semantic and phonological/orthographic similarity.

Meyer and Schvaneveldt (1971) found that the word *nurse*, for example, was processed faster when it was preceded by its semantic associate such as *doctor* than when it was preceded by an unrelated lexical item. This effect may be explained by spreading activation through the links between semantically related words which primes the recognition of those words (Collins & Loftus, 1975). Speech errors made by 'normals' and aphasics also confirm that semantically related lexical items are linked in the mental lexicon. Usually words that are close in meaning or belong to the same semantic field get

substituted by each other, e.g., *I better give you a map --> ... a calendar* (from Emmorey & Fromkin, 1988). Another piece of evidence comes from free word association experiments where participants are given words and asked to respond with the first word that comes to mind (e.g., Ervin, 1957). The most likely response is a semantically related word (e.g., *salt - pepper*), indicating that word meaning is a major governing principle in the organization of the mental lexicon. Additional convincing evidence comes from a study conducted by Freedman & Loftus (1971), where participants could name more "Fruits beginning with P" than "P-words that are fruits". Information about word meaning facilitated lexical access to a greater extent than did information about the initial segment of the word.

However, word form (i.e., its phonological or orthographic properties) also plays an important role in lexical access and organization. There is evidence indicating that similar-sounding words may be linked or stored close to each other in the mental lexicon. Attempts to retrieve a word sometimes activate its phonological neighbors, resulting in speech errors (e.g., the substitution of *cylinders* with *syllables*), which often occurs with words that have similar beginnings or endings, although this phenomenon is not limited to such cases (e.g., Tweney, Tkacz, & Zaruba, 1975). The existence of phonologically-based links between lexical items has also been confirmed in the studies of the "tip-of-the-tongue" phenomenon. Thus, Brown & McNeill (1966) found that when participants were induced to produce the "tip-of-the-tongue" phenomenon, they were more likely to approximate the target words with similar-sounding words than with semantically-related words. For instance, the most common response for the word *sampan* was *sarong* but not its semantic associates such as *junk* or *houseboat*.

The above indicates that word form along with word meaning is an important principle governing lexical organization and access. This fact is reflected in practically every model of the lexicon, although each model presents a slightly different picture of how information about word form and meaning is stored and accessed during recognition.

The major difference is usually drawn between serial search and parallel/direct access models. Serial search models, such as that in Forster (1976), assume that during word recognition, lexical items are searched sequentially, one after another. In parallel access models, such as Morton's (1969, 1979) logogen model, connectionist models (e.g., McClelland & Rumelhart, 1981), and Marslen-Wilson's (1989) cohort model, multiple lexical entries are activated directly by the perceptual input. Such activation occurs in parallel and the candidate that shares the greatest number of features with the input wins over the others. In all these models, word meaning and form both play a role in the organization of the lexicon, along with some other principles.

In Forster's (1976) serial search model, lexical access proceeds through three major access files, two of which contain information about word form (orthographic and phonological), and the third - about word meaning (semantic/syntactic). Only one route is available at a time. During word recognition, the perceptual representation is constructed in the access file mostly based on the initial sounds or letters of the word. Entries are searched one by one, until an exact match is found. The second stage involves a search in the master lexicon that is organized according to word frequency, with the most frequent entries on top, and contains cross-references with associated words.

In Morton's logogen model, each word is assumed to be a "logogen" that is activated

to a certain threshold during lexical access, depending on the number of features that it shares with the perceptual input. The activation of a lexical entry/logogen occurs based on the semantic, phonological, and orthographic information contained in the input. All the data about a lexical item is available during recognition, and all the logogens with matching information are activated in parallel. Activation may spread from a logogen to its associates. Frequently used lexical items have a lowered activation threshold, which speeds up lexical access.

Connectionist models that also assume direct and multiple access to lexical items (e.g., McClelland & Rumelhart, 1981), view word organization as the strength of connections between nodes representing words or their features. Lexical access proceeds through input, output, and hidden nodes. Hidden nodes are responsible for internal processing, and their functional levels represent different kinds of information about words, such as information about their semantic, phonological and orthographic properties. When a node or connection is activated, activation spreads in all directions to the representations that are semantically, phonologically or orthographically similar to the target word. Frequently used lexical items have stronger connections to lower-level nodes, which facilitates access to such items.

In Marslen-Wilson's (1989) cohort model designed to explain auditory word recognition, there is also direct and multiple lexical access. All the potential candidates that match the word-initial cohort (one or two word-initial phonemes) get activated and are subsequently eliminated as more phonological or contextual input is received. Thus, the model claims that when a word is heard initially, all of its phonological neighbors are also activated. Semantic or contextual priming is assumed to narrow down the initial

cohort, thus speeding up lexical access.

The Fromkin coaddressing model (1985) contains separate but interconnected semantic, phonological, and orthographic subcomponents. The various representations of a word (i.e., phonological, orthographic etc.) are co-addressed. The model is important because it explains the effect of phonology on visual word recognition by allowing connections between phonological and orthographic representations. Many studies have shown that in both visual and auditory word recognition, both the phonological and orthographic representations of a word are computed automatically. Thus, Humphreys, Evett and Taylor (1982) found that visual word recognition was faster when the word was primed by its homophone, indicating that phonological similarity between the prime and target facilitates visual recognition.

To summarize, evidence from word recognition by monolinguals indicates that both word meaning and word form play a role in lexical organization and access. Various theoretical models described above all view semantic, phonological, and orthographic properties of lexical items as different routes involved in lexical access, and these properties are presumably networked. Lexical items sharing some of those properties are located in proximity to each other in the lexicon and are linked by stronger connections, which facilitates their activation during recognition.

2.2 Organization of the Bilingual Mental Lexicon

2.2.1 Common versus Separate Storage

A great deal of research in the past fifteen years has been concerned with how words are organized in the mind of a *bilingual* and with how bilingual lexical access is achieved. However, in contrast to the monolingual lexicon studies described above, the major focus here has not been on the kinds of considerations (e.g., semantic, phonological, orthographic etc.) that govern bilingual lexical organization, but, rather, on whether the words of a bilingual's two languages are stored together or separately. This issue goes back to the distinction between compound and coordinate bilinguals proposed in Weinreich's (1953) early bilingual research. The problem of common/separate storage has been extensively researched but has not been resolved in any definitive way.

A great deal of evidence has been produced in favor of both views.

The "independence hypothesis" assumes separate stores for words of the bilingual's two languages, with information from one system not readily available to the other. Most experimental evidence supporting this model of bilingual lexical organization comes from word fragment completion, repetition priming and proactive interference release tasks. Thus, Watkins & Peynircioglu (1983) found no facilitation effect of the stimulus word for the completion of a word fragment of its translation, suggesting a separate representation for words of the two languages. In repetition priming tasks such as those employed in Kirsner et al. (1980, 1984) and Scarborough et al. (1984), no priming effect was found for translations, whereas the normal repetition priming effect was found for same-language words. In proactive interference release studies, participants experienced

a release from proactive interference in recall when the language of items on a list was changed (e.g., Goggin & Wickens, 1971; Dillon et al., 1973). All of these studies have demonstrated that words of the two languages are represented in relatively autonomous and independent stores.

However, even more robust experimental evidence exists in favor of the "interdependence hypothesis", according to which words from both languages are stored together, in a single language-independent module, so that information from the bilingual's two languages interacts. Evidence supporting this view comes from free recall studies, cross-language semantic and sentence priming tasks as well as the Stroop task. On all these tasks, the observed effects were similar within and across languages, which is usually interpreted as evidence for language-independent, common semantic store. Thus, in free recall experiments (e.g., Kolers, 1966; Lopez & Young, 1974), no difference was observed in the between- and within-language conditions. By the same token, for fluent bilinguals, the semantic priming effect has been obtained both across and within languages in a number of studies (e.g., Meyer & Ruddy, 1974; Schwanenflugel & Rey, 1986). In sentence priming tasks (e.g., Kroll & Borning, 1987), cross-language as well as within-language sentence context effects have been obtained. In Stroop tasks (cross-language color-naming), the typical result is that there is significant interference from a related word in a bilingual's other language (e.g., Preston & Lambert, 1969), again suggesting that a common word store is accessed by bilinguals.

More recently, several researchers (e.g., Durgunoglu & Roediger, 1987; Heredia & McLaughlin, 1992) have convincingly argued that the issue of common/separate bilingual lexical storage is *indeterminable* since the specific processing demands of

various experimental tasks cause different results and lead to opposite conclusions. Specifically, in *data-driven tasks* such as word fragment completion, bilinguals exhibited a language-specific pattern of results, while in *conceptually driven tasks* like free recall, language-independent results were observed.

2.2.2 Concept-Mediation versus Word-Association

To reconcile the contradicting evidence concerning the common/separate storage issue presented in the previous section, a number of researchers have proposed a distinction between a general conceptual, language-independent level of representation containing conceptual/semantic information, and a more language-specific lexical level in which lexical form information is stored (e.g., Kroll (1993) and other versions of the "hierarchical models" of bilingual memory). The contradicting results obtained in the two sets of studies described in the previous section could now be explained in terms of the different levels of representation probed in the conceptually driven and data-driven tasks.

Although this proposal brought the common/separate store debate to a resolution, it gave rise to another debate in the bilingual literature. This second debate focused on the nature of connections between the two levels of representation. One proposal, called Concept-Mediation, postulates that the words of the two languages are connected via a language-independent conceptual store, with no direct connections between lexical items across languages. The alternative proposal, Word-Association, allows for direct links between equivalent words in the two languages, while the conceptual store can only be accessed directly from L1 but not L2, so that the meaning of L2 words is always retrieved

via translation into L1. Potter et al. (1984) compared bilingual performance in a picture-naming and a word-translation task and obtained similar results on both tasks. This led them to support the concept-mediation model, since if direct interlingual word-association existed, translation latencies would have been shorter (picture-naming requires concept-mediation). Concept-mediation, on the other hand, predicts similar response latencies on the two tasks, consistent with the results of this study, since both tasks would require the concept to be accessed prior to the activation of an L2 lexical item. The concept-mediation model also received support in a cross-linguistic priming study conducted by Schwanenflugel & Rey (1986). However, Kroll & Curley (1988) and Chen & Leung (1989) found the opposite pattern of results for less proficient bilinguals who were faster at translating words than they were at naming pictures, upholding the word-association hypothesis. The latter finding was important since it suggested a developmental shift from word-association to concept-mediation across a 'bilingual lifespan' and started the trend of treating bilingual lexical organization as a non-uniform phenomenon.

2.3 Word-Type Effects in Bilingual Lexical Representation and Access

As can be seen from the previous sections, the issue of bilingual lexical organization was considered for the most part in black-and-white terms, leaving a place for only one possibility (common vs. separate storage, concept-mediation vs. word-association) while the available evidence upheld both. The lexical organization of a bilingual was largely viewed as a uniform structure.

It has been suggested lately in the psycholinguistic literature on bilingualism that the way the words of the two languages are represented and connected in the mind of a bilingual depends on a number of factors, such as the level of proficiency in the non-dominant language, L2 learning strategy and the context of acquisition, patterns of language use as well as an array of word characteristics (De Groot, 1995). In other words, contrary to the previous views, bilingual lexical representation is non-uniform across as well as within individuals.

2.3.1 Form-to-Meaning Mapping in Bilingual Lexical Organization

Of particular interest is the *intra*individual variation in bilingual lexical organization. De Groot (1993) has advocated a mixed-representational system where the representation of each pair of cross-linguistic equivalents depends on the particular characteristics of these words and their associated concepts. Following some proposals in the monolingual literature (e.g., Bierwisch & Schreuder, 1992), De Groot (also, De Groot, 1992a; De Groot, 1992b) views a word's representation as a collection of nodes and a single meaning element - as a node, as reflected in her distributed conceptual feature model (see *Figure 2.1* below). She suggests that various interlingual pairs differ in the extent to which they share conceptual representational elements. The question is whether there are classes of words that are more likely to share many (or few) representational elements across the language barrier. De Groot studied the effects of a word's concreteness and the cognate status of cross-language equivalents and found that concrete and abstract words are represented differently in the bilingual lexicon, as are cognate and non-cognate

translations, with more common representational elements and therefore stronger cross-language links existing between concrete words and cognates. At that point, it was suggested that those common representational elements were at the conceptual feature level.

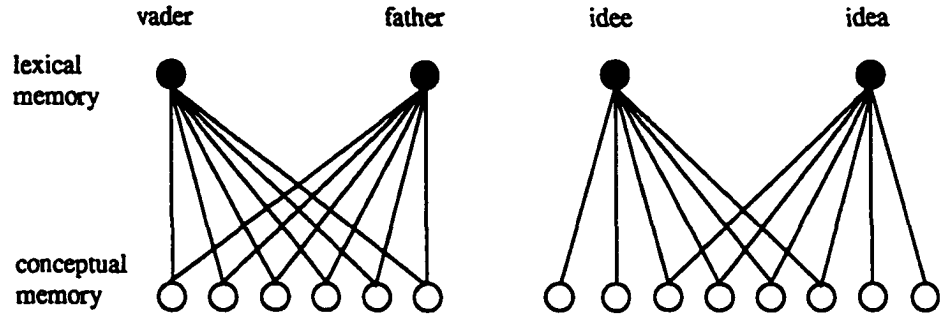

Figure 2.1 **Distributed Conceptual Feature Model (De Groot, 1992b, 1993)**

The initial theoretical account of word-type effects presented above has been recently broadened by extending the view of a word's representation as a collection of distributed features to the lexical level (Kroll & De Groot, 1997). The new distributed lexical/conceptual feature model (see ***Figure 2.2*** below) distinguishes between the language-independent conceptual feature and lexical feature levels. As is commonly the case in bilingual research, this model assumes that the lexical level of representation does not include aspects of word meaning (which resides at the conceptual level) but only aspects of word form. The view that word meaning and form are represented at different levels is becoming common in monolingual research as well (e.g., see Smith, 1997). The distributed lexical/conceptual feature model also postulates the language-specific lemma that mediates between the two above levels on the one hand and higher-level language processes on the other hand. The notion of lemma is commonly used in the monolingual

literature (e.g., Levelt, 1989; Bock & Levelt, 1994) and is assumed to contain semantic and syntactic information about a lexical item, as opposed to the lexeme that contains other kinds of information, such as information about the word's phonological, orthographic, and morphological properties. In the current model, the lemma is understood as containing the lexical item itself as well as some syntactic and semantic information about this item. However, Kroll & De Groot note that in the absence of sentential context, the lemma would only reflect the mapping between the conceptual and lexical distributed feature levels, i.e., it would reflect the meaning-to-form mapping.

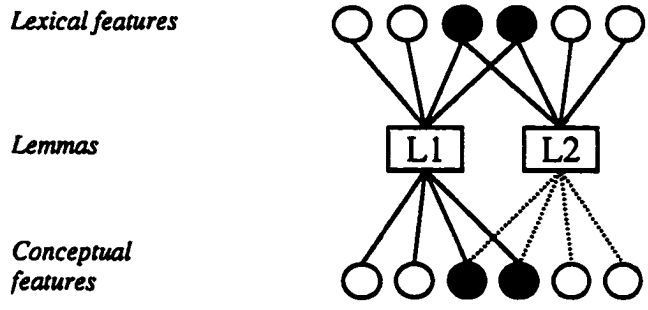

Figure 2.2 **Distributed Lexical/Conceptual Feature Model (Kroll & De Groot, 1997)**

The distributed lexical/conceptual feature model makes it possible to represent interlingual overlap based not only on semantic but on formal (phonological and orthographic) properties of words as well. Examining bilingual lexical organization and access from this perspective is in line with the theoretical models and experimental results from the monolingual mental lexicon literature (see Section 2.1), where both word form and meaning are viewed as the major principles governing word organization and recognition. There is no reason why similar fundamental principles should not play a role in bilingual lexical organization and access. However, in bilingual research, the

discussion of their role has been overshadowed by the common/separate storage controversy described above. In fact, it may be the case that the latter issue has not been resolved because those more fundamental principles underlying lexical organization have been ignored in bilingual research. One of the ways this gap can be filled is by uncovering the classes of words that are more likely to share representational elements across the language barrier as well as combinations of such elements at the conceptual and lexical levels that make this barrier more permeable, i.e., contribute to greater interlingual lexical activation.

The issue of word-type effects opens a broad area of research which may produce important theoretical and practical implications for the study of bilingual lexical organization and access as well as for language learning and instruction, specifically, in the area of vocabulary acquisition.

The sections below contain an overview of the studies that may be classified under the rubric of word-type effects as well as those dealing with other issues relevant for the current study.

2.3.2 Translation Equivalent Processing

There have been a number of experimental studies that investigated the processing of translation equivalents by bilinguals, and most of those studies were conducted within the framework of the separate/common storage debate described in Section 2.2.1. The major purpose of such investigations was to determine whether semantically equivalent words of the two languages had shared representations.

The most common experimental paradigm employed in this research has been the cross-linguistic repetition priming ("translation-priming") with lexical decision task. This task is similar to the monolingual repetition priming in a lexical decision task that measures the facilitation effect resulting from the repetition of a word within the same language (e.g., *chien – chien*, where the same French word is used as a prime and a target). In the case of the cross-linguistic repetition priming task, it is the equivalent of a word in the other language rather than the same word that is repeated (e.g., the French word *chien* used as a prime and its English equivalent *dog* as a target) . A reduction in response time (RT) to the presentation of the translation equivalent is interpreted as evidence of shared representation across languages, while the absence of such facilitation is taken as evidence of separate stores[2].

Diverging results have been obtained on this task. Although intuitively, it would seem that for a bilingual individual, words that share meaning in the two languages (i.e., translation equivalents) should facilitate each other's processing, many of these studies reported lack of a repetition priming effect for translations. Thus, Kirsner, Brown, Abrol, Chandra & Sharma (1980) obtained a repetition priming effect in the within- but not in the between-language condition. The absence of the interlingual priming effect for translation equivalents was also reported by Scarborough, Gerard & Cortese (1984), Cristoffanini, Kirsner & Milech (1986), and by Kirsner, Smith, Lockhart, King and Jain (1984). However, all of these studies employed long intervals between the prime and the target presentations (10 minutes or more).

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[2] Another common version of the cross-linguistic primed lexical decision task is a semantic priming task (similar to the monolingual semantic priming task). In contrast to the repetition priming version, this task measures the facilitation effect of a word on a semantically related word in the second language, rather than on its translation equivalent (e.g., the French *chien* priming its English semantic associate, such as *cat*).

Many of the studies that employed shorter intervals between those two presentations reported significant cross-linguistic priming effects for translation equivalents. Such results were obtained, for example, by Jin (1990) for Korean-English bilinguals and by Chen & Ng (1989) for Chinese-English bilinguals. In these studies, the target presentation immediately followed the prime presentation. However, both of those studies were criticized on methodological grounds. The former used a high ratio of related prime-target pairs, which could have increased the participants' expectations of pairs that required a "yes" response and therefore contributed to a greater priming effect. The latter used the stimulus onset asynchrony (SOA) of 300 milliseconds that was long enough to also have allowed for the use of strategies by the participants.

De Groot & Nas (1991) employed the masked priming technique to investigate the processing of translation equivalents and other stimulus groups by Dutch-English bilinguals. In a masked priming task, the prime is masked and the prime-target interval is very short (50-60 ms), so that the prime is not visible for most participants. It is believed (e.g., Forster, 1998) that the masked priming paradigm makes it possible to reduce the chance of strategy use by participants to a minimum since it eliminates all extralinguistic influences. De Groot & Nas obtained a significant translation equivalent priming effect in both masked and unmasked conditions in their experiment. This study where strategy use was minimized confirmed the results obtained by Jin (1990) and Chen & Ng (1989) who employed unmasked primes in their experiments.

To summarize, most of the studies on translation equivalent processing indicate that semantically equivalent words in a bilingual's two languages facilitate each other's processing and, therefore, at some level, they should have a common representation or

representational elements; however, a small number of studies failed to find such facilitation, suggesting that there may be a certain degree of separation in the representation of translation equivalents.

2.3.3 Processing of Cognate Words

A number of studies examined bilingual processing of cognate words, i.e., words in different languages that are similar in both meaning and form. In graphemically similar languages, cognates show semantic, phonological and orthographic similarity, while in languages that employ different scripts, they only have semantic and phonological resemblance. The study of cognates allows us to investigate the role played by these various factors in bilingual word organization.

As is the case with studies of translation equivalent processing, the most common paradigm employed to investigate cognate processing is the cross-linguistic primed lexical decision task. Since cognates can be viewed as translation equivalents that also have formal resemblance, these studies often compare the processing of cognates with that of regular, non-cognate translations. Such comparison enables researchers to focus on the role of individual variables (i.e., semantic, phonological, and orthographic properties of words) in the lexical organization of bilinguals.

The overwhelming majority of studies reported significant priming effects for cognate translations. In their experiment that involved Spanish-English bilinguals, Cristoffanini, Kirsner & Milech (1986) obtained a repetition priming effect for cognates that was similar to the priming effect obtained for derivationally and inflectionally related

words within the same language. No such effect was obtained for non-cognate translations in their study (long intervals were employed, see Section 2.3.2). Based on these results, the authors suggested that it is morphology rather than language that plays a major role in bilingual lexical organization (this idea was also developed in Kirsner, 1986). Gerard & Scarborough (1989) in their study of Spanish-English bilinguals also found a significant repetition priming effect for cognate but not for non-cognate translations.

Priming effects for *both* cognate and non-cognate Dutch-English translations were reported by De Bot, Cox, Ralston, Schaufeli & Weltens (1995) in an auditory lexical decision task and by Woutersen, De Bot & Weltens (1995) in their auditory and visual lexical decision tasks.

De Groot & Nas (1991) conducted a masked priming experiment described in Section 2.3.2 and obtained a priming effect for both cognates and non-cognates in both masked and unmasked conditions. In addition to the cross-linguistic repetition priming task, they also conducted a cross-linguistic semantic/associative priming task where in the masked condition, a priming effect was only obtained for cognates but not for non-cognate translations. This combination of results led them to conclude that both cognates and non-cognates are connected at the lexical level but that only cognates have shared conceptual representations. Davis, Sanchez-Casas & Garcia-Albea (1991) and Sanchez-Casas, Davis & Garcia-Albea (1992) also conducted masked priming experiments and found priming effects for both cognates and non-cognates, although the effects were significantly larger for cognates.

In a translation task, De Groot (1992a) found that cognates were translated faster and

more accurately than non-cognates. Later, De Groot & Comijs (1995) compared the processing of cognate and non-cognate translations in a translation recognition task and a translation production task. They found that in the translation production task, semantic variables played a larger role when non-cognates were translated (from L1 to L2) compared to when cognates were translated. However, in the translation recognition task, semantic variables played an equally large role in the translation of cognates and non-cognates.

Despite some differences in results, the above experimental findings indicate that although both cognate and non-cognate translations appear to be linked in the bilingual mental lexicon, these two word types are represented in a different fashion. The formal (phonological and graphemic) properties that cognates share seem to affect the way they are stored and processed by bilinguals.

2.3.4 Processing of 'False Friends' (Pseudocognates)

Relatively few studies have investigated the processing of false friends, or *faux amis*, by bilinguals. False friends are like cognates in that they also show interlingual phonological and, in the case of graphemically similar languages, orthographic similarity. However, unlike cognates, they are different semantically. This combination of form overlap and meaning difference makes false friends one of the most difficult aspects in L2 vocabulary acquisition. At the same time, examining the on-line processing of such words may provide important insight into bilingual lexical organization and processing, specifically, into the role played by phonological, orthographic and semantic variables.

Gerard & Scarborough (1989) compared the processing of false friends (which they called homographic noncognates), cognate and non-cognate translations by Spanish-English bilinguals in a cross-linguistic repetition priming task mentioned above (long lags between repetitions were employed). Their results showed a significant priming effect for false friends and cognates but no such effect for non-cognate translations. The size of the priming effect was similar for cognates and false friends. However, their experiment also included same-language blocks (i.e., Spanish or English only), where they had their participants recognize words of the types described above and found that the recognition of false friends within such same-language blocks was not influenced by second language knowledge. Such combination of results from different experimental blocks was interpreted by the authors as evidence that neither a completely separate nor a completely shared model of bilingual memory is adequate, suggesting the existence of language-specific lexicons within an integrated semantic memory, as well as common encoding processes in the visual word recognition of graphemically similar languages.

Beauvillain & Grainger (1987) examined the processing of false friends (homographic noncognates) in a primed lexical decision experiment that included tasks with short and long SOAs. At a short SOA, they obtained priming from false friends whose meaning, in the given language reading of the primes, was unrelated to the cross-language target. Such an effect was not present at a longer SOA. This pattern of activation was interpreted as indicating that at an initial, more automatic stage, lexical access in bilinguals is not language-specific.

De Bot, Cox, Ralston, Schaufeli & Weltens (1995) conducted an auditory cross-linguistic priming experiment also mentioned above (Section 2.3.3) and found significant

priming effects for all three word types, i.e., for false friends, cognates and non-cognate translations. Their study included both intermediate and near-native Dutch-English bilinguals, and the results were similar for both participant groups.

In the translation recognition task conducted by De Groot and Comijs (1995), participants showed an overall bias toward an "accept" response when the stimuli were perceptually similar and toward a "reject" response when they were perceptually dissimilar. In other words, false friends were harder to reject as non-translations compared to regular, phonologically and orthographically different non-translations, while cognates were easier to recognize as translations compared to non-cognate translations. This pattern of results strongly suggests that word form (represented at the lexical feature level in Kroll and De Groot's model, see 2.3.1 above) alongside word meaning (conceptual feature level) is an important factor in bilingual processing.

Overall, the studies that examined the processing of *faux amis* suggest that false friends may share representational elements at the lexical level (in terms of the distributed lexical/conceptual feature model), which results in activation spreading between them and, therefore, in interlingual priming.

2.3.5 Word-Type Effects in the Processing of Languages with Different Scripts

Very few studies have examined lexical representation and processing in bilinguals whose two languages employ different alphabets. Most researchers have examined bilinguals with language pairs such as Spanish and English, Dutch and English, or French and English. In addition to the fact that these language pairs use the same writing system,

i.e., the Latin alphabet, they exhibit a relatively large degree of overall similarity. However, looking at bilinguals whose two languages use different scripts is essential for getting a complete picture of bilingual word organization, especially, of the role played by the orthographic versus phonological properties of lexical items.

Several studies involving languages with different scripts have been mentioned in the preceding sections. Kirsner, Brown, Abrol, Chadha & Sharma (1980) investigated translation equivalent processing by Hindi-English bilinguals in a primed lexical decision task (Hindi employs Devanagri script). No interlingual equivalent priming was obtained, which was interpreted as evidence of separate word stores for the two alphabetically different languages. Long repetition lags were used in this experiment, and the results are parallel to the similar same-script experiments discussed in Section 2.3.2. In other different-script experiments discussed in the same section, such as Jin's (1990) study of Korean-English bilinguals and Chen & Ng's (1989) study of Chinese-English bilinguals, targets immediately followed primes. In those experiments, significant translation priming effects were obtained. Translation priming effects were also reported for Chinese-English bilinguals by Jiang (1995), for Thai-English bilinguals by Davis & Schoknecht (1996) and for Hindu-Urdu bilinguals by Brown, Sharma & Kirsner (1984).

The above results suggest that script difference does not interfere with the interlingual activation of semantically equivalent lexical items. In fact, it has been suggested by Forster (1998) that such difference even enhances translation priming by directing lexical search to a language-specific lexicon.

Gollan, Forster & Frost (1997) examined the processing of cognate and non-cognate translations in Hebrew-English and English-Hebrew bilinguals using the masked priming

paradigm. A significant priming effect was obtained for both cognate and non-cognate translations when the priming direction was from L1 to L2, with cognates enjoying a significantly greater facilitation compared to non-cognates. However, in the L2 to L1 priming direction, the priming effect for regular, non-cognate, translations was inconsistent, and cognates did not show a significant advantage over non-cognates. The authors' interpretation of the results is along the lines of Forster's dual-lexicon argument described in the previous paragraph. However, if script differences, as they claim, provided cues that facilitated lexical access by directing it to a specific lexicon, it seems that no asymmetry effect based on the direction of priming should have occurred. This asymmetry could be explained by the fact that since the masked priming paradigm was employed, when the primes were in L2, the participants might not have had enough time to process them. The study produced important new results, especially as far as cognate processing in different script languages is concerned. It showed that enhanced cognate priming can be obtained in the absence of interlingual orthographic overlap, based solely on semantic and phonological similarity.

Although several studies have examined translation equivalent processing by different-script bilinguals, very few have investigated the processing of cognates by such bilinguals (see previous paragraph), and, to the best of my knowledge, none of the studies have looked at false friend processing across different scripts.

2.3.6 Ambiguous Word Processing

Bilingual processing may also be affected by a difference in the number of readings a word has in the two languages. For example, the French word *livre* is ambiguous and may be translated into English as either *book* or *pound*. Words that are ambiguous in one of a bilingual's languages but not in the other present a challenge in bilingual communication and, therefore, for bilingual processing models. Extending Kroll and De Groot's (1997) model described in 2.3.1 above to represent the complex links that arise in such cases, will result in an ambiguous L1 word being represented by two lemmas that show a complete overlap at the lexical feature level, and each of these L1 lemmas would show an overlap with a different L2 lemma at the conceptual level (see *Figure 2.3* below).

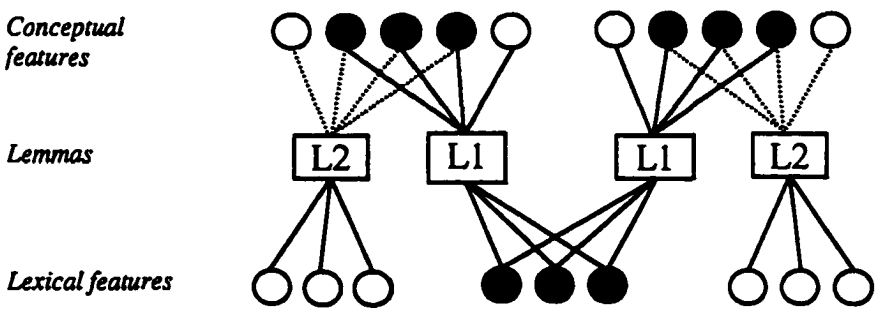


***Figure 2.3* Ambiguous Word Representation**

The issue of ambiguous word processing has figured very prominently in the monolingual psycholinguistic literature. However, virtually no studies have been conducted to date that would investigate how *bilinguals* process words that have two possible readings within a language (as different from the cross-language ambiguity found in false friends/pseudocognates).

In the monolingual literature, the two major issues in this area have been (1) ambiguous versus unambiguous word processing, prominent in early research, and later on, (2) the issue of multiple meaning activation.

The goal of the first type of research was to find out whether ambiguous words had a processing (dis)advantage compared to unambiguous lexical items. A number of experiments have shown that sentences containing ambiguous words take longer to process (e.g., Foss, Bever, & Silver, 1968; MacKay & Bever, 1967). Foss and Jenkins (1973) conducted a phoneme monitoring task and found that response times to target phonemes were faster following unambiguous words compared to when they occurred following ambiguous words. These results suggested that ambiguous words were harder to process due to extensive meaning search that preceded meaning selection. Similarly, a processing advantage for unambiguous words was reported in color-naming experiments (e.g., Conrad, 1974), where response times following unambiguous words were significantly faster than those following ambiguous items. Similar conclusions concerning ambiguous word processing were reached in studies that used eye fixation as the dependent variable (e.g., Duffy, Morris, and Rayner, 1988; Rayner and Duffy, 1986).

Several other studies produced the opposite results, suggesting that ambiguous words are in fact easier to process than unambiguous ones. Thus, Rubenstein, Garfield, and Millikan (1970) found that participants performed lexical decision to ambiguous items faster compared with unambiguous items when presented in isolation. A later study by Rubenstein, Lewis, and Rubenstein (1971) showed that this advantage existed only for ambiguous items with equiprobable meanings. The ambiguity advantage effect has been also reported by Jastrzembski and Stanners (1975), Kellas, Ferraro, and Simpson (1988),

and by Millis and Button (1989). However, the effect seems to be limited to lexical decision experiments: for instance, Borowski and Masson (1996) failed to find ambiguity advantage in a naming latency task but obtained it in a lexical decision task.

Thus, experimental evidence has been produced in favor of both views concerning the ambiguity processing (dis)advantage. Both views can be explained in terms of different lexical processing models. Thus, ambiguity disadvantage is easy to account for if extensive serial search is assumed, as in Forster's (1976) model (see Section 2.1). Since all readings of an ambiguous word would have to be accessed consecutively before the final selection is made, unambiguous items would enjoy a processing advantage. The ambiguity advantage effect can be explained in terms of Morton's (1969, 1979) logogen model (see Section 2.1). Assuming that each meaning of an ambiguous word is represented in a separate logogen, the likelihood that one of the logogens associated with an ambiguous word would reach the activation threshold increases, compared to that for unambiguous words whose meaning is represented in one logogen only. Researchers working within the framework of distributed representation models (e.g., Kawamoto, 1993) have also attempted to provide an account of the ambiguity advantage effect. In fact, Kawamoto and colleagues were able to model the ambiguity advantage effect in a computer simulation using a recurrent distributed network (Kawamoto, 1993; Kawamoto, Farrar, and Kello, 1994).

The study of ambiguity advantage brings up the question of whether all meanings of ambiguous lexical items are accessed during processing, which has been the focus of the second research direction in the area of ambiguous word processing, as indicated at the beginning of this section. The purpose of research on multiple meaning activation has

been to find out whether all meanings of an ambiguous word are activated independent of context or, alternatively, whether access to ambiguous word meaning is context-dependent, resulting in the activation of the contextually-relevant meaning only. The results produced in these studies have been widely used in the modularity of mind debate since their aim was to investigate whether access to word meaning is affected by higher-level processes (in particular, by contextual considerations); in other words, whether the mental lexicon is cognitively impenetrable. Results in favor of both views have been obtained in various monolingual studies, which are reviewed below.

Most research has produced results that support multiple meaning activation for ambiguous words. In a seminal study conducted by Swinney (1979), a cross-modal primed lexical decision task was used. Ambiguous primes were embedded in sentential context and presented auditorily, while targets to which the participants had to respond were presented visually at the end of the ambiguous prime presentation. Some of the targets were related to the contextually appropriate and some – to the contextually inappropriate meaning of the ambiguous prime. Swinney found that there was no significant difference in facilitation produced for these two types of targets, even in the presence of a strongly biasing context, thus suggesting that all meanings of an ambiguous word are accessed initially, irrespective of context. However, when the prime-target interval was increased to three syllables (approximately 750-1000 milliseconds), multiple meaning activation disappeared: the priming effect was only obtained for contextually appropriate targets in this condition. This result was attributed to post-lexical access, during which a single, contextually relevant meaning is selected out of all the meanings of the ambiguous word that were accessed initially.

Similar results were obtained in a number of other studies. Thus, Onifer and Swinney (1981) conducted what was essentially a replication of Swinney's previous study, but ambiguous words in this study had a dominant and a subordinate meaning. Their results support multiple meaning activation irrespective of context and of meaning dominance. More evidence for multiple meaning activation comes from naming experiments conducted by Tanenhaus, Leiman and Seidenberg (1979), Seidenberg, Tanenhaus, Leiman, & Bienkowski (1982), and from Jones' (1989) color-naming experiment.

A number of other studies have produced evidence supporting selective, contextually-dependent access to ambiguous word meaning. One of the early studies was conducted by Schwaneveldt, Meyer, & Becker (1976), in which participants performed lexical decision on word triplets. The second word in a triplet was ambiguous, and the first and third words could be either related to the same or to different meanings of the ambiguous word. They found that in the latter condition the response times to the third word did not differ significantly from response times to unrelated word sequences used in the control condition. This suggests that only the relevant meaning of an ambiguous word is activated in the presence of a biasing context, supporting the selective access hypothesis.

Further evidence for selective access came from a number of studies conducted by Tabossi and colleagues (e.g., Tabossi, 1988a, 1988b; Tabossi & Zardon, 1993). Thus, the cross-modal primed lexical decision task used by Tabossi, Colombo and Job (1987) was largely parallel to that used by Onifer and Swinney (1981); however, it produced the opposite results, supporting selective meaning access as well as the dominant meaning processing advantage. The different results obtained in these two studies that employed

similar designs were attributed to the different ways in which materials, specifically, sentential contexts, were constructed by the researchers. Another piece of evidence for selective access to ambiguous word meaning comes from a study conducted by Jones (1991). In a cross-modal semantic priming task she found that facilitation only occurred for the contextually appropriate meanings of ambiguous words, at both short and long interstimulus intervals.

To summarize, the issue of ambiguous word processing has received a lot of attention in the monolingual psycholinguistic literature, with experimental evidence produced in favor of both multiple access and selective access hypotheses.

As far as the issue of ambiguous word processing by bilinguals is concerned, to the best of my knowledge, there appears to be only one study that has looked into it so far. Frenck-Mestre and Prince (1997) compared the performance of proficient French-English bilinguals in their L2 to that of native speakers of the same L2[3] in primed lexical decision tasks that included, among others, lexical items that were ambiguous in the L2 but not in the L1. The pattern of results obtained for proficient bilinguals did not differ significantly from that for native speaker controls, and multiple activation of ambiguous word meanings occurred in both cases. For less proficient bilinguals, facilitation was only obtained for the dominant meaning of ambiguous words. The authors used these results to conclude that L2 lexical information is largely autonomous since there was no difference in the proficient bilinguals' and native speakers' performance.

The nature of the task used in that study did not require the bilingual participants to

[3] A closer reading of this paper suggests that the participants who the authors refer to as the control group of native English speakers were in fact native English speakers who had French as their L2, i.e., they were English-French bilinguals, which raises some questions as to whether their performance can be used as a baseline measure to assess the L2 performance of French-English bilinguals.

activate lexical items in both of their languages, since all the stimuli were presented in one language (L2). To get a better understanding of how ambiguous words are represented and processed by bilinguals, it would also be worth while to investigate this issue in a task that would require bilinguals to process both L1 and L2 items, i.e., in a cross-linguistic task.

2.4 A Comprehensive Study of Word-Type Effects in the Lexical Processing of Same-Script and Different-Script Bilinguals

2.4.1 Introduction

As has been shown in the previous sections, the most recent trend in bilingual research has been to treat bilingual lexical organization as a non-uniform mixed structure. A number of researchers have put word-type effects in the center of their experimental studies or used interlingual correlates of different types to get at the more general principles that govern lexical organization and access in bilinguals.

By examining how different types of interlingual word pairs that represent various form/meaning mapping combinations are processed on-line, it is possible to find out which of these combinations of elements at the conceptual and lexical levels contribute to greater interlingual lexical activation. Such comparison would also clarify the individual role of semantic and phonological/orthographic considerations in bilingual word organization and access, which are major factors in monolingual lexicon models. In other words, the study of word-type effects makes it possible to discuss the bilingual lexicon in terms of more universal principles, rather than viewing the language barrier as the basic

determiner of how bilinguals store and process words in their two languages.

The current study was designed to provide insight into word-type effects in bilingual lexical organization and access by examining an array of interlingual word types as they are processed by both same-script and different-script bilinguals in two different on-line tasks. Such extensive comparison across different word types and bilingual groups makes it possible to gain a better understanding of what role semantic, phonological, and orthographic similarity play in bilingual lexical access and representation.

The two bilingual participant groups used in the study were French-English bilinguals (the same-script group) and Russian-English bilinguals (the different-script group). By comparing the performance of these two groups on the same kinds of tasks using the same stimulus types, it was possible to specifically target the effect of orthographic similarity. As was mentioned in Section 2.3.5, few researchers have looked at different-script bilinguals, and, to the best of my knowledge, none have compared the performance of same-script versus different-script bilinguals within the framework of a single study. Because of the differences in experimental design and kinds of stimuli used by various researchers, it would be problematic to compare results for same-script and different-script bilinguals unless they were obtained using exactly the same tasks and stimulus types, as in the present study.

2.4.2 Word Types under Investigation

Although the present study examines a range of word types, it does not appear possible to conduct an exhaustive investigation of all word-type effects within the

framework of one study. Therefore, word-type effects that are the subject of this investigation are restricted to those resulting from different combinations of meaning/form mappings in L1 and L2.

The present study examines the effect of twelve distinct meaning-to-form mappings on bilingual processing (see *Table 2.1* and *Figures 2.4(a) & 2.4(b)* below). These are grouped under the five major word types which are discussed below:

(1) regular (non-cognate) translations,

☞i.e., words that are similar in meaning but different in form in the two languages. As has been discussed in the above review, many bilingual studies have looked at translation equivalent processing, producing contradicting results concerning interlingual facilitation for such items. The present study compares translation equivalent processing with a number of other stimulus types listed below and provides additional experimental evidence from a bilingual group that has not been studied before (Russian-English bilinguals), a point that also applies to all the other word types examined here. Another contribution is the between-group comparison of translation processing by same-script and different-script bilinguals.

(2) cognates,

☞i.e., words that have the same meaning and the same or almost the same phonological form in L1 and L2 (as well as the same orthographic form in same-script languages). As was indicated in the literature overview, a number of studies have examined cognate processing by bilinguals and obtained a facilitation effect. Only one study (Gollan, Forster & Frost, 1997) examined this issue for different-script bilinguals. The current study compares cognate processing with other word-types and across two different

bilingual groups (same-script versus different-script). The latter allows me to investigate the role of orthographic similarity in the representation and processing of cognate words. This role is further clarified within the same-script bilingual group by having the participants process cognates that show complete or partial orthographic overlap.

(3) false friends,

☞i.e., words that have the same or almost the same phonological form (as well as the same orthographic form in same-script languages) but different meanings in the two languages.

This word type has received less attention in bilingual research, although, considered together with the results for cognate and non-cognate translations, it is essential in clarifying the contribution of feature overlap at the lexical (form) versus conceptual (meaning) levels for interlingual word activation. Also, none of the previous studies have examined false friend processing by different-script bilinguals. The present study is a step toward filling in those gaps in bilingual research. Furthermore, this study also examines interlingual facilitation between L1 words that have false friends in L2 and their real translation equivalents. Comparing those with regular translations makes it possible to see whether the existence of interlingual feature overlap at the lexical level may inhibit the bilingual processing of words that share elements at the conceptual level. The contribution of representational elements at each of those two levels for interlingual activation is also assessed by comparing the facilitation effect produced by a word on its false friend and on its real translation.

(4) unrelated lexical items in L1 and L2,

☞i.e., items that differ in both meaning and form in the two languages.

As in most previous studies, these are largely used as a baseline group in the current investigation. Also included as a separate group, are words that show accidental phonological similarity in the two languages but, unlike "false friends", are never confused either because they are different parts of speech or because there is an obvious difference in etymology, and their phonological similarity is perceived as very superficial.

(5) ambiguous L1 words and their L2 correlates,

☞i.e., cases where two distinct meanings are expressed in a single lexical item in L1 but in two distinct lexical items in L2.

As was indicated in the overview of previous research, virtually no studies have examined the processing of ambiguous words by bilinguals, although this line of research can potentially have significant implications for both bilingual and monolingual lexical processing[4]. The current study makes a contribution in this direction by looking at the following types of words:

- ambiguous L1 words that have two different non-cognate translations in L2;
- ambiguous L1 words that have one cognate and one non-cognate translation in L2.

Analyzing the processing of these different subgroups in contextually appropriate and contextually inappropriate conditions makes it possible to test the multiple activation/selective access hypotheses as well as the ambiguity (dis)advantage effect (see Section 2.3.6 for details) across the language boundary. In other words, it makes it possible to study these two major issues in monolingual word processing research from a bilingual perspective.

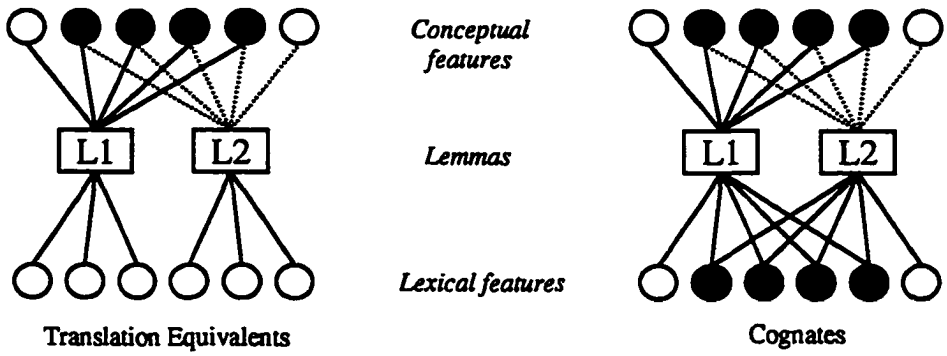
[4] The only known exception is Frenck-Mestre and Prince (1997) described in Section 2.3.6 who examined the processing of ambiguous *L2* words by bilinguals (however, the task employed was not cross-linguistic).

A summary of word types examined in the present study is provided in *Table 2.1*. This information is also given in *Figures 2.4(a)* and *2.4(b)* using the schematic representations for each type in terms of Kroll and De Groot's (1997) distributed lexical/conceptual feature model (see Section 2.3.1).

Table 2.1 **Stimulus Types Summary**

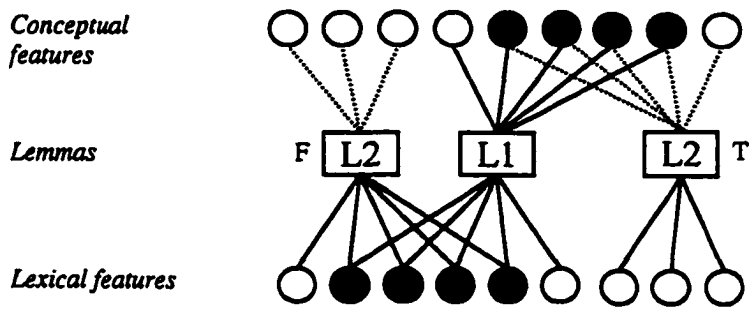
	L 1 (French/Russian)[5]	L 2 (English)	Form	Meaning
1.	Translation Equivalent *pont* – 'bridge'	Translation Equivalent *bridge*	-	+
2.	Cognate *tulipe* – 'tulip'	Cognate *tulip*	+	+
3, 4.	False Friend *pain* – 'bread'	False Friend *pain*	+	-(?)
		Translation Equivalent *bread*	-	+
5.	Phonologically Similar *sac* – 'bag'	Phonologically Similar *suck*	+(?)	-
6.	Any word *poumon* – 'lung'	Non-translation *stick*	-	-
7, 8.	Ambiguous1[6] (X1, x2) *livre* 'book/pound' –	Translation of (X1) *BOOK*	-	+
	preprimed by *manuscrit* 'manuscript'	Translation of (x2) *pound*	-	+(?)
9, 10.	Ambiguous 2 a (Y1, y2) *mille* 'mile/thousand' –	Cognate (Y1) *MILE*	+	+
	preprimed by *kilomètre* 'kilometer'	Translation of (y2) *thousand*	-	+(?)
11, 12.	Ambiguous 2 b (y1, Y2) *mille* 'mile/thousand' –	Cognate (y1) *mile*	+	+(?)
	preprimed by *chiffre* 'number'	Translation of (Y2) *THOUSAND*	-	+

[5] French-English examples only are given in this introductory section for ease considerations.
[6] The contextually "appropriate", or preprimed, ambiguous word meanings are capitalized.

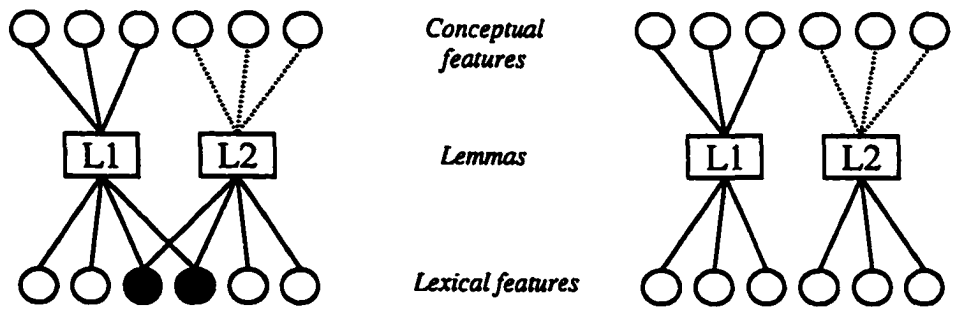


Translation Equivalents

Cognates



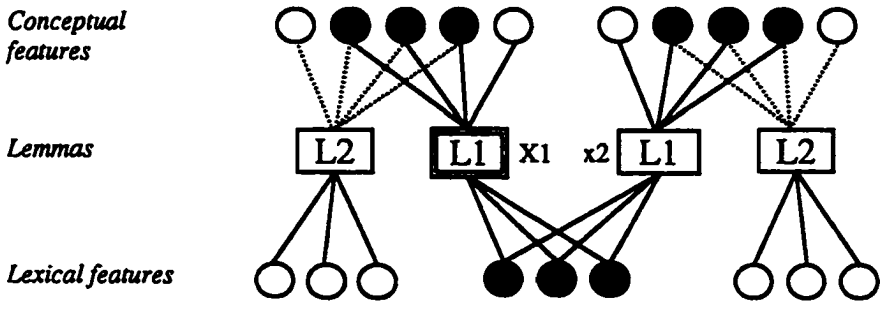
A Word with its False Friend (F) and Real Translation (T)



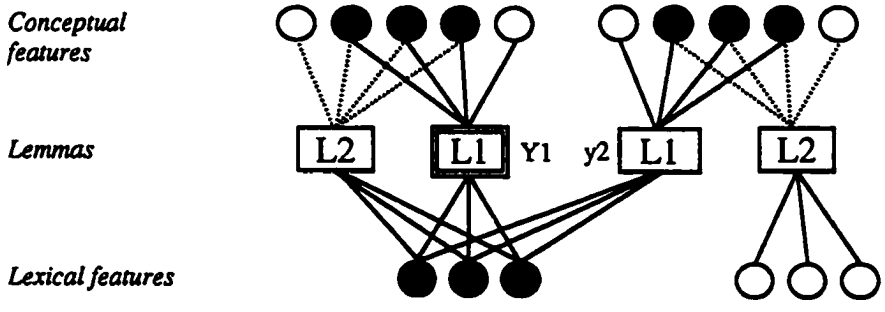
Phonologically Similar Items

Non-Translations

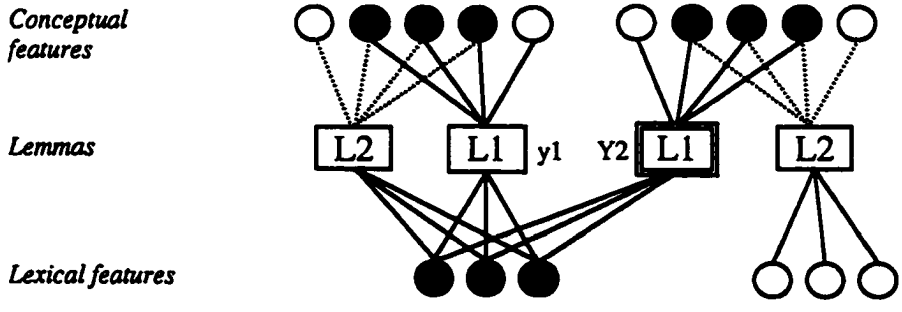
Figure 2.4(a) **Schematic Representations of Stimulus Types (non-ambiguous)**



Ambiguous1 (X1, x2), X1 & x2 have non-cognate translations



Ambiguous2 (Y1, y2), Y1 has a cognate translation



Ambiguous2 (y1, Y2), y1 has a cognate translation

Figure 2.4(b) **Schematic Representations of Stimulus Types (ambiguous)[7]**

[7] The contextually "appropriate", or preprimed, ambiguous word meanings are capitalized and double-framed.

2.4.3 Questions and Hypotheses

As has been discussed above, comparing each distinct stimulus type to other word types offers an opportunity to examine the role of conceptual and lexical features in bilingual processing. *Table 2.2* below summarizes the research questions addressed by individual comparisons between pairs of word types, as well as the anticipated results concerning their relative processing ease as measured by response latency on the cross-linguistic primed lexical decision task (see Section 2.4.4 for a description of experimental paradigms).

Table 2.2 **Research Questions and Hypotheses**

#	Question	Test Type ('a' in graphs)	Control Type ('b' in graphs)	Anticipated Result (RTs)
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates *(tulipe - tulip)*	Translation Equivalents *(pont – bridge)*	
2.	Does interlingual overlap at the lexical level give false friends a processing advantage similar to that for cognates?[8]	Cognates *(tulipe – tulip)*	False Friends *(pain – pain)*	

[8] This comparison is not possible on the translation recognition task (see Section 2.4.4), since it requires a "yes" response for one of the compared stimulus types (cognates) and a "no" response for the other (false friends).

3.	Does lexical feature overlap result in the same degree of interlingual activation (IA) as conceptual overlap? (i.e., are a word's false friend and its true translation activated with equal ease?)[9]	False Friends *(pain – pain)*	False Friend in L1 and its real L2 Translation *(pain – bread)*	
4.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any 'false friends'?)	Translation Equivalents *(pont - bridge)*	False Friend in L1 and its real L2 Translation *(pain – bread)*	
5.	Can lexical feature overlap alone result in interlingual activation?[10]	False Friends *(pain – pain)*	Non-Translations *(poumon – stick)*	
6.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar *(sac – suck)*	Non-Translations *(poumon – stick)*	

[9] This comparison is not possible on the translation recognition task for the same reason as the comparison in Question 2.

[10] The anticipated pattern of results in this case would be reversed on the translation recognition task, since interlingual activation of false friends would make it harder for a bilingual to reject them as translations (for a more complete discussion, see Sections 2.3.4 and 2.4.4). This may also apply to Question 6 below.

7.	Is multiple meaning activation carried over across languages? (if 'yes', this would also be evidence for multiple activation in L1)	Ambiguous L1 Words & Contextually *Un*primed L2 Translations: a) *livre - pound*, preprimed by *manuscrit* b) *mille - thousand*, preprimed by *kilomètre* (the preprimed meaning has a cognate translation) c) *mille - mile*, preprimed by *chiffre* (the unprimed translation is a cognate)	Non-Translation *(poumon – stick)*	
8.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually *Un*primed L2 Cognate Translation *(mille - mile,* preprimed by *chiffre)*	Ambiguous L1 Word & Contextually *Un*primed L2 Translation *(livre – pound,* preprimed by *manuscrit)*	
9.	Is there an ambiguity disadvantage effect for items with interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation *(livre - book,* preprimed by *manuscrit)*	Translation Equivalents *(pont – bridge)*	
10.	Is there an ambiguity disadvantage effect for items with both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation *(mille - mile,* preprimed by *kilomètre)*	Cognates *(tulipe – tulip)*	

The above questions are investigated for the different-script (Russian-English) and same-script (French-English) bilingual groups. Because such a comparison of different bilingual groups has never been done before in a single study, two contrasting hypotheses concerning the differences between the two participant groups were considered. According to the first one, it was expected that the same-script group (French-English) would show an overall processing advantage resulting from greater lexical level overlap, based on shared orthographic and phonological features, while the different-script group (Russian-English) would only be able to benefit from common phonological features. Also considered was the possibility that in some cases, this orthographic overlap may instead cause inhibition for the same-script group (for example, in the case of false friends), resulting in slower response times compared to the different-script group. This latter argument is along the lines of Forster (1998) and Gollan, Forster & Frost (1997) presented in Section 2.3.5, who argued that different-script bilinguals may be expected to show a greater processing advantage in cross-linguistic tasks because the script difference helps to direct lexical search toward a specific lexicon.

Evidence from second language acquisition research also supports both of the above possibilities. While most of the studies show that similarity between the learner's two languages acts as a "facilitating agency", helping the learner to "pass more rapidly along the developmental continuum" (Corder, 1981, p.101), a number of studies have shown that language dissimilarity may actually have a positive effect on L2 achievement, especially in the area of orthography, since it lowers transfer expectations and thus helps to cut down on the amount of negative transfer (e.g., Ringbom, 1978; Sjoholm, 1976).

2.4.4 Experimental Paradigms Employed

The two on-line tasks that were chosen to investigate the above issues are very different in nature. One is the cross-linguistic repetition priming with lexical decision task, a paradigm commonly used in bilingual research and parallel to the monolingual repetition priming lexical decision task (see Section 2.3.2). The other is the translation recognition task, which has also been used in bilingual research (e.g., De Groot & Comijs, 1995), although not as often as the first task and, to the best of my knowledge, it has never been used with different-script bilinguals.

On the cross-linguistic repetition priming task, a bilingual is normally presented with word pairs consisting of equivalent L1 and L2 items, and the time required to perform a lexical decision on the second item (L2 in the present study) is recorded. The task measures the facilitation effect (reduction in response latency) resulting from a prior presentation of the equivalent word in the other language, compared to a prior presentation of an unrelated or nonsense word in that language: e.g., *chien* (the French for 'dog') – *dog* (English), as compared to *barde* (a French non-word) – *dog* (English).

On the translation recognition task, a bilingual is required to decide whether pairs of stimulus words, such as *chien – dog* or *chien – desk*, are translations of each other. The two words may be presented on the computer screen either simultaneously or consecutively (as in the present study).

The two tasks are different in several respects: (1) using the dichotomy described in Section 2.2.1 (Durgunoglu & Roediger, 1987), cross-linguistic repetition priming is a data-driven task, while translation recognition appears to be a more conceptually-driven

task; (2) cross-linguistic priming may be characterized as a more implicit task, while translation recognition is more explicit and metalinguistic in nature: although on both tasks lexical items from a bilingual's two languages are presented, the translation recognition task encourages participants to draw connections between words in the two languages, while the cross-linguistic priming task does not[11].

With a consecutive presentation of interlingual pair members on the translation task, an identical trial structure can be employed on the two tasks (e.g., in the present study, an L2 item was always preceded by an L1 item; for a more complete discussion of the trial structure in this study, see Sections 3.2-3 & 4.2-3 below). Both tasks require bilinguals to (a) access the L1 item, and (b) access the L2 item. The only thing that differs is the task performed by the participant: on the cross-linguistic priming task, the bilingual's decision is based on the L2 item only. Here, the bilingual essentially has to report on whether he or she has succeeded in accessing the L2 item (if this item is a non-word, lexical access would fail, resulting in a "no" response). On the translation recognition task the decision has to be based on both the L1 and L2 items. The bilingual has to perform a translatability judgment, rather than just reporting lexical access results. As was mentioned above, the translation recognition task therefore encourages the participant to draw direct links between L1 and L2 items, and the decision performed on this task is more metalinguistic in nature compared to that on the priming task. The priming task presumably taps a more automatic processing stage compared to the translation recognition task.

[11] A number of cross-linguistic priming experiments (see Section 2.3.2) have been criticized for using a high ratio of related items, which may have encouraged participants to use translation as a strategy. However, in the current study, this ratio was balanced to prevent strategy use by participants.

The two tasks also invite different kinds of responses for some of the word types examined in this study and discussed in Section 2.4.2. Since all of them are real words, they require "yes" responses on the priming task. However, on the translation task, some of the stimulus types, such as false friends, require a "no" response. Therefore, different patterns of results may be expected in such cases, depending on the task. For example, Comparison 5 in *Table 2.2* (Section 2.4.3) would predict that on the priming task, interlingual activation based on lexical overlap shown by false friends will result in faster response times compared to unrelated items. At the same time, such false friend activation would lead to slower response times on the translation task since it would bias the translation judgment toward the "yes" (wrong) response. Also due to the difference in responses required on the two tasks, some of the comparisons that can be performed on the priming task are impossible on the translation recognition task, since this would involve directly comparing "yes" and "no" responses (e.g., cognates and false friends, see *Table 2.2* above). In other cases, such comparisons may be avoided by choosing a different control type on the translation recognition task. Thus, for Question 7 (*Table 2.2*) which concerns multiple meaning activation of ambiguous words, the response times for contextually unprimed translations can be compared with those for contextually primed translations (rather than unrelated items), in which case no difference in response times between the two groups would indicate multiple activation (see Sections 3.3.5 & 4.3.5).

The following two chapters are parallel in structure and discuss the methodology that was involved in conducting the above on-line tasks, as well as the results obtained from each of them, for the Russian-English (Chapter 3) and French-English (Chapter 4) participant groups.

CHAPTER THREE

RUSSIAN-ENGLISH EXPERIMENTS

3.1 Introduction

All Russian-English experiments were run in a single session that lasted between 45 and 55 minutes for most participants. Each participant performed the experiments and additional tasks in the following order:

- Experiment 1 (Cross-Linguistic Priming with Lexical Decision) 20-25 min
- Recall Task 1 2-3 min
- Language Background Questionnaire 3-5 min
- Experiment 2 (On-line Translation Recognition) 8-10 min
- Recall Task 2 2-3 min
- Experiment 3 (Off-line Translation Recognition/Proficiency Check) 5-7 min

3.2 Russian-English Experiment 1: Cross-Linguistic Priming with Lexical Decision

3.2.1 Participants

Thirty-eight educated adult Russian-English bilinguals participated in the experiment as volunteers. All the participants had Russian as their L1. All of them can be described as Russian-dominant bilinguals currently residing in Edmonton, Alberta, Canada and using both Russian and English in various situations. All but five participants had an undergraduate or graduate university degree. In order to collect information about the participants, a Language Background Questionnaire (*Appendix B*) was administered

between the experimental tasks. The Questionnaire responses revealed that most of the participants used their L2 (English) at work and their L1 (Russian) at home, whereas in social situations, both languages were used. The average starting age for learning English was 12. Most of the participants had spent some time learning English in a classroom setting ($\bar{x}$ years = 7). The average number of years spent by the participants in an English-speaking environment was 5 years. On the seven-point proficiency scale, all participants rated their overall English language proficiency as five or higher. When asked how often they come across an unfamiliar L2 (English) word, most of the participants indicated "rarely" or "sometimes". In order to check for possible L1 attrition participants were also asked how often they forgot L1 words and their meanings. Most of the participants answered "never" or "rarely".

Based on the above information, these participants may be classified as "advanced bilinguals" (although see Grosjean (1997) for a discussion of divergent definitions and classifications of bilinguals).

3.2.2 Apparatus

The experiment was run on an Apple Macintosh 520 Powerbook laptop computer that was brought to a location convenient for the participants. Each participant was tested individually. The Psyscope software package (Cohen et al., 1993) was used for stimulus presentation and data recording. Response times were measured from the onset of words. The stimuli were presented in black characters on a white background.

3.2.3 Stimuli and Design

The experimental design centered around the following 12 stimulus categories (hereafter referred to as the "basic stimulus groups")[12]:

(1) regular (non-cognate) translations, hereafter referred to as "translation equivalents";

(2) cognates, i.e., words that have the same or almost the same form and the same meaning in L1 and L2;

(3) false friends, i.e., words that have the same or almost the same form but different meanings in the two languages;

(4) L1 words that have false friends in L2 with their real translation equivalents;

(5) words that are phonologically similar in the two languages but that, unlike "false friends", are never confused either because they are different parts of speech or because there is an obvious difference in etymology;

(6) L1 words and unrelated L2 words ("non-translations");

(7), (8) ambiguous L1 words (homophones) that have two different non-cognate translations in L2 with their contextually primed or contextually unprimed translations (group "Ambiguous 1" below);

(9), (10), (11), (12) ambiguous L1 words (homophones) that have one cognate and one non-cognate translation in L2 with their contextually primed and

[12] These are the stimulus types introduced in Chapter 2 (section 2.4.2 "Word Types Under Investigation").

contextually unprimed translations (group "Ambiguous 2 a & b" below).

The basic stimulus types are summarized in *Table 3.1*. The character "+" stands for meaning/form similarity, and "-" stands for meaning/form difference. Question marks indicate problematic cases. The contextually primed meanings of homophones are capitalized.

Table 3.1 **Basic Stimulus Types (Russian-English)**

	L 1 (RUSSIAN)	L 2 (ENGLISH)	Form	Mean-ing	Abbre-viation
1.	Translation Equivalent *ошибка* – 'mistake'	Translation Equivalent *mistake*	-	+	TrEq
2.	Cognate *секрет* – 'secret'	Cognate *secret*	+	+	Cogn
3,4.	False Friend *батон* – 'loaf'	False Friend *baton*	+	-(?)	FfFf
		Translation Equivalent *loaf*	-	+	FfTr
5.	Phonologically Similar *сок* – 'juice'	Phonologically Similar *sock*	+(?)	-	PhSim
6.	Any word *ветер* – 'wind'	Non-translation *snake*	-	-	Unrel
7,8.	Ambiguous1 (X1, x2) *язык* 'tongue/language'- preprimed by *рот* 'mouth'	Translation of (X1) *TONGUE*	-	+	A1Yes
		Translation of (x2) *language*	-	+(?)	A1No
9,10.	Ambiguous 2a (Y1, y2) *роман* 'romance/novel' - preprimed by *любовь* 'love'	Cognate (Y1) *ROMANCE*	+	+	A2CYes
		Translation of (y2) *novel*	-	+(?)	A2NcNo
11,12.	Ambiguous 2b (y1, Y2) *акция* 'action/share' preprimed by *корпорация* 'corporation'	Cognate (y1) *action*	+	+(?)	A2CNo
		Translation of (Y2) *SHARE*	-	+	A2NcYes

The English targets were all balanced for frequency across the groups, according to Kučera and Francis (1967). It was not possible to balance the frequency of both Russian and English stimuli due to the other restrictions imposed on the choice of the stimuli. It was therefore decided to balance the frequency of the English targets across the different stimulus groups since it was the response time to *these* words that was measured in the experiment.

In order to bias the participant's reading of an L1 homophone toward one of its meanings (i.e., in order to create an appropriate/primed or inappropriate/unprimed context), an L1 "preprime" was presented before each stimulus pair. For example, a participant saw the sequence *[стрела* ('arrow') - *лук* ('onion/bow') – *bow]*, in which case the English translation and the Russian preprime refer to the same meaning of the ambiguous Russian word. In order to bias the reading of the ambiguous word toward a different meaning, the Russian preprime would have to be replaced, for example, by *овощ* ('vegetable'). In order to conceal the above from the participants, *all* types of stimulus pairs were preceded by L1 preprimes, i.e., on every trial, a word triplet was presented. The word triplet methodology was first used by Schvaneveldt, Meyer, & Becker (1976) in their monolingual study of ambiguous word recognition.

In order to select preprimes for the basic stimulus groups, a semantic relatedness judgment task was administered to seven Russian monolinguals in Moscow, Russia. They were given a list of Russian words selected as primes for the basic stimulus groups and, for each of them, were asked to write down the first word that came to mind (for ambiguous words, they were asked to write down one associate for each of the two meanings). The volunteers who performed this task were asked to write down the words

as quickly as possible and never to go back to change their answers. The judgments made by different participants were then compared and the most commonly chosen associates were selected as preprimes for the experiment.

Because the priming paradigm was employed in this experiment, another major stimulus group consisted of the same English targets primed by nonsense Russian words and was used as *a baseline measure* to calculate the priming effect. The latter was obtained by subtracting the response times for the basic stimulus groups described above from the response times for the respective baseline groups. The L1 preprimes were also presented for the baseline group in order to keep the trial structure parallel throughout the experiment and, by doing so, to keep the participants unaware of the specific nature of the task. The preprimes in this case were random Russian words.

The remaining major stimulus group in this task was made up of two types of foils. In both of them, targets were nonsense English words, but in the first, primes were nonsense Russian words. In the second group, primes were real Russian words. Such a design allowed me to balance the number of "yes" and "no" responses and the number of real and nonsense words in both prime and target positions. The L1 preprimes were also used with the foil groups for the reasons stated above. When the primes were real words, preprimes were related to them in approximately fifty percent of the trials, and unrelated in the rest.

Both Russian and English nonsense words were derived by changing one or more phonemes in real Russian or English words. They complied with Russian or English phonotactic constraints respectively. This was done because a number of studies (e.g.,

Shulman & Davison, 1977) have shown that unlike random letter strings, words derived in this fashion require a relatively deep level of stimulus processing.

To summarize, the following major stimulus groups were used in this task:

1) Basic stimulus groups:

- 12 types
- Types 1-8: 10 pairs each
- Types 9-12: 9 pairs each

2) Baseline groups:

- 12 types
- Types 1-8: 10 pairs each
- Types 9-12: 9 pairs each

3) Foils:

- Nonsense L1/Nonsense L2: 78 pairs
- Real L1/Nonsense L2: 78 pairs

Not all the words in the basic and baseline stimulus groups were seen by each participant. The participants were subdivided into 2 subgroups (Versions A & B) in order to prevent the same bilingual from seeing the same stimulus word in two different basic conditions (i.e., stimulus groups (3,4), (7,8), (9,10), (11,12) in *Table 3.1* above).

3.2.4 Procedure

The participants were tested individually in a normally lit room. They sat in front of a computer monitor at a comfortable reading distance. The instructions were presented to the participants in English on the computer screen. They were told that they were going to see word triplets on the screen, one after another. The first two members of the triplet would be Russian words, and the third one - an English word. They were told that some of those could be nonsense words, i.e., words that do not really exist. The participants were instructed to read all the words, and for the third (English) word, they were told to decide whether it was a real English word by pushing the "yes" (?/) or "no" (z) button on the keyboard. The participants provided the "yes" responses with their right hands (a green label was attached to the "yes" button), and they provided the "no" responses with their left hands (a red label was attached to the "no" button). They were asked to give their responses as quickly and at the same time as accurately as possible. In order to make sure that the participants read all the three words, they were told in the instructions that they would be asked to perform a short task on the Russian words after they completed the experiment. After a participant read the instructions, the experimenter drew his/her attention to the most important points once again, after which s/he had an opportunity to ask questions. There was a short practice session prior to the actual experiment that consisted of ten trials, with the same proportion of the different stimulus groups as in the actual experiment. During the practice session, the participants received feedback in the

form of a beep whenever they gave the wrong answer; there was no feedback in the actual experiment. After s/he had completed the practice session, the participant had another opportunity to ask questions.

There were 312 trials in the actual experiment, with a rest break in the middle. The rest break ended whenever the participant pushed a button to resume the experiment. The experiment took about twenty minutes to complete.

Each trial started with a presentation of a fixation point (an asterisk) for 250 milliseconds (ms) in the spot where the preprime was to appear (slightly above the center of the screen), followed by a blank interstimulus interval (ISI) that lasted 250 ms. The preprime was then presented for 300 ms in 30 TransCyrillic font, followed by an ISI of 400 ms. Subsequently, the participant saw the prime in 48 TransCyrillic font in the center of the screen, just below the preprime position, for 350 ms, which was followed by an ISI of 250 ms. Finally, the target was presented in 48 Chicago font just under the prime position, a little below the center of the screen. The target stayed on the screen until the participant pressed either the "yes" or the "no" button. There was a blank interval of 500 ms before the start of the next trial. All the stimuli were presented in lowercase.

After the experiment, the participants performed a recall task. They were given a sheet of paper with a list of 45 Russian words on it. Their task was to check off those words that they had seen in the experiment. About forty percent of the words on the list were those that had been used as preprimes or primes in the actual experiment. This was the short comprehension check on the Russian words that the participants were told in the instructions they would be asked to perform. This check ensured that the participants

were processing not only the English targets but the Russian preprimes and primes as well.

3.2.5 Results and Discussion

An analysis of subject-wise response latency and accuracy resulted in the inclusion of the data supplied by 33 participants (out of the original set of 38).

The data from the experiment were analyzed using the two-way analysis of variance option of the SygmaStat statistical package. For each subject, mean response times (RTs) for each basic stimulus type were calculated for the primed and unprimed (baseline) condition. All incorrect responses were excluded from those calculations, as well as all the responses beyond two standard deviations from the grand mean (calculated for all subjects for all pairs with real English targets). A 2-by-12 repeated measures ANOVA was performed on those values. Both the stimulus type (12 types) and the presentation condition (primed vs. unprimed) were treated as within-subjects variables in the subjects analysis. In addition, an item analysis was performed, where means for individual items were calculated for both primed and unprimed conditions, and a 2-by-12 ANOVA was done on those values. Again, all incorrect responses were excluded when calculating the means, along with all the responses that were greater than two standard deviations from the mean. In this analysis, stimulus type was treated as a between-items factor, and priming condition was a within-items factor. The mean values used in the subject-based and item-based analyses are presented in *Table 3.2* below.

Table 3.2[13] **Experiment 1 (R-E**[14]**): Primed Lexical Decision. Mean Response Time and Priming Effect as a Function of Stimulus Type and Priming Condition**

			Response Times, ms (subject-based)		Response Times, ms (item-based)		Priming Effect[15,16]	
	Stimulus Type	Example	Unprimed	Primed	Unprimed	Primed	subject-based	item-based
1.	Translation Equivalents (TrEq)	ошибка – *mistake*	819.3	736.0	817.8	736.3	83.3*	81.5*
2.	Cognates (Cogn)	секрет – *secret*	778.0	679.8	778.3	682.8	98.2*	95.5*
3.	False Friends (FfFf)	*батон – baton*	838.5	769.6	824.8	770.4	68.9*	54.4
4.	False Friends with Real Translations (FfTr)	*батон – loaf*	832.4	791.6	834.4	795.3	40.8	39.1
5.	Phonologically Similar Words (PhSim)	*сок – sock*	813.3	828.6	818.1	832.5	-15.3	-14.4
6.	Unrelated Words (Unrel)	*ветер – snake*	822.6	824.0	829.1	830.0	-1.4	-0.9
7.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*язык* (preprimed by *рот) – TONGUE*	837.0	730.0	835.4	730.1	107.0*	105.3*

[13] As before, the contextually primed meanings of ambiguous words are capitalized.
[14] Russian-English
[15] The priming effect was calculated by subtracting the RT in the primed condition from that in the unprimed condition.
[16] Cases where the priming effect reached statistical significance ($p<0.05$) are marked with an asterisk.

8.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*язык* (preprimed by *рот*) – *language*	788.7	739.1	784.2	738.6	49.6*	45.6
9.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*роман* (preprimed by *любовь*) – *ROMANCE*	852.2	757.1	859.3	774.1	95.1*	85.2*
10.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*роман* (preprimed by *любовь*) – *novel*	882.5	788.6	878.9	792.0	93.9*	86.9*
11.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*акция* (preprimed by *корпорация*) – *action*	829.0	702.5	817.3	700.3	126.5*	117.0*
12.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*акция* (preprimed by *корпорация*) – *SHARE*	888.6	809.1	895.4	808.6	79.5*	86.8*

Overall, substantial cross-linguistic priming was observed. The main effect of priming was significant, F_1 (1, 32) = 56.8, $p<0.01$ and F_2 (1, 100) = 94.3, $p<0.01$, where F_1 refers to the subjects analysis and F_2 refers to the items analysis. For most of the related stimulus types, the priming effect reached statistical significance (see *Table 3.2* above and *Figure 3.1* below). This indicates that the paradigm employed in the experiment was reliable.

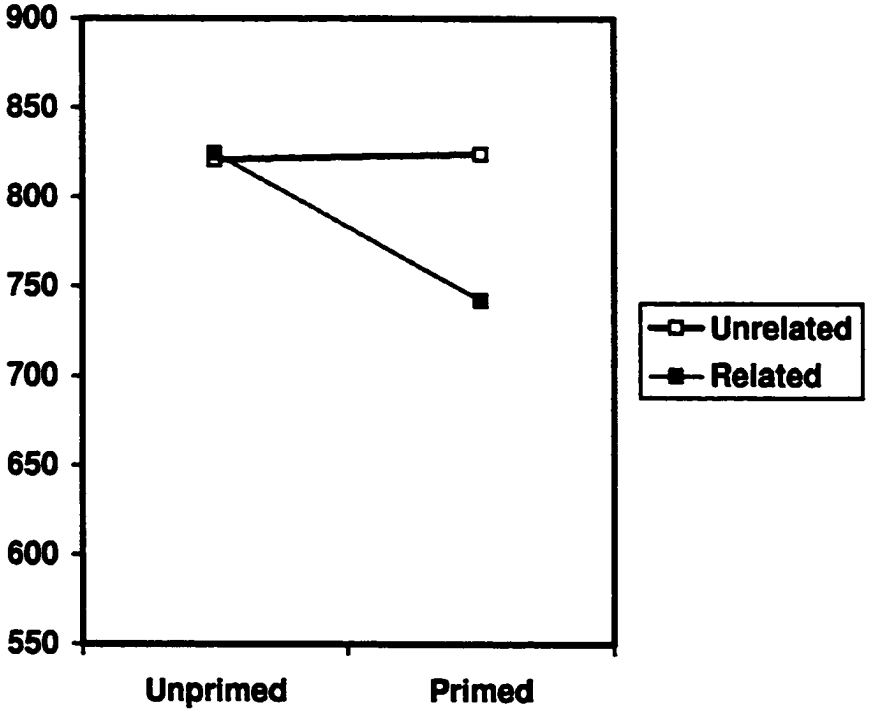


Figure 3.1 **Overall Priming Effect (R-E): Related vs. Unrelated Stimulus Types**

The main effect of stimulus type was also significant, F_1 (11, 352) = 7.5, $p<0.01$ and F_2 (11, 100) = 2.0, $p<0.05$.[17] The priming effect obtained for individual stimulus groups is represented in the bar graph in *Figure 3.2* below. The individual planned comparisons will be discussed in detail below.

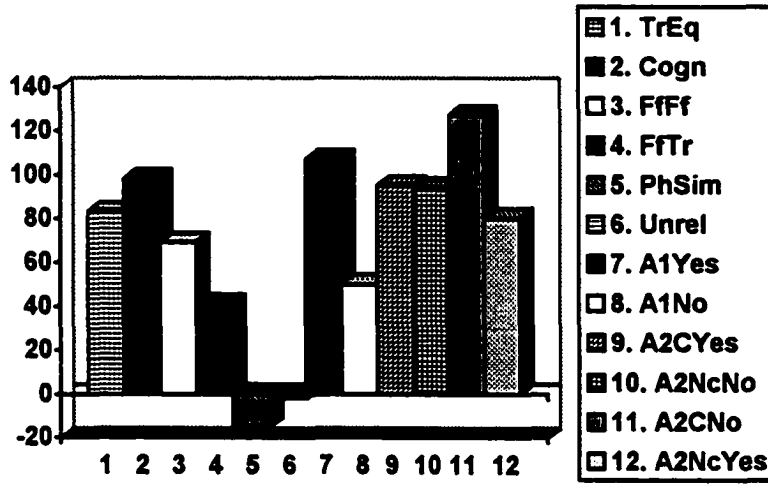


Figure 3.2 **Priming Effect and Stimulus Type (R-E)**

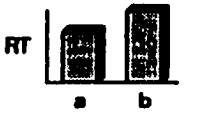
There was an interaction between the priming and stimulus type variables, with F_1 (11, 352) = 3.1, $p<0.01$ and F_2 (11, 100) = 3.2, $p<0.01$.

[17] No main effect of word type with accuracy as the dependent variable was detected, which may be attributable to the fact that L2 targets stayed on the screen until a decision was reached by a bilingual. The latter resulted in high accuracy scores across word types, creating a 'ceiling effect'. This applies to all the on-line tasks reported in this thesis.

The specific hypotheses that were previously formulated (Section 2.4.3) were tested by looking at *a priori* contrasts in the data. For all the planned comparisons, subject-based t-tests were conducted. The results of those tests are presented in *Table 3.3* below[18].

[18] Again, the results are based on the data supplied by 33 participants.

Table 3.3 **Experiment 1 (R-E): Primed Lexical Decision. Summary of Planned Pairwise Comparisons[19]**

#	Question	Test Type ('a' in graphs)	Control Type ('b' in graphs)	Result (response times)
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates (Cogn) секрет – *secret*	Translation Equivalents (TrEq) ошибка – *mistake*	 YES *p<0.01
2.	Does interlingual overlap at the lexical level give false friends a processing advantage similar to that for cognates?	Cognates (Cogn) секрет – *secret*	False Friends (FfFf) *батон – baton*	 NO *p<0.01
3.	Does lexical feature overlap result in the same degree of interlingual activation (IA) as conceptual overlap? (i.e., are a word's false friend and its true translation activated with equal ease?)	False Friends (FfFf) *батон – baton*	False Friend in L1 and its real L2 Translation (FfTr) *батон – loaf*	 YES
4.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any 'false friends'?)	Translation Equivalents (TrEq) ошибка – *mistake*	False Friend in L1 and its real L2 Translation (FfTr) *батон – loaf*	 YES *p<0.01

[19] Statistically significant differences are indicated with an asterisk.

5.	Can lexical feature overlap alone result in interlingual activation?	False Friends (FfFf) *батон – baton*	Non-Translations (Unrel) *вепер – snake*	 YES *p<0.05
6.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar (PhSim) *сок – sock*	Non-Translations (Unrel) *вепер – snake*	 NO

7.	**Is multiple meaning activation carried over across languages?** **(if 'yes', this would also be evidence for multiple activation in L1)**	Ambiguous L1 Words & Contextually *Un*primed L2 Translations (A1No, A2NcNo, A2CNo): 1) *язык – language*, preprimed by *рот* 2) *роман – novel*, preprimed by *любовь* 3) *акция - action*, preprimed by *корпорация*	Non-Translations (Unrel) *ветер – snake*	YES  *p<0.01  *p<0.05  *p<0.01

8.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually Unprimed L2 Cognate Translation (A2CNo) *акция* (preprimed by *корпорация*) – *action*	Ambiguous L1 Word & Contextually Unprimed L2 Translation (A1No) *язык* (preprimed by *рот) - language*	 YES *p<0.05
9.	Is there an ambiguity disadvantage effect for items with interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation (A1Yes) *язык* (preprimed by *рот) – TONGUE*	Translation Equivalents (TrEq) ошибка – *mistake*	 NO
10.	Is there an ambiguity disadvantage effect for items with both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation (A2CYes) *роман* (preprimed by *любовь*) – *ROMANCE*	Cognates (Cogn) секрет – *secret*	 YES *p<0.05

As can be seen from *Table 3.3*, planned pairwise comparisons showed the following results[20]:

(1) Cognate vs. non-cognate translations

When compared with regular translation equivalents, cognates showed significantly faster response times, which can be attributed to the fact that in addition to conceptual feature overlap, cognates also show overlap at the lexical feature level (i.e., they are similar in form in addition to being similar in meaning). This comparison demonstrates that both conceptual and lexical feature overlap contribute to interlingual activation and accords with the results obtained in other studies that examined cognate processing in bilinguals (Section 2.3.3). Thus, the fact that the link between cognates in Russian and English is only phonological and not both phonological and orthographic as in previous studies, did not change the pattern of results. This finding is also in agreement with the study of different-script bilinguals conducted by Gollan, Forster & Frost (1997) and described in Section 2.3.4.

(2) Cognates vs. false friends

The fact that both conceptual and lexical feature overlap contribute to interlingual activation finds further support in the comparison of cognates and false friends (pseudocognates): the former were significantly easier to process than the latter. Both types of interlingual pairs show overlap at the lexical level, but false friends, unlike cognates, have no overlap at the conceptual level, giving the true cognates a processing

[20] The reader is referred back to *Figures 2.4(a)* and *2.4(b)* in Chapter 2 for the schematic representations of the different stimulus types.

advantage. This result runs counter to that reported by Gerard and Scarborough (1989) who found similar-sized priming effects for these two word types. This difference in results may be attributable to the fact that their participants were same-script bilinguals (Spanish-English), and the orthographic similarity may have enhanced the lexical level overlap. It is remarkable, however, that although false friends were harder to process compared to cognates in the present different-script experiment, they still showed a significant priming effect, as in most of the previous same-script studies (Section 2.3.4).

(3) False friends vs. true translations

However, similarity based on lexical feature overlap can sometimes inhibit processing, even overriding the facilitative effect of conceptual similarity. When the same item shows conceptual-feature overlap with one L2 item and lexical feature overlap with another, the former does not seem to take the upper hand in processing. This becomes evident in the comparison of false friends with stimulus pairs that consisted of a potential false friend and its real L2 translation equivalent (FfFf & FfTr). Processing times for these groups were not significantly different, while one would have expected the latter to show an advantage over the former due to the similarity in meaning. Moreover, the opposite trend was observed: false friends showed faster response times than true translations, although this difference did not reach statistical significance. This comparison shows that similarity in meaning does not always win out over similarity in form. Instead, the latter may override the former, slowing down processing, which was the case with the pairs consisting of a false friend and its real translation equivalent. Presumably, the link between the L1 word and L2 word that is not its translation but has

the same form (i.e., a false friend) can not be shut off, inhibiting the processing of the true translation equivalent that is different in form. Such a link based on lexical feature overlap must be very strong and automatic since the participants were advanced bilinguals who knew the true word meanings (the accuracy rate for both false friends and false friends with real translations was 93 per cent), but were inhibited nevertheless, unable to shut off the 'wrong' form-based link. To the best of my knowledge, previous studies have not looked into this type of comparison.

(4) Translation equivalents with and without false friends

The above reasoning finds support in the comparison between pairs consisting of a potential false friend with its real translation and those consisting of regular translation equivalents (FfTr and TrEq). The results show that a word facilitates its translation better if there are no 'competitors', i.e., potential false friends in the L2. Although both of the above stimulus types can be classified as "translations", i.e., words that are similar in meaning but different in form, regular translation equivalents showed a significant processing advantage. Again, the phonologically-based link between the L1 word and an L2 word that is similar in form (i.e., a false friend) is activated and acts to inhibit the processing of the true translation. There is no such inhibition in the case of regular translation equivalents, which results in a processing advantage. Again, as was the case in the previous comparison, conceptual-level processing is slowed down as a result of interlingual activation at the lexical feature level.

(5) False friends vs. unrelated items

When compared with unrelated words, false friends showed faster processing times. Although both of these word types are different at the conceptual level, lexical feature overlap (phonological in the case of Russian and English) gives false friends a processing advantage. This is in line with the other results described above and with previous studies (Section 2.3.4). Also, as was mentioned above, a priming effect was obtained for false friends but, naturally, not for unrelated items. This pattern of results shows that interlingual lexical feature overlap alone is sufficient to result in interlingual activation in bilinguals, as similar-sounding items have been shown to prime each other monolingually (Section 2.1).

(6) "Phonologically similar" items

Phonologically similar words (see operational definition in Section 2.4.2) proved to be no different from regular unrelated words, despite their partial phonological similarity. Such similarity must be too superficial in order for any interlingual activation to take place. This may suggest that there is no basis for singling out such items into a separate stimulus type in further bilingual studies, since they seem to be no different from unrelated words in terms of processing difficulty. However, the other experiments in this study may offer additional evidence concerning this issue.

Planned comparisons conducted for the ambiguous stimulus groups yielded the following results:

(7) Interlingual activation of unprimed ambiguous word translations

The three unprimed ambiguous stimulus types (A1No, A2NcNo, & A2CNo), i.e., those where the preprime and the L2 target referred to two different meanings of the ambiguous L1 prime, were individually contrasted with the unrelated stimulus group. All the three comparisons showed that the unprimed ambiguous groups were processed significantly easier than unrelated stimuli. This result is important since it confirms that multiple meaning activation occurs cross-linguistically during bilingual processing of ambiguous L1 stimuli. Multiple meaning activation has been previously confirmed for monolingual processing in various studies, such as Swinney (1979) and others (see Section 2.3.6). This experiment has shown that multiple meanings are also activated across the language boundary. If the unprimed meanings of the ambiguous words in L1 had not been activated, their L2 counterparts would have shown no difference from unrelated stimuli in terms of processing time. However, such counterparts of the unprimed meanings were processed significantly easier than unrelated words, showing that those meanings had been activated along with the primed ones.

As was discussed in Section 2.3.4, ambiguity can be represented as *intra*lingual lexical feature overlap in terms of Kroll and De Groot's distributed feature model (see *Figures 2.3 & 2.4(b)*). Such overlap causes multiple meaning activation in L1, after which L2 translations of both meanings are activated due to the interlingual conceptual feature overlap in the case of non-cognate translations and both lexical and conceptual overlap in the case of cognate translations.

(8) Unprimed cognate and non-cognate translations of ambiguous items

The activation of the unprimed meaning was facilitated when this meaning was encoded as an L2 cognate. This follows from the contrast between the A2CNo and A1No types, their only difference being that the former is a cognate translation of the unprimed meaning and the latter is a non-cognate. Processing was significantly faster for the former type. Again, this demonstrates how lexical feature overlap can facilitate interlingual lexical processing.

(9-10) Ambiguous vs. non-ambiguous items

Finally, two comparisons were conducted to see whether non-ambiguous words are easier to process than ambiguous ones. The first comparison was drawn between regular translations and ambiguous L1 words that have two non-cognate translations (the primed type, A1Yes, was used to eliminate all the differences between the groups under comparison except for meaning ambiguity). There was no difference in processing times for the two stimulus types, suggesting that in this case, ambiguity was neither an advantage nor a disadvantage for bilingual lexical processing. The second comparison was drawn between cognate translations (Cogn) and "ambiguous" cognates (again, the primed type, A2CYes, was used as the comparison group for the reasons given above). Regular unambiguous cognates showed a processing advantage, corroborating the result obtained in some previous studies (see Section 2.3.6) that the fewer meanings a word has, the easier it is to process.

The latter result would be expected based on the other results obtained in this experiment and based on my proposed extension of Kroll and De Groot's model (Sections 2.3.1 & 2.3.4). Since multiple meaning activation occurs for ambiguous words (see above), it would be reasonable to assume that a non-ambiguous word would facilitate its translation better because there would be no other items 'competing' to get activated. However, this was not confirmed by the first contrast presented above (with non-cognate translations). The only conclusion that can be drawn when considering both of the above contrasts, is that neither of them showed an advantage for ambiguous words over unambiguous ones, which some previous studies have found (Section 2.3.6). Unambiguous words were processed with either equal or greater ease compared to ambiguous words. The second experiment may offer additional evidence concerning this issue.

3.3 Russian-English Experiment 2: Translation Recognition

3.3.1 Participants

All Russian-English bilinguals who participated in Experiment 1 also participated in this experiment.

3.3.2 Apparatus

The apparatus was identical to that used in the previous experiment.

3.3.3 Stimuli and Design

The same basic stimulus groups that were used in Experiment 1 were also used in this experiment. These basic stimulus types are summarized in *Table 3.4* (repeated from *Table 3.1* for convenience). Again, the character "+" stands for meaning/form similarity, and "-" stands for meaning/form difference. Question marks indicate problematic cases. The contextually primed meanings of homophones are capitalized.

Table 3.4 **Basic Stimulus Types (Russian-English)**

	L 1 (RUSSIAN)	L 2 (ENGLISH)	Form	Meaning	Abbreviation
1.	Translation Equivalent *ошибка* – 'mistake'	Translation Equivalent *mistake*	-	+	TrEq
2.	Cognate *секрет* – 'secret'	Cognate *secret*	+	+	Cogn
3,4.	False Friend *батон* – 'loaf'	False Friend *baton*	+	-(?)	FfFf
		Translation Equivalent *loaf*	-	+	FfTr
5.	Phonologically Similar *сок* – 'juice'	Phonologically Similar *sock*	+(?)	-	PhSim
6.	Any word *ветер* – 'wind'	Non-translation *snake*	-	-	Unrel
7,8.	Ambiguous1 (X1, x2) *язык* 'tongue/language'- preprimed by *рот* 'mouth'	Translation of (X1) *TONGUE*	-	+	A1Yes
		Translation of (x2) *language*	-	+(?)	A1No
9,10.	Ambiguous 2a (Y1, y2) *роман* 'romance/novel' - preprimed by *любовь* 'love'	Cognate (Y1) *ROMANCE*	+	+	A2CYes
		Translation of (y2) *novel*	-	+(?)	A2NcNo
11,12.	Ambiguous 2b (y1, Y2) *акция* 'action/share' preprimed by *корпорация* 'corporation'	Cognate (y1) *action*	+	+(?)	A2CNo
		Translation of (Y2) *SHARE*	-	+	A2NcYes

The frequency balancing was identical to that employed in Experiment 1, with the following exception: two of the stimulus groups (Translation Equivalents and Non-Translations), had to be subdivided into two subgroups each according to their frequency (high or low) since it turned out to be difficult to balance the English frequency of these stimuli with the other stimulus groups. This subdivision made it possible to compare these two groups with all the other groups by using the high or the low frequency

subgroup in each case, depending on the frequency of the other stimulus group involved in each individual planned comparison.

Overall, there were 12 basic stimulus groups in this experiment, each of which contained the following numbers of item pairs (see *Table 3.4* above):

- Type 1: 20 (including high- and low-frequency subgroups)
- Type 2: 16
- Types 3-5: 10
- Type 6: 54[21] (including high- and low-frequency subgroups)
- Types 7-8: 10
- Types 9-12: 9

Similar to Experiment 1, not all the stimuli were seen by each participant. The participants were subdivided into 2 subgroups (Versions A & B) in order to prevent the same bilingual from seeing the same stimulus word in two different conditions (i.e., stimulus groups (3,4), (7,8), (9,10), (11,12) in *Table 3.4*).

3.3.4 Procedure

The participants performed this task after completing the first experiment as well as the recall task following that experiment and after filling out the Language Background Questionnaire. The procedure employed in this experiment was identical to that used in Experiment 1, with the following two exceptions:

[21] The number of items in the unrelated stimulus group had to be increased to 54 in order to balance the number of "yes" and "no" responses in the experiment.

(1) The participants' task was different. They were instructed to decide whether words 2 and 3 in each trial could ever be translations of each other by pushing the "yes" (?/) or "no" (z) button on the keyboard. The participants were asked to make their judgments about translatability as general as possible. Similar to Experiment 1, the words in each trial were presented consecutively, and the last word stayed on the screen until a decision was made by the bilingual.

(2) Since real words only were used in this experiment, the number of trials could be reduced. The experiment consisted of 138 trials conducted in a single block and took about seven minutes to complete.

3.3.5 Results and Discussion

An analysis of subject-wise response latency and accuracy resulted in the inclusion of the data supplied by all 38 participants.

The data from the experiment were analyzed using the one-way analysis of variance option of the SygmaStat statistical package. Similar to the first experiment, subject- and item-based analyses were performed. Separate analyses were performed for the "yes" and "no" responses in each case. In the subjects analysis, mean response times were calculated for each subject for each stimulus type. All incorrect responses were excluded from those calculations, as well as all the responses beyond two standard deviations from the respective means. One-way repeated measures ANOVAs were performed separately for the "yes" and "no" responses. Stimulus type was treated as a within-subjects variable with 10 levels in the analysis of the "yes" responses and with 4 levels in the analysis of the "no" responses. In the items analysis, means for individual items were calculated, and

a one-way repeated measures ANOVA was performed on those values, separately for the "yes" and "no" responses. The same kinds of responses as in the subjects analysis were excluded. In this analysis, stimulus type was treated as a between-items factor, with 10 levels in the "yes" analysis and 4 levels in the "no" analysis. The mean values used in the subject-based and item-based analyses for the "yes" and "no" responses are presented in *Tables 3.5* and *3.6* below. For the two stimulus types that had high- and low-frequency subgroups (translations and unrelated words), the collapsed values are presented in all the tables that follow since a planned comparison procedure revealed no difference in response times between the subgroups in both cases.

Table 3.5[22] **Experiment 2 (R-E): Translation Recognition.**

Mean Response Time as a Function of Stimulus Type. "YES" responses

	Stimulus Type	Example	Mean RTs, ms (subject-based)	Mean RTs, ms (item-based)
1.	Translation Equivalents (TrEq)	ошибка *-mistake*	820.5	820.3
2.	Cognates (Cogn)	секрет *- secret*	778.0	778.7
3.	False Friends with Real Translations (FfTr)	*батон - loaf*	1182.4	1220.9
4.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*язык* (preprimed by *рот) - TONGUE*	1110.4	1159.0
5.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*язык* (preprimed by *рот) - language*	1170.5	1187.4
6.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*роман* (preprimed by *любовь*) - *ROMANCE*	1168.3	1205.1
7.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*роман* (preprimed by *любовь*) - *novel*	1204.0	1254.8

[22] The contextually primed meanings of ambiguous words are capitalized.

8.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*акция* (preprimed by *корпорация*) - *action*	1087.1	1071.7
9.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*акция* (preprimed by *корпорация*) - *SHARE*	1185.2	1292.6

Table 3.6 **Experiment 2 (R-E): Translation Recognition.**

Mean Response Time as a Function of Stimulus Type. "NO" responses

	Stimulus Type	**Example**	**Mean RTs, ms (subject-based)**	**Mean RTs, ms (item-based)**
1.	False Friends (FfFf)	*батон -baton*	1724.7	1726.2
2.	Phonologically Similar Words (PhSim)	*сок - sock*	1149.3	1163.3
3.	Unrelated Words	*ветер - snake*	1110.2	1112.2

The main effect of stimulus type was significant for both the "yes" (F_1 (8, 332) = 10.5, $p<0.01$, F_2 (8, 92) = 8.20, $p<0.01$) and "no" (F_1 (2, 109) = 14.61, $p<0.01$, F_2 (2, 70) = 18.80, $p<0.01$) responses, where F_1 refers to the subjects analysis and F_2 refers to the items analysis. This indicates that word-type effects play a role in bilingual lexical processing. Response times for individual stimulus groups for both types of responses are graphed in *Figures 3.3* and *3.4* below.

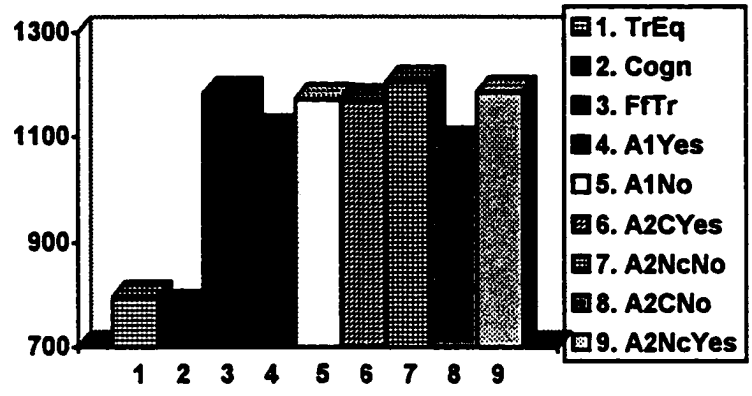


Figure 3.3 **Translation Latency ("Yes" Responses, R-E)**

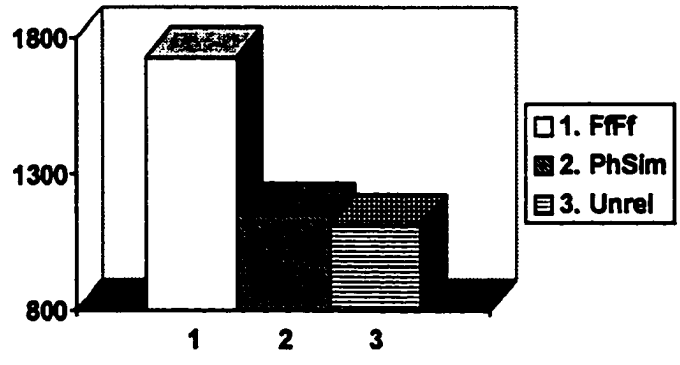


Figure 3.4 **Translation Latency ("No" Responses, R-E)**

The specific hypotheses that were previously formulated (Section 2.4.3) were tested by looking at individual *a priori* contrasts in the data. For all the planned comparisons, t-tests were conducted. The results of those tests are represented in *Table 3.7* below[23].

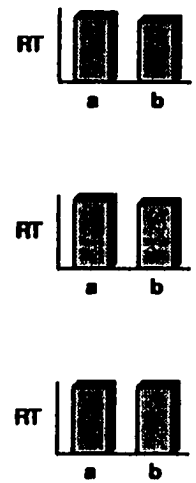
[23] Again, the results are based on the data supplied by all 38 participants.

Some of the control lexical types differ from those used in the planned comparisons in Experiment 1. This replacement was made in order to avoid a direct comparison between the "yes" and "no" responses. Some of the planned comparisons performed in Experiment 1 were not possible here for the same reason.

Table 3.7 **Experiment 2 (R-E): Translation Recognition. Summary of Planned Pairwise Comparisons**[24]

#	Question	Test Type ('a' in graphs)	Control Type ('b' in graphs)	Result (response times)
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates (Cogn) секрет – *secret*	Translation Equivalents (TrEq) ошибка – *mistake*	 YES *p<0.05
2.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on the lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any "false friends"?)	Translation Equivalents (TrEq) ошибка – *mistake*	False Friend in L1 and its real L2 Translation (FfTr) *батон – loaf*	 YES *p<0.01
3.	Can lexical feature overlap alone result in interlingual activation?	False Friends (FfFf) *батон – baton*	Non-Translations (Unrel) *ветер – snake*	 YES *p<0.01
4.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar (PhSim) *сок – sock*	Non-Translation (Unrel) *ветер – snake*	 NO

[24] Statistically significant differences are indicated with an asterisk.

5.	**Is multiple meaning activation carried over across languages?** **(if 'yes', this would also be evidence for multiple activation in L1)**	Ambiguous L1 Words & Contextually *Un*primed L2 Translations (A1No, A2NcNo, A2CNo) 1) *язык – language*, preprimed by *рот* 2) *роман - novel*, preprimed by *любовь* 3) *акция - action*, preprimed by *корпорация*	Ambiguous L1 Words & Contextually Primed L2 Translations (A1Yes, A2NcYes, A2CYes) 1) *язык – TONGUE*, preprimed by *рот* 2) *акция – SHARE*, preprimed by *корпорация* 3) *роман - ROMANCE*, preprimed by *любовь*	YES 
6.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually Unprimed L2 Cognate Translation (A2CNo) *акция* (preprimed by *корпорация*) – *action*	Ambiguous L1 Word & Contextually Unprimed L2 Translation (A1No) *язык* (preprimed by *рот*) – *language*	 NO

7.	Is there an ambiguity disadvantage effect for items with interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation (A1Yes) *язык* (preprimed by *рот*) – *TONGUE*	Translation Equivalents (TrEq) ошибка – *mistake*	 YES *p<0.01
8.	Is there an ambiguity disadvantage effect for items with both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation (A2CYes) *роман* (preprimed by *любовь*) – *ROMANCE*	Cognates (Cogn) секрет – *secret*	 YES *p<0.01

As can be seen from *Table 3.7*, planned pairwise comparisons showed the following results:

(1) Cognate vs. non-cognate translations

Response times to cognates were significantly faster than those to regular translations. Again, as was the case in Experiment 1, lexical feature overlap in addition to conceptual feature overlap gave cognates a processing advantage. Faster response times to cognates compared to non-cognates corroborate previous translation recognition results indicating that bilinguals show a bias toward an "accept" response when the stimuli are perceptually similar and toward a "reject" response when they are perceptually dissimilar (e.g., De Groot & Comijs, 1995). Since cognate translations are perceptually similar and non-cognate ones are not, this creates a bias towards a "yes" response for the former and towards a "no" response for the latter, giving cognates a processing advantage. Thus, lexical feature overlap *is* a factor in translation recognition, too.

(2) Translation equivalents with and without false friends

The above statement finds further support in the comparison between pairs consisting of a potential false friend with its real translation and those consisting of regular translation equivalents (FfTr & TrEq). The results show that a word facilitates its translation better if there are no 'competitors', i.e., potential false friends in the L2. Regular translations had a statistically significant processing advantage. This result is exactly parallel to that obtained in Experiment 1. The phonologically-based link between the L1 word and an L2 word that is similar in form (a false friend) is activated and acts to

inhibit the processing of the true translation. There is no such inhibition in the case of regular translation equivalents, which results in a processing advantage. Again, as was the case in Experiment 1, conceptual-level processing is slowed down as a result of interlingual activation at the lexical feature level. This comparison shows that even in translation, which would seem to be a more meaning-based process, similarity in meaning does not always win over the similarity in form. Instead, the latter may override the former and slow down processing, which was the case with the pairs consisting of a false friend and its real translation. The participants were inhibited by form similarity despite the fact that they knew the real translations of false friends: the accuracy rate for false friends and false friends with real translations was 95% and 92% respectively.

(3) False friends vs. unrelated items

When compared with unrelated words, false friends showed slower response times. This result is opposite to the one obtained in Experiment 1, where false friends were processed faster. This was attributed to the overlap at the lexical feature level (Section 3.2.5). This overlap may also be the reason for the reverse pattern of results in the present experiment. Such overlap may inhibit translation and cause a bilingual to spend more time before rejecting false friends as possible translations, a result parallel to that obtained by De Groot & Comijs (1995). Perceptually dissimilar words are easier to reject as translations, while perceptually similar ones (in this case, false friends) create a bias toward a "yes" response.

(4) 'Phonologically similar' items

Response times for 'phonologically similar' items (see operational definition in Section 2.4.2) were slower than those for unrelated words, but this difference was not statistically significant. Slower response times for phonologically similar items may be attributed to the same kind of inhibition that was found for false friends. Such inhibition is a result of the partial phonological similarity between these words, which creates a bias towards a "yes" response on the translation task. However, since lexical level overlap in this case is not as big as in the case of false friends, the bias towards the wrong response and therefore the inhibition is much weaker, and the difference between this group and unrelated items does not reach significance.

Planned comparisons conducted for the ambiguous stimulus groups yielded the following results:

(5) Interlingual activation of unprimed and primed ambiguous word translations

All the three unprimed ambiguous stimulus types (A1No, A2NcNo, & A2CNo), i.e., those where the preprime and the L2 target referred to two different meanings of the ambiguous L1 target, were contrasted with the respective primed type (A1Yes, A2NcYes, & A2CYes). All the three comparisons showed that the unprimed and primed groups were processed with relatively equal ease. This result confirms that multiple meaning activation occurs cross-linguistically during bilingual processing of ambiguous L1 stimuli, parallel to the result obtained in Experiment 1 (see also Section 2.3.6 for a discussion of previous monolingual results). If the unprimed meanings of the ambiguous words in L1 had not been activated, their L2 counterparts would have shown significantly

slower response times than those of the primed meanings. However, the L2 counterparts of the unprimed and primed meanings were processed with relatively equal ease, showing that the unprimed meanings had been activated along with the primed ones.

An argument parallel to that in Section 3.2.5 can be made here. As was shown in Section 2.3.6, ambiguity can be represented as *intra*lingual lexical feature overlap in terms of Kroll and De Groot's distributed feature model (see *Figures 2.3 & 2.4(b)*). Such overlap causes multiple meaning activation in L1, after which L2 translations of both meanings are activated due to the interlingual conceptual feature overlap in the case of non-cognate translations and both lexical and conceptual overlap in the case of cognate translations.

(6) Unprimed cognate and non-cognate translations of ambiguous items

The A2CNo and A1No types were contrasted to see whether the cross-linguistic activation of the unprimed meaning is facilitated when this meaning is encoded as an L2 cognate (as in A2CNo). Response times for the two groups were not significantly different, although they were faster for the A2CNo group, which can be explained by the additional processing advantage derived from shared lexical-level features.

(7-8) Ambiguous vs. non-ambiguous items

Finally, two comparisons were conducted to see whether non-ambiguous words are easier to process than ambiguous ones. The first comparison was drawn between regular translations and ambiguous L1 words that have two non-cognate translations (the primed type, A1Yes, was used to eliminate all the differences between the groups under comparison except for meaning ambiguity). Regular translation equivalents showed a

significant processing advantage. This confirms that unambiguous words are easier to process compared to ambiguous ones, a result that has been obtained in a number of monolingual studies (see Section 2.3.6). The second comparison was drawn between cognate translations (Cogn) and ambiguous cognates (again, the primed type, A2CYes, was used as the comparison group for the reasons given above). Regular, unambiguous cognates showed a processing advantage, corroborating the result obtained in the first comparison: the fewer meanings a word has, the easier it is to process.

Both of the above results would be expected based on the other results obtained in this and in the previous experiment, and also based on my proposed extension of Kroll and De Groot's model (Sections 2.3.1 & 2.3.6). Since multiple meaning activation occurs for ambiguous words (see above), it would be reasonable to assume that a non-ambiguous word would facilitate its translation better because there would be no other items 'competing' for activation.

3.4 Russian-English Experiment 3: Off-Line Translation Recognition (Proficiency Check)

3.4.1 Participants, Apparatus, Stimuli & Design

All Russian-English bilinguals who participated in Experiments 1 and 2 also participated in this experiment. The apparatus, stimuli and design were identical to those used in Experiment 2.

3.4.2 Procedure

The participants were tested individually in a normally lit room. They performed this task after they finished the second experiment and the recall task following it. The participants sat in front of a computer monitor at a comfortable reading distance. The instructions were presented to them in English on the computer screen. The participants were told that they were going to see word pairs on the screen, with both members of the pair appearing on the screen simultaneously. Each pair consisted of a real Russian and a real English word. The participants were instructed to read the word pairs and decide whether the pair members could ever be translations of each other by choosing one of the following four options: 1) "yes"; 2) "no"; 3) "unsure"; 4) "don't know the English word". They were instructed to make their judgments about translatability as general as possible. Different key color labels were used for each of the responses. In contrast to the previous task, the participants were instructed to take as much time as they needed to think over the answers and to make their responses as accurately as possible. Therefore,

the hand they were using to provide the answers did not matter. Participants were given a legend showing the color labels corresponding to each of the answers, so that they did not have to memorize them. After a participant read the instructions, the experimenter drew his/her attention to the most important points once again, after which s/he had an opportunity to ask questions. There was no practice session before this experiment since it was conducted off-line.

The experiment consisted of 138 trials conducted in a single block and took about five minutes to complete.

Each trial started with a presentation of a fixation point (an asterisk) for 250 ms in the center of the screen, followed by a blank interstimulus interval that lasted 250 ms. Subsequently, the participant saw two words on the screen, one below the other: the Russian word was presented slightly above and the English word slightly below the center of the screen. The Russian word appeared in 48 TransCyrillic font, and the English word - in 48 Chicago font. Both words stayed on the screen until a decision was reached by the participant regarding their translatability. There was a blank interval of 250 ms before the start of the following trial.

3.4.3 Results and Discussion

Mean response accuracy on this proficiency task was calculated individually for each participant in the experiment to make sure that the participants' self-ratings given in the Language Background Questionnaire were trustworthy. The accuracy score for each participant is given in *Table 3.8* below.

Table 3.8 **Proficiency Check (R-E):**

Mean Response Accuracy (% Correct) by Subject

Participant #	Response Accuracy (% Correct)	Participant #	Response Accuracy (% Correct)
1.	89	20.	81
2.	96	21.	76
3.	77	22.	78
4.	88	23.	94
5.	83	24.	84
6.	85	25.	84
7.	90	26.	82
8.	84	27.	89
9.	90	28.	74
10.	84	29.	72
11.	91	30.	87
12.	90	31.	88
13.	89	32.	87
14.	89	33.	83
15.	87	34.	75
16.	90	35.	87
17.	93	36.	95
18.	79	37.	73
19.	91	38.	93

The above scores suggest that that the self-ratings provided by the participants on the Language Background Questionnaire are indeed trustworthy for the purposes of this study[25].

Response accuracy (expressed in percent of correct responses) was also calculated for each stimulus type. The numbers are given in *Tables 3.9* and *3.10* below (the percentage of "unsure" responses is also given).

[25] The average proportion of "don't know the English word" responses was 1.8%.

Table 3.9 **Proficiency Check (R-E). Response Accuracy as a Function of Stimulus Type. "YES" responses**

	Stimulus Type	Example	% Correct	% Unsure
1.	Translation Equivalents	ошибка – *mistake*	97.9	0.53
2.	Cognates (Cogn)	секрет – *secret*	99.1	1.15
4.	False Friends with Real Translations (FfTr)	*батон – loaf*	85.3	8.95
7.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*язык* (preprimed by *рот)* – *TONGUE*	87.3	2.63
8.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*язык* (preprimed by *рот)* – *language*	96.8	0.00
9.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*роман* (preprimed by *любовь*) – *ROMANCE*	88.8	3.42
10.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*роман* (preprimed by *любовь*) – *novel*	86.9	7.37
11.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*акция* (preprimed by *корпорация*) – *action*	82.3	3.42
12.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*акция* (preprimed by *корпорация*) – *SHARE*	79.2	5.26

Table 3.10 **Proficiency Check (R-E). Response Accuracy as a Function of Stimulus Type. "NO" responses**

			Response Accuracy (% Correct)	
	Stimulus Type	Example	% Correct	% Unsure
3.	False Friends (FfFf)	*батон –baton*	67.9	16.32
5.	Phonologically Similar Words (PhSim)	*сок – sock*	93.5	3.16
6.	Unrelated Words	*ветер – snake*	96.7	1.72

As can be seen from *Table 3.10*, false friends represented the biggest problem for the participants: this stimulus group has the lowest accuracy score and the highest percentage of "unsure" responses. This result is not surprising: it is well known that *faux amis* are a major source of errors among unbalanced bilinguals/second language learners. Also, the fact that on this task, the participants were given the option of answering "unsure" may have decreased the accuracy rate. The above results for false friends agree with those produced in the two online experiments and with other experiments in the literature (Section 2.3.4) where it has been shown that on translation recognition tasks, bilinguals are biased to respond "yes" to stimuli that sound or look the same and "no" to those that do not.

3.5 Summary of the Russian-English Experiments

The purpose of this part of the study was to examine word-type effects in the lexical processing of advanced Russian-English bilinguals and to uncover the combinations of elements at the conceptual and lexical levels of representation that contribute to a greater degree of interlingual activation. In addition to examining the role of semantic and phonological variables, these experiments allowed me to study the effect of script difference on bilingual lexical processing and to relate it to the previous results obtained for same-script bilinguals, as well as to those obtained in the French-English experiments below (see Chapter 5 for a general discussion).

The above objectives were achieved by comparing priming effects and translation recognition response times for various stimulus groups in the two on-line experiments reported above. The similarities and differences between the results of the priming and translation recognition experiments are summarized in *Table 3.11* below:

Table 3.11 **Russian-English Experiments 1 & 2: Results Compared**

Experiment		Comparison of Results
Primed Lexical Decision	**Translation Recognition**	
Cognates were processed faster than non-cognate translations	Cognates were processed faster than non-cognate translations	Similar
Cognates were easier to process compared to false friends	N/A	N/A
False friends were processed faster compared to a potential false friend with its real translation (difference not significant)	N/A	N/A
Processing advantage of regular translation equivalents over those that have a potential false friend	Processing advantage of regular translation equivalents over those that have a potential false friend	Similar

False friends were processed faster than unrelated words	False friends were processed slower than unrelated words	Different
No difference between phonologically similar and unrelated words	Phonologically similar items were processed slower than unrelated words (difference not significant)	Similar
Cross-linguistic multiple meaning activation for ambiguous words	Cross-linguistic multiple meaning activation for ambiguous words	Similar
Cross-linguistic activation of the unprimed ambiguous word meaning occurs easier when L2 expresses it in a cognate	Cross-linguistic activation of the unprimed ambiguous word meaning occurs easier when L2 expresses it in a cognate (difference not significant)	Different
Ambiguity does not provide a processing advantage	Non-ambiguous words have a processing advantage compared to ambiguous words	Similar

On both tasks, shared conceptual and lexical features resulted in interlingual activation. It is especially important to note that interlingual facilitation occurred despite the fact that the participants' two languages use different scripts. Such a difference did not prevent L1 words from activating related lexical items in L2. An interlingual priming effect was obtained for all the stimulus types that show conceptual feature overlap, while there was no facilitation for the semantically unrelated stimulus types (unrelated and phonologically similar words). A priming effect was also obtained for items that show lexical feature/form overlap (false friends), as well as for those sharing representational elements at both levels (cognates).

Overall, the two experiments demonstrated that bilingual lexical processing is affected by word type (i.e., by how form is mapped onto meaning in the two languages). Different feature combinations at the conceptual and lexical level result in varying degrees of processing difficulty in terms of Kroll & De Groot's distributed lexical/conceptual feature model.

The Russian-English experiments have revealed the following five major tendencies regarding word-type effects in bilingual lexical processing:

1) Both interlingual conceptual and lexical feature overlap (i.e., meaning and form similarity) facilitate bilingual processing.
2) On both experimental tasks, items that show lexical in addition to conceptual feature overlap have a processing advantage.
3) Spreading activation from an L1 to an L2 word caused by lexical feature overlap may slow down the activation of its true L2 translation equivalent, i.e., interfere with the activation of a link based on conceptual overlap.
4) Both meanings of an ambiguous word are activated no matter which of them was primed, and this multiple meaning activation spreads across the language barrier, resulting in the activation of both translations in the second language.
5) Greater interlingual activation results from semantically unambiguous words than from ambiguous ones.

Overall, the results suggest that bilingual lexical processing is not fundamentally different from monolingual processing, reflecting the fact that both bilingual and monolingual lexicons are structured along the lines of form and meaning similarity, with words connected in a single cross-referenced network, no matter whether they are words of one or two languages. Most importantly, script does not seem to be a basis for language separation in bilinguals. For different-script bilinguals who participated in this study, words in one language facilitated the processing of related words in the second language, despite the fact that the two languages do not share orthography. Finally, the

lexicon of each bilingual is non-uniform, since representations may be shared to a greater or lesser extent depending on the interlingual word type, as can be seen from the processing differences reported in this chapter.

CHAPTER FOUR

FRENCH-ENGLISH EXPERIMENTS

4.1 Introduction

The design and procedure for the French-English experiments were largely parallel to those of the Russian-English experiments described in Chapter 3.

All French-English experiments were run in a single session that lasted between 45 and 55 minutes for most participants. Each participant performed the experiments and additional tasks in the following order:

- Experiment 1[26] (Cross-Linguistic Priming with Lexical Decision) 20-25 min
- Recall Task 1 2-3 min
- Language Background Questionnaire 3-5 min
- Experiment 2 (On-line Translation Recognition) 7-10 min
- Recall Task 2 2-3 min
- Experiment 3 (Off-line Translation Recognition/Proficiency Check) 5-6 min

4.2 French-English Experiment 1: Cross-Linguistic Priming with Lexical Decision

4.2.1 Participants

Thirty-four educated adult French-English bilinguals participated in the experiment and were paid a nominal fee in exchange for their participation. All the participants had

[26] In this chapter, Experiments 1, 2, & 3 refer to the French-English experiments, unless explicit reference is made to the Russian-English experiments.

French as their L1. All of them can be described as French-dominant bilinguals currently residing in Montreal, Quebec, Canada and using both French and English in various situations. Most of the participants were university students. In order to collect information about the participants, a Language Background Questionnaire (*Appendix B*) was administered between the experimental tasks. The Questionnaire responses revealed that while all of the participants used both French and English on a daily basis, most of the participants spoke French (their L1) at home, similar to the Russian-English group. About half of them used their L1 at work and the other half used English (L2) or both, whereas in the Russian-English group, most of the participants reported using L2 at work. In social situations, both languages were used, although French was used somewhat more frequently than English. The average starting age for learning English was 9 (as compared to 12 for the Russian group). Most of the participants had spent some time learning English in a classroom setting ($\bar{x}$ years = 7, the same as for the Russian-English group). The average number of years spent by the participants in an English-speaking environment was 3 years (5 years for the Russian group). On the seven-point proficiency scale, all participants rated their overall English language proficiency as five or higher. When asked how often they came across an unfamiliar L2 (English) word, most of the participants indicated "rarely" or "sometimes" (similar to the Russian group). In order to check for possible L1 attrition, participants were also asked how often they forgot L1 words and their meanings. Most of the participants also answered "rarely" or "sometimes".

Based on the above information, these participants may be classified as "advanced bilinguals" although, as was mentioned in the previous chapter, there are divergent

definitions and classifications of bilinguals (see Grosjean (1997) for a discussion). As can be seen from the above, the French-English participant group is comparable to the Russian-English group in most respects. It appears that the few differences that do exist between these two groups of bilinguals, such as wider L1 use at work by the French group, result from the fact that the French-English participants are living in a predominantly L1 environment, while the Russian-English ones are living in an L2 environment. The other differences seem to balance each other out: the average age for starting L2 learning was a bit younger for the French-English participants, but the Russian-English participants had spent more time living in the L2 environment.

4.2.2 Apparatus

The French-English testing, conducted at the University of Montreal, employed the identical apparatus as that used in the Russian-English experiments (see Section 3.2.2).

4.2.3 Stimuli and Design

The 12 stimulus categories that formed the core of the experiment were almost identical to the ones used in the Russian-English experiments (see Sections 2.4.2 and 3.2.3).[27]

[27] In these experiments, an additional group of 'identical' cognates, different from regular cognates in that their spelling in L1 and L2 is identical, was included (it was impossible to include this group in the Russian-English experiments because of the different scripts).

These basic stimulus types are summarized again in *Table 4.1*. The character "+" stands for meaning/form similarity, and "-" stands for meaning/form difference. Question marks indicate problematic cases. The contextually primed meanings of homophones are capitalized.

Table 4.1 **Basic Stimulus Types (French-English)**

	L 1 (FRENCH)	L 2 (ENGLISH)	Form	Mean-ing	Abbre-viation
1.	Translation Equivalent *pont* – 'bridge'	Translation Equivalent *bridge*	-	+	TrEq
2.	Cognate *tulipe* – 'tulip'	Cognate *tulip*	+	+	Cogn
2a.	Identical Cognate *jungle* – 'jungle'	Identical Cognate *jungle*	+	+	CognId
3,4.	False Friend *pain* – 'bread'	False Friend *pain*	+	-(?)	FfFf
		Translation Equivalent *bread*	-	+	FfTr
5.	Phonologically Similar *sac* – 'bag'	Phonologically Similar *suck*	+(?)	-	PhSim
6.	Any word *poumon* – 'lung'	Non-translation *stick*	-	-	Unrel
7,8.	Ambiguous1 (X1, x2) *livre* 'book/pound' – preprimed by *manuscrit* 'manuscript'	Translation of (X1) *BOOK*	-	+	A1Yes
		Translation of (x2) *pound*	-	+(?)	A1No
9,10.	Ambiguous 2a (Y1, y2) *mille* 'mile/thousand' – preprimed by *kilomètre* 'kilometer'	Cognate (Y1) *MILE*	+	+	A2CYes
		Translation of (y2) *thousand*	-	+(?)	A2NcNo
11,12.	Ambiguous 2b (y1, Y2) *mille* 'mile/thousand' – preprimed by *chiffre* 'number'	Cognate (y1) *mile*	+	+(?)	A2CNo
		Translation of (Y2) *THOUSAND*	-	+	A2NcYes

As in the previous experiments, the English targets were all balanced for frequency across the groups, according to Kučera and Francis (1967).

Again, the experiment employed the triplet methodology. In order to bias the participant's reading of an L1 homophone toward one of its meanings (i.e., in order to create an appropriate/primed or inappropriate/unprimed context), an L1 "preprime" was presented before each stimulus pair. For example, a participant saw the sequence *[chiffre* ('number') – *mille* ('mile/thousand') – *thousand]*, in which case the English translation and the French preprime refer to the same meaning of the ambiguous French word. In order to bias the reading of the ambiguous word toward a different meaning, the French preprime would have to be replaced, for example, by *kilomètre* ('kilometer'). In order to conceal the above from the participants, *all* types of stimulus pairs were preceded by L1 preprimes, i.e., on every trial, a word triplet was presented.

In order to select preprimes for the basic stimulus groups, a semantic relatedness judgment task was administered to ten monolingual French speakers in Montreal, Quebec, using a procedure identical to that employed in the Russian-English experiments.

Similarly, all other aspects of stimulus construction (e.g., the baseline and foil groups) were identical to the Russian-English priming experiment.

These procedures resulted in the following major stimulus groups:

1) Basic stimulus groups:

- 13 types
- Types 1-4, 7-12: 10 pairs each
- Type 5: 8 pairs
- Type 6: 30 pairs

2) Baseline groups:

- 13 types
- Types 1-4, 7-12: 10 pairs each
- Type 5: 8 pairs
- Type 6: 30 pairs

3) Foils:

- Nonsense L1/Nonsense L2: 98 pairs
- Real L1/Nonsense L2: 98 pairs

Not all the words in the basic and baseline stimulus groups were seen by each participant. The participants were subdivided into 2 subgroups (Versions A & B) in order to prevent the same bilingual from seeing the same stimulus word in two different basic conditions (i.e., stimulus groups (3,4), (7,8), (9,10), (11,12) in *Table 4.1* above).

4.2.4 Procedure

In order to maximize comparability across the Russian-English and French-English studies, the identical procedure was used in this priming experiment[28].

[28] The addition of 'identical cognates' resulted in an increase of trials to 392 in this experiment. An additional rest break was also included. The experiment took about 20-23 minutes to complete.

4.2.5 Results and Discussion

The data from all 34 participants in the experiment were analyzed using the two-way analysis of variance option of the SygmaStat statistical package. For each subject, mean response times for each basic stimulus type were calculated for the primed and unprimed (baseline) conditions. All incorrect responses were excluded from those calculations, as well as all the responses beyond two standard deviations from the grand mean (calculated for all subjects for all pairs with real English targets). A 2-by-13 repeated measures ANOVA was performed on those values. Both stimulus type (13 types) and presentation condition (primed vs. unprimed) were treated as within-subjects variables in the subjects analysis. In addition, an items analysis was performed, where means for individual items were calculated for both primed and unprimed conditions, and a 2-by-13 ANOVA was done on those values. Again, all incorrect responses were excluded when calculating the means, along with all the responses that were greater than two standard deviations from the grand mean. In this analysis, stimulus type was treated as a between-items factor, and priming condition was a within-items factor. The mean values used in the subject-based and item-based analyses are presented in *Table 4.2* below.

Table 4.2[29] **Experiment 1 (F-E**[30]**): Lexical Decision. Mean Response Time and Priming Effect as a Function of Stimulus Type and Priming Condition**

			Response Times, ms (subject-based)		Response Times, ms (item-based)		Priming Effect[31,32]	
	Stimulus Type	Example	Unprimed	Primed	Unprimed	Primed	subject-based	item-based
1.	Translation Equivalents (TrEq)	*pont – bridge*	630.0	585.0	629.0	585.4	45.0*	43.6*
2.	Cognates (Cogn)	*tulipe – tulip*	649.5	610.8	647.7	606.8	38.7*	40.9*
3.	Identical Cognates (CognId)	*jungle – jungle*	619.2	578.6	614.2	572.9	40.6*	41.3*
3.	False Friends (FfFf)	*pain – pain*	638.0	606.0	629.4	595.7	32.0	33.7
4.	False Friends with Real Translations (FfTr)	*pain – bread*	658.0	615.9	658.5	618.0	42.1*	40.5*
5.	Phonologically Similar Words (PhSim)	*sac – suck*	650.8	669.0	651.4	666.6	-18.2	-15.2
6.	Unrelated Words (Unrel)	*poumon – stick*	639.6	641.6	639.1	639.5	-2.0	-.4

[29] As before, the contextually primed meanings of ambiguous words are capitalized.
[30] French-English
[31] The priming effect was calculated by subtracting the RT in the primed condition from that in the unprimed condition.
[32] Cases where the priming effect reached statistical significance ($p<0.05$) are marked with an asterisk.

7.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*livre* (preprimed by *manuscrit) – BOOK*	653.0	624.8	663.0	642.8	28.2	20.2
8.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*livre* (preprimed by *manuscrit) – pound*	623.8	602.4	633.2	601.7	21.4	31.5
9.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*mille* (preprimed by *kilomètre) – MILE*	653.2	591.6	642.2	587.2	61.6*	55.0*
10.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*mille* (preprimed by *kilomètre) – thousand*	645.0	629.8	644.1	630.4	15.2	13.7
11.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*mille* (preprimed by *chiffre) – mile*	637.9	612.4	634.7	601.4	25.5	33.3
12.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*mille* (preprimed by *chiffre) – THOUSAND*	647.1	620.7	644.5	616.8	26.4	27.7

Overall, cross-linguistic priming was observed. The main effect of priming was significant, F_1 (1, 33) = 46.6, $p<0.01$ and F_2 (1, 262) = 20.7, $p<0.01$, where F_1 refers to the subjects analysis and F_2 refers to the items analysis. For many of the related stimulus types, the priming effect reached statistical significance (see *Table 4.2* above and *Figure 4.1* below). This indicates that the paradigm employed in the experiment was reliable.

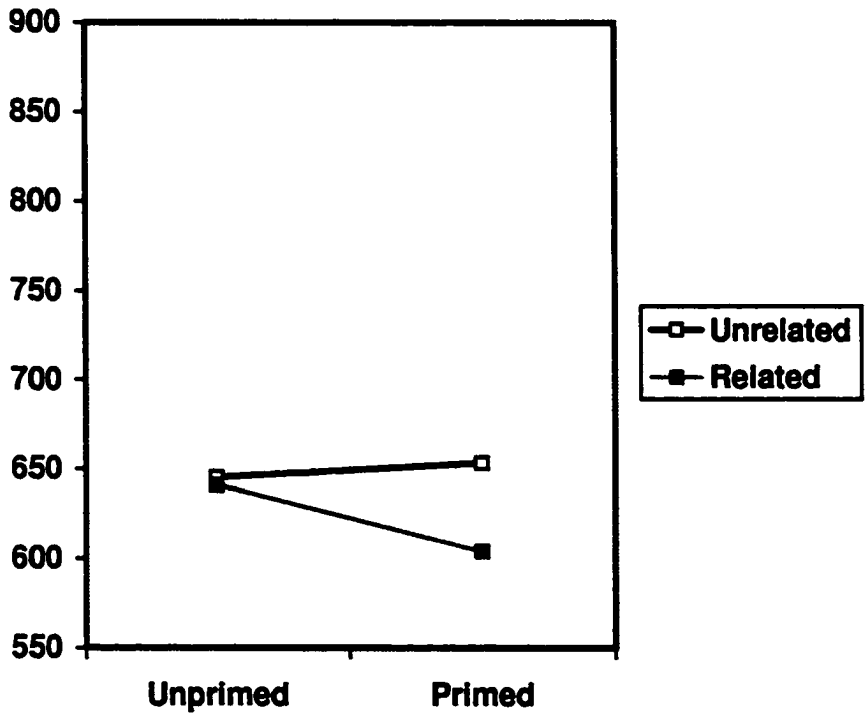


***Figure 4.1* Overall Priming Effect (F-E): Related vs. Unrelated Stimulus Types**

The main effect of stimulus type was also significant, F_1 (12, 396) = 4.8, $p<0.01$ and F_2 (12, 262) = 2.5, $p<0.01$. The priming effect obtained for individual stimulus groups is represented in the bar graph in *Figure 4.2* below. The individual planned comparisons will be discussed in detail below.

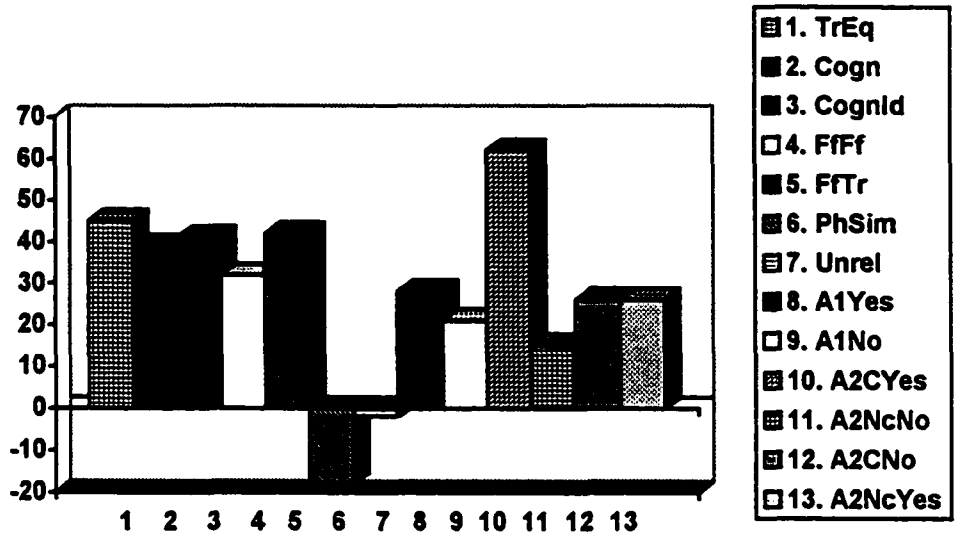


Figure 4.2 **Priming Effect and Stimulus Type (F-E)**

There was no significant interaction between the priming and stimulus type variables (although it was close to significance on the subjects analysis, with F_1 (12, 396) = 1.7, p=0.07).

The specific hypotheses that were previously formulated (Section 2.4.3) were tested by looking at *a priori* contrasts in the data. For all the planned comparisons, subject-based t-tests were conducted. The results of those tests are presented in *Table 4.3* below.[33,34]

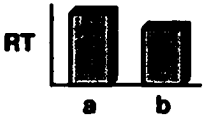
[33] The results are based on the data supplied by all 34 participants.
[34] Hypothesis (3) is specific to the French-English experiments since it can only be tested for same-script languages.

Table 4.3 **Experiment 1 (F-E): Primed Lexical Decision. Summary of Planned Pairwise Comparisons**

#	Question	Test Type ('a' in graphs)	Control Type ('b' in graphs)	Result (response times)
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates & Identical Cognates (Cogn & CognId) *tulipe – tulip* *jungle – jungle*	Translation Equivalents (TrEq) *pont – bridge*	 NO
2.	Does interlingual overlap at the lexical level give false friends a processing advantage similar to that for cognates?	(i) Cognates (Cogn) *tulipe – tulip*	False Friends (FfFf) *pain – pain*	 YES
		(ii) Identical Cognates (CognId) *jungle – jungle*	False Friends (FfFf) *pain – pain*	 NO *p<0.05
3.	For lexical items that exhibit overlap at both the conceptual and lexical level, does it matter whether the latter includes identical orthography?	Identical Cognates (CognId) *jungle – jungle*	Cognates (Cogn) *tulipe – tulip*	 YES *p<0.01

4.	Does lexical feature overlap result in the same degree of interlingual activation (IA) as conceptual overlap? (i.e., are a word's false friend and its true translation activated with equal ease?)	False Friends (FfFf) *pain – pain*	False Friend in L1 and its real L2 Translation (FfTr) *pain – bread*	 YES
5.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on the lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any "false friends"?)	Translation Equivalents (TrEq) *pont – bridge*	False Friend in L1 and its real L2 Translation (FfTr) *pain – bread*	 YES *p<0.05
6.	Can lexical feature overlap alone result in interlingual activation?	False Friends (FfFf) *pain – pain*	Non-Translations (Unrel) *poumon – stick*	 YES *p<0.05
7.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar (PhSim) *sac – suck*	Non-Translations (Unrel) *poumon – stick*	 YES *p<0.05

8.	**Is multiple meaning activation carried over across languages?** **(if 'yes', this would also be evidence for multiple activation in L1)**	Ambiguous L1 Words & Contextually *Un*primed L2 Translations (A1No, A2NcNo, A2CNo): 1) *livre - pound*, preprimed by *manuscrit* 2) *mille - thousand*, preprimed by *kilomètre* 3) *mille - mile*, preprimed by *chiffre*	Non-Translations (Unrel) *poumon – stick*	YES  *p<0.01   *p<0.05

9.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually Unprimed L2 Cognate Translation (A2CNo) *mille* (preprimed by *chiffre*) – *mile*	Ambiguous L1 Word & Contextually Unprimed L2 Translation (A1No) *livre* (preprimed by *manuscrit) – pound*	 NO
10.	Is there an ambiguity disadvantage effect for items that show interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation (A1Yes) *livre* (preprimed by *manuscrit) – BOOK*	Translation Equivalents (TrEq) *pont – bridge*	 YES *p<0.01
11.	Is there an ambiguity disadvantage effect for items that show both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation (A2CYes) *mille* (preprimed by *kilomètre*) – *MILE*	Cognates & Identical Cognates (Cogn & CognId) *tulipe – tulip* *jungle – jungle*	 NO

As can be seen from *Table 4.3*, planned comparisons showed the following results[35]:

(1) Cognate vs. non-cognate translations

A significant priming effect was obtained in this experiment for both cognate and non-cognate translations. However, the former did not show a processing advantage, contrary to what would be expected based on most previous research into cognate processing (Section 2.3.3). Lexical level overlap in addition to conceptual overlap did not seem to result in a processing advantage. However, *identical* cognates (those with completely similar spellings), when analyzed as a separate group, showed somewhat faster response times compared to non-cognate translations, although the difference was not statistically significant.

(2) Cognates vs. false friends

The two cognate groups also produced different patterns of results when they were compared with pseudocognates (false friends). Both cognates and false friends show overlap at the lexical level, but false friends, unlike cognates, have no overlap at the conceptual level, which should presumably give the true cognates a processing advantage. This is what was observed when identical cognates were compared with false friends: the former were easier to process. However, for non-identical cognates (those showing slight differences in spelling across languages), no processing advantage compared to false friends was obtained. This result finds support in a previous study by Gerard and Scarborough (1989) who found similar-sized priming effects for cognates and

[35] The reader is referred back to *Figures 2.4(a)* and *2.4(b)* in Chapter 2 for the schematic representations of the different stimulus types.

false friends. In same-script languages, lexical level overlap seems to be a powerful factor even in the absence of conceptual overlap, which is reflected in the priming effect and relatively fast response times obtained for false friends (as in most of the previous same-script studies described in Section 2.3.4).

(3) Orthographically identical and non-identical cognates

The two comparisons described above underscore another issue: when conducting experiments on same-script bilingual lexical processing, it is important to distinguish between two types of cognates, those having identical orthography and those showing slight orthographic differences (e.g., the presence of an *accent* in the case of French). The two cognate groups have yielded different patterns of results in this cross-linguistic priming experiment. A direct comparison of these two groups has shown a significant processing advantage for identical cognates (see Hypothesis 3 in *Table 4.3*), which may be attributable to a more complete overlap of orthographic features in such words.

(4) False friends vs. true translations

The effect of lexical level overlap on interlingual lexical activation in same-script bilinguals is further emphasized in another comparison involving false friends. When the same item shows conceptual-feature overlap with one L2 item and lexical-feature overlap with another, the former does not seem to take the upper hand in processing. This becomes evident in the comparison of false friends with stimulus pairs that consisted of a potential false friend and its real L2 translation equivalent (FfFf & FfTr). Processing times for these groups were not significantly different, while one would have expected the latter to show an advantage over the former due to the similarity in meaning. This

comparison shows that similarity in meaning does not always win out over similarity in form. Presumably, the link between the L1 word and an L2 word that is not its translation but has the same form (i.e., a false friend) cannot be shut off, inhibiting the processing of the true translation equivalent that is different in form (see also (5) below). Such links based on lexical feature overlap must be very strong since the participants were advanced bilinguals who knew the true word meanings (the accuracy rates were 87 per cent for the FfFf group and 97 per cent for the FfTr group[36]), but were nevertheless unable to shut off the 'wrong' form-based link. The above resulted in the interlingual priming effect for both the false friend and the true translation equivalent. To the best of my knowledge, previous studies have not looked into this type of comparison.

(5) Translation equivalents with and without false friends

The above reasoning finds support in the comparison between pairs consisting of a potential false friend with its real translation and those consisting of regular translation equivalents (FfTr and TrEq). The results show that a word facilitates its translation better if there are no 'competitors', i.e., potential false friends in the L2. Although both of the above stimulus types can be classified as "translations", i.e., words that are similar in meaning but different in form, regular translation equivalents showed a processing advantage that was statistically significant. Again, the phonologically- and orthographically-based links between the L1 word and an L2 word that is similar in form (i.e., a false friend) is activated and acts to inhibit the processing of the true translation. There is no such inhibition in the case of regular translation equivalents, which results in

[36] It should be noted, however, that the conclusions reported here are based on the correct responses only.

a processing advantage. Again, as was the case in the previous comparison, conceptual-level processing is slowed down as a result of interlingual activation at the lexical feature level.

(6) False friends vs. unrelated items

Finally, false friends showed faster processing times when compared with unrelated words. Although both of these word types are different at the conceptual level, lexical feature overlap (orthographic and phonological in the case of French and English) gives false friends a processing advantage. This is in line with the other results described above and with previous studies (Section 2.3.4). Also, as was mentioned above, a priming effect was obtained for false friends but, naturally, not for unrelated items. This pattern of results shows that lexical feature overlap alone is sufficient to generate interlingual activation in bilinguals, as similar-sounding items have been shown to prime each other monolingually (Section 2.1).

(7) "Phonologically similar" items

Contrary to what was expected, phonologically similar words (see operational definition in Section 2.4.2) showed slower response times compared to unrelated items. This result is puzzling and does not suggest an obvious explanation, especially in the light of the previous comparison that showed a processing advantage of false friends over unrelated items. It could be the case that orthographic interference is taking place in the case of phonologically similar items: these words show phonological but very little

orthographic overlap, which may cause inhibition on a visual task like the one employed in the present experiment[37].

It should also be noted that the representations of false friends and phonologically similar items in bilinguals are different in nature. Although originally, false friends were operationally defined as items that show lexical but not conceptual overlap (Section 2.4.2), it may well be the case that there is a certain degree of conceptual overlap between such items. Bilinguals may create 'false' semantic links between lexically-linked items of the two languages. In fact, this may well be the criterion for labeling a pair of words as 'false friends' (for a more complete discussion of this issue, see Section 5.3.3 of the final chapter).

Planned comparisons conducted for the *ambiguous* stimulus groups yielded the following results:

(8) Interlingual activation of unprimed ambiguous word translations

The three unprimed ambiguous stimulus types (A1No, A2NcNo, & A2CNo), i.e., those with the L1 preprime and the L2 target referring to two different meanings of the ambiguous L1 prime, were individually contrasted with the unrelated stimulus group. The comparisons showed that the unprimed ambiguous groups were easier to process than unrelated stimuli. The difference was statistically significant for A1No and A2CNo. These results are important since they confirm that multiple meaning activation occurs cross-linguistically during bilingual processing of ambiguous L1 stimuli. If the unprimed meanings of the ambiguous words in L1 had not been activated, their L2 counterparts

[37] This hypothesis may be tested in an auditory primed lexical decision task.

would have shown no difference from unrelated stimuli in terms of processing time. However, such counterparts of the unprimed meanings were processed faster than unrelated words, showing that those meanings had been activated along with the primed ones.

As was discussed in Section 2.3.6, ambiguity can be represented as *intra*lingual lexical feature overlap in terms of Kroll and De Groot's distributed feature model (see *Figures 2.3 & 2.4(b)*). Such overlap causes multiple meaning activation in L1, after which L2 translations of both meanings are activated due to the interlingual conceptual feature overlap in the case of non-cognate translations and both lexical and conceptual overlap in the case of cognate translations.

(9) Unprimed cognate and non-cognate translations of ambiguous items

The unprimed meaning of an ambiguous word was not easier to activate when this meaning was encoded as an L2 cognate. This follows from the contrast between the A2CNo and A1No types, their only difference being that the former is a cognate translation of the unprimed meaning and the latter is a non-cognate. No significant difference in processing times for these two word types was observed.

(10-11) Ambiguous vs. non-ambiguous items

Finally, two comparisons were conducted to see whether non-ambiguous words were easier for bilinguals to process than ambiguous ones.

The first comparison was drawn between regular translations and ambiguous L1 words that have two non-cognate translations (the primed type, A1Yes, was used to eliminate all the differences between the groups under comparison except for meaning ambiguity). Regular unambiguous translations received significantly faster response times, corroborating the result obtained in some previous monolingual studies (see Section 2.3.6) that the fewer meanings a word has, the easier it is to process. This is the outcome that would be expected based on the other results obtained in this experiment and based on my proposed extension of Kroll and De Groot's model (Sections 2.3.1 & 2.3.6). Since multiple meaning activation occurs for ambiguous words (see above), it would be reasonable to assume that a non-ambiguous word would facilitate its translation better because there would be no other items 'competing' to get activated.

However, a similar advantage for unambiguous items was not obtained in the second comparison that was conducted between cognate translations (Cogn) and "ambiguous" cognates (again, the primed type, A2CYes, was used as the comparison group for the reasons given above). There was no significant difference in processing times for the two stimulus types, showing that in this case, ambiguity was neither an advantage nor a disadvantage for bilingual lexical processing.

Overall, it can be concluded from the above two comparisons that unambiguous words were processed with either equal or greater ease compared to ambiguous items, i.e., in either case, ambiguity did not result in a processing advantage.

4.3 French-English Experiment 2: Translation Recognition

4.3.1 Participants

All French-English bilinguals who participated in Experiment 1 also participated in this experiment.

4.3.2 Apparatus

The apparatus was identical to that used in the previous experiment.

4.3.3 Stimuli and Design

The same basic stimulus groups that were used in Experiment 1 were also used in this experiment. These basic stimulus types are summarized in *Table 4.4* (repeated from *Table 4.1* for convenience). The character "+" stands for meaning/form similarity, and "-" stands for meaning/form difference. Question marks indicate problematic cases. The contextually primed meanings of homophones are capitalized.

Table 4.4 **Basic Stimulus Types (French-English)**

	L 1 (FRENCH)	L 2 (ENGLISH)	Form	Meaning	Abbreviation
1.	Translation Equivalent *pont* – 'bridge'	Translation Equivalent *bridge*	-	+	TrEq
2.	Cognate *tulipe* – 'tulip'	Cognate *tulip*	+	+	Cogn
2a.	Identical Cognate *jungle* – 'jungle'	Identical Cognate *jungle*	+	+	CognId
3,4.	False Friend *pain* – 'bread'	False Friend *pain*	+	-(?)	FfFf
		Translation Equivalent *bread*	-	+	FfTr
5.	Phonologically Similar *sac* – 'bag'	Phonologically Similar *suck*	+(?)	-	PhSim
6.	Any word *poumon* – 'lung'	Non-translation *stick*	-	-	Unrel
7,8.	Ambiguous1 (X1, x2) *livre* 'book/pound' – preprimed by *manuscrit* 'manuscript'	Translation of (X1) *BOOK*	-	+	A1Yes
		Translation of (x2) *pound*	-	+(?)	A1No
9,10.	Ambiguous 2a (Y1, y2) *mille* 'mile/thousand' – preprimed by *kilomètre* 'kilometer'	Cognate (Y1) *MILE*	+	+	A2CYes
		Translation of (y2) *thousand*	-	+(?)	A2NcNo
11,12.	Ambiguous 2b (y1, Y2) *mille* 'mile/thousand' – preprimed by *chiffre* 'number'	Cognate (y1) *mile*	+	+(?)	A2CNo
		Translation of (Y2) *THOUSAND*	-	+	A2NcYes

The frequency balancing was identical to that employed in Experiment 1.

Overall, there were 13 basic stimulus groups in this experiment, each of which contained the following numbers of item pairs (see *Table 4.4* above):

- Types 1-4: 10 pairs each
- Type 5: 8 pairs

- Type 6: 56 pairs[38]
- Types 7-12: 10 pairs each

Similar to Experiment 1, not all the stimuli were seen by each participant. The participants were subdivided into 2 subgroups (Versions A & B) in order to prevent the same bilingual from seeing the same stimulus word in two different conditions (i.e., stimulus groups (3,4), (7,8), (9,10), (11,12) in *Table 4.4*).

4.3.4 Procedure

The participants performed this task after completing the first experiment as well as the recall task following that experiment and after filling out the Language Background Questionnaire. The procedure employed in this experiment was identical to that used in Experiment 1, with the following two exceptions:

(1) The participants' task was different. They were instructed to decide whether words 2 and 3 in each trial could ever be translations of each other by pushing the "yes" (?/) or "no" (z) button on the keyboard. The participants were asked to make their judgments about translatability as general as possible. Similar to Experiment 1, the words in each trial were presented consecutively, and the last word stayed on the screen until a decision was made by the bilingual.

(2) Since real words only were used in this experiment, the number of trials could be reduced. The experiment consisted of 124 trials conducted in a single block and took about seven minutes to complete.

[38] The number of items in the unrelated stimulus group had to be increased to 56 in order to balance the number of "yes" and "no" responses in the experiment.

4.3.5 Results and Discussion

An analysis of subject-wise response latency and accuracy resulted in the inclusion of the data supplied by all 34 participants.

The data from the experiment were analyzed using the one-way analysis of variance option of the SygmaStat statistical package. As in the previous experiment, subject- and item-based analyses were performed. Separate analyses were performed for the "yes" and "no" responses in each case. In the subjects analysis, mean response times were calculated for each subject for each stimulus type. All incorrect responses were excluded from those calculations, as well as all the responses beyond two standard deviations from the respective grand means. One-way repeated measures ANOVAs were performed separately for the "yes" and "no" responses. Stimulus type was treated as a within-subjects variable with 10 levels in the analysis of the "yes" responses and with 3 levels in the analysis of the "no" responses. In the items analysis, means for individual items were calculated, and a one-way ANOVA was performed on those values, separately for the "yes" and "no" responses. The procedure for eliminating outliers was the same as in the subjects analysis. In this analysis, stimulus type was treated as a between-items factor, with 10 levels in the "yes" analysis and 3 levels in the "no" analysis. The mean values used in the subject-based and item-based analyses for the "yes" and "no" responses are presented in *Tables 4.5* and *4.6* below.

Table 4.5[39] **Experiment 2 (F-E): Translation Recognition.**

Mean Response Time as a Function of Stimulus Type. "YES" responses

	Stimulus Type	Example	Mean RTs, ms (subject-based)	Mean RTs, ms (item-based)
1.	Translation Equivalents (TrEq)	*pont – bridge*	693.8	707.5
2.	Cognates (Cogn)	*tulipe – tulip*	587.8	586.5
3.	Identical Cognates (CognId)	*jungle – jungle*	582.2	583.0
4.	False Friends with Real Translations (FfTr)	*pain – bread*	752.3	796.1
5.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*livre* (preprimed by *manuscrit) – BOOK*	777.9	787.6
6.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*livre* (preprimed by *manuscrit) – pound*	773.1	827.6
7.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*mille* (preprimed by *kilomètre*) – *MILE*	643.2	646.8
8.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*mille* (preprimed by *kilomètre*) – *thousand*	853.4	899.3
9.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*mille* (preprimed by *chiffre*) – *mile*	644.1	643.8
10.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*mille* (preprimed by *chiffre*) – *THOUSAND*	828.5	858.3

Table 4.6 **Experiment 2 (F-E): Translation Recognition.**

Mean Response Time as a Function of Stimulus Type. "NO" responses

	Stimulus Type	Example	Mean Response Times, ms (subject-based)	Mean Response Times, ms (item-based)
1.	False Friends (FfFf)	*pain – pain*	954.1	1012.3
2.	Phonologically Similar Words (PhSim)	*sac – suck*	820.0	826.5
3.	Unrelated Words (Unrel)	*poumon – stick*	789.6	784.3

[39] Again, the contextually primed meanings of ambiguous words are capitalized.

The main effect of stimulus type was significant for both the "yes" (F_1 (9, 293) = 27.2, $p<0.01$, F_2 (9, 86) = 12.5, $p<0.01$) and "no" (F_1 (2, 94) = 17.5, $p<0.01$, F_2 (2, 67) = 14.9, $p<0.01$) responses, where F_1 refers to the subjects analysis and F_2 refers to the items analysis. This indicates that word-type effects play a role in bilingual lexical processing. Response times for individual stimulus groups for both types of responses are graphed in *Figures 4.3* and *4.4* below.

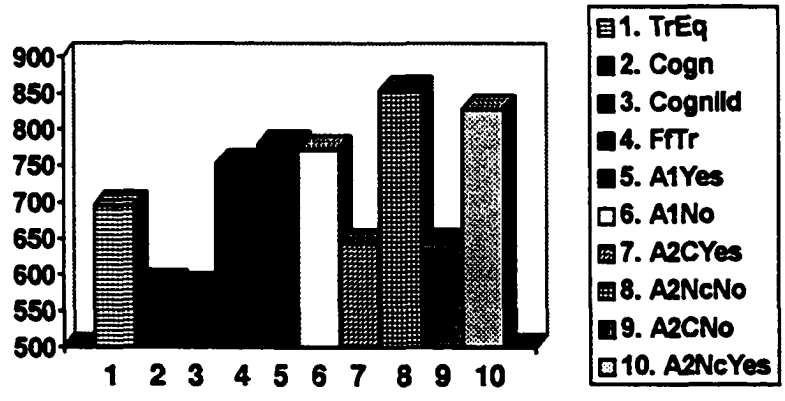


***Figure 4.3* Translation Latency ("Yes" Responses, F-E)**

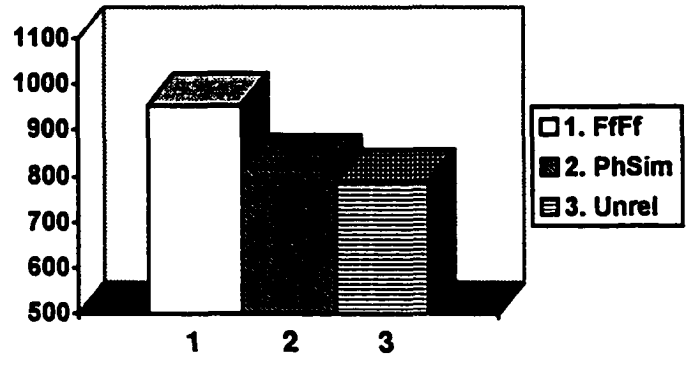


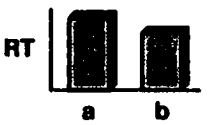
Figure 4.4 **Translation Latency ("No" Responses, F-E)**

The specific hypotheses that were previously formulated (see Section 2.4.3) were tested by looking at individual *a priori* contrasts in the data. For all the planned comparisons, t-tests were conducted. The results of those tests are represented in *Table 4.7* below[40]. Some of the control lexical types differ from those used in the planned comparisons in Experiment 1. This replacement was made in order to avoid a direct comparison between the "yes" and "no" responses. For the same reason, some of the planned comparisons performed in Experiment 1 were not possible here.

[40] Again, the results are based on the data supplied by all 34 participants.

Table 4.7 **Experiment 2 (F-E): Translation Recognition. Summary of Planned Pairwise Comparisons**

#	Question	Test Type ('a' in graphs)	Control Type ('b' in graphs)	Result (response times)
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates & Identical Cognates (Cogn & CognId) *tulipe – tulip* *jungle – jungle*	Translation Equivalents (TrEq) *pont – bridge*	 YES *p<0.01
2.	For lexical items that exhibit overlap at both the conceptual and lexical level, does it matter whether the latter includes identical orthography?	Identical Cognates (CognId) *jungle – jungle*	Cognates (Cogn) *tulipe – tulip*	 NO
3.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on the lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any "false friends"?)	Translation Equivalents (TrEq) *pont – bridge*	False Friend in L1 and its real L2 Translation (FfTr) *pain – bread*	 YES *p<0.01
4.	Can lexical feature overlap alone result in interlingual activation?	False Friends (FfFf) *pain – pain*	Non-Translations (Unrel) *poumon – stick*	 YES *p<0.01

5.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar (PhSim) *sac – suck*	Non-Translations (Unrel) *poumon – stick*	 YES *p<0.05
6.	Is multiple meaning activation carried over across languages? (if 'yes', this would also be evidence for multiple activation in L1)	Ambiguous L1 Words & Contextually *Un*primed L2 Translations (A1No, A2NcNo, A2CNo): 1) *livre - pound*, preprimed by *manuscrit* 2) *mille - thousand*, preprimed by *kilomètre* 3) *mille - mile*, preprimed by *chiffre*	Ambiguous L1 Words & Contextually Primed L2 Translations (A1Yes, A2NcYes, A2CYes) 1) *livre – BOOK*, preprimed by *manuscrit* 2) *mille – THOUSAND*, preprimed by *chiffre* 3) *mille - MILE*, preprimed by *kilomètre*	YES   

7.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually Unprimed L2 Cognate Translation (A2CNo) *mille* (preprimed by *chiffre*) – *mile*	Ambiguous L1 Word & Contextually Unprimed L2 Translation (A1No) *livre* (preprimed by *manuscrit)* – *pound*	 YES *p<0.01
8.	Is there an ambiguity disadvantage effect for items with interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation (A1Yes) *livre* (preprimed by *manuscrit)* – *BOOK*	Translation Equivalents (TrEq) *pont* – *bridge*	 YES *p<0.01
9.	Is there an ambiguity disadvantage effect for items with both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation (A2CYes) *mille* (preprimed by *kilomètre*) – *MILE*	Cognates & Identical Cognates (Cogn & CognId) *tulipe* – *tulip* *jungle* – *jungle*	 YES *p<0.01

As can be seen from *Table 4.7*, planned comparisons showed the following results:

(1) Cognate vs. non-cognate translations

When compared to regular translation equivalents, both identical and non-identical cognates showed significantly faster response times, which can be attributed to the fact that in addition to conceptual feature overlap, cognates also show overlap at the lexical feature level. This result is in line with the other studies that compared cognate and non-cognate processing by bilinguals (Section 2.3.3), including translation recognition tasks where bilinguals were showing a bias toward an "accept" response when the stimuli were perceptually similar and toward a "reject" response when they were perceptually dissimilar (e.g., De Groot & Comijs, 1995). This cognate advantage was not found in Experiment 1. Apparently, for same-script bilinguals in this study perceptual similarity/lexical level overlap resulted in greater interlingual activation in the translation task than it did in the priming task.

(2) Orthographically identical and non-identical cognates

On the translation task, lexical level overlap gave cognates a processing advantage over non-cognates even in the absence of complete orthographic similarity. In contrast to the results of Experiment 1, identical and non-identical cognates did not show a processing difference on this task. It took bilinguals an equal amount of time to translate cognates that show differences in orthography across the two languages and those that do not. Such orthographic discrepancies may have played a greater role in the priming task, resulting in a processing disadvantage for non-identical cognates, because of the more

automatic nature of processing involved and therefore the shorter time frame required by that task.

(3) Translation equivalents with and without false friends

The facilitating role of lexical level overlap in translation is further emphasized in the comparison between pairs consisting of a potential false friend with its real translation and those consisting of regular translation equivalents (FfTr & TrEq). The results show that a word facilitates its translation better if there are no 'competitors', i.e., potential false friends, in L2. Regular translations had a processing advantage that was statistically significant. This result is exactly parallel to that obtained in Experiment 1. The phonologically- and orthographically-based links between the L1 word and an L2 word (false friend) is activated and acts to inhibit the processing of the true translation. There is no such inhibition in the case of regular translation equivalents, which results in a processing advantage. Again, as was the case in Experiment 1, conceptual-level processing is slowed down as a result of interlingual activation at the lexical feature level.

(4) False friends vs. unrelated items

When compared with unrelated items, false friends showed slower response times. This result is opposite to the one obtained in Experiment 1, where false friends were processed faster. This was attributed to the overlap at the lexical feature level (Section 4.2.5). This overlap may also be the reason for the reverse pattern of results in the present experiment. Such overlap may inhibit translation and cause a bilingual to spend more time before rejecting false friends as possible translations, a result parallel to that

obtained by De Groot & Comijs (1995). Perceptually dissimilar words are easier to reject as translations, while perceptually similar ones (in this case, false friends) create a bias toward a "yes" response and slow down translation.

(5) "Phonologically similar" items

Phonologically similar words (see operational definition in Section 2.4.2) showed slower response times compared to unrelated items. Phonological similarity between L1 and L2 words must have led to a slowdown in processing, parallel to what happened with false friends (see above). In line with previous translation tasks, bilinguals in this experiment showed a bias toward an "accept" response (and, therefore, slower response times) when processing perceptually similar non-translations. However, this similarity is much greater in the case of false friends (see above), resulting in a much stronger inhibition.

Planned comparisons conducted for the *ambiguous* stimulus groups yielded the following results:

(6) Interlingual activation of unprimed and primed ambiguous word translations

All the three unprimed ambiguous stimulus types (A1No, A2NcNo, & A2CNo), i.e., those with the L1 preprime and the L2 target referring to two different meanings of the ambiguous L1 target, were contrasted with the respective primed type (A1Yes, A2NcYes, & A2CYes). All the three comparisons showed no significant differences in response times for the unprimed and primed groups. This result confirms that multiple meaning activation occurs cross-linguistically during bilingual processing of ambiguous L1

stimuli, parallel to the result obtained in Experiment 1 (for a discussion of ambiguous word processing by monolinguals, see also Section 2.3.6). If the unprimed meanings of the ambiguous words in L1 had not been activated, their L2 counterparts would have shown significantly slower response times than those of the primed meanings. However, the L2 counterparts of the unprimed and primed meanings were processed with relatively equal ease, showing that the unprimed meanings had been activated along with the primed ones.

An argument parallel to that in Section 4.2.5 can be made here. As was shown in Section 2.3.6, ambiguity can be represented as *intra*lingual lexical feature overlap in terms of Kroll and De Groot's distributed feature model (see *Figures 2.3 & 2.4(b)*). Such overlap causes multiple meaning activation in L1, after which L2 translations of both meanings are activated due to the interlingual conceptual feature overlap in the case of non-cognate translations and both lexical and conceptual overlap in the case of cognate translations.

(7) Unprimed cognate and non-cognate translations of ambiguous items

The A2CNo and A1No types were contrasted to see whether the cross-linguistic activation of the unprimed meaning is facilitated when this meaning is encoded as an L2 cognate (as in A2CNo). Indeed, response times in this case were significantly faster, an advantage that was not found in Experiment 1. This may again suggest that for same-script bilinguals, the effect of perceptual similarity is more pronounced on a translation task, biasing a bilingual toward an 'accept' response for perceptually similar translations (A2CNo in this case) and toward a 'reject' response for perceptually dissimilar ones

(A1No). This is parallel to the advantage cognates showed as compared to regular translation equivalents on this task.

(8-9) Ambiguous vs. non-ambiguous items

Finally, two comparisons were conducted to see whether non-ambiguous words were easier for the bilinguals to process than ambiguous ones. The first comparison was drawn between regular translations and ambiguous L1 words that have two non-cognate translations (the primed type, A1Yes, was used to eliminate all the differences between the groups under comparison except for meaning ambiguity). Regular translation equivalents had a significant processing advantage. This shows again that unambiguous words are easier to process compared to the ambiguous ones.

The second comparison was drawn between cognate translations (Cogn) and ambiguous cognates (again, the primed type, A2CYes, was used for the same reason as above). Again, regular, unambiguous cognates showed faster response times.

Overall, the results from these two comparisons along with those obtained in Experiment 1 corroborate that the fewer meanings a word has, the easier it is processed by bilinguals.

4.4 French-English Experiment 3: Off-Line Translation Recognition (Proficiency Check)

4.4.1 Participants, Apparatus, Stimuli & Design

All French-English bilinguals who participated in Experiments 1 and 2 also participated in this experiment. The apparatus, stimuli and design were identical to those used in Experiment 2.

4.4.2 Procedure

The procedure was identical to that employed in the Russian-English proficiency check (see Section 3.4.2). The participants were instructed to read the word pairs and decide whether the pair members could ever be translations of each other by choosing one of the following four options: 1) "yes"; 2) "no"; 3) "unsure"; 4) "don't know the English word". The participants were instructed to take as much time as they needed to think over the answers and to make their responses as accurately as possible.

The experiment consisted of 124 trials conducted in a single block and took about five minutes to complete.

4.4.3 Results and Discussion

As in the Russian-English study, mean response accuracy on this proficiency task was calculated individually for each participant in the experiment to make sure that the

participants' self-ratings given in the Language Background Questionnaire were trustworthy. The accuracy score for each participant is given in *Table 4.8* below.

Table 4.8 **Proficiency Check (F-E):**

Mean Response Accuracy (% Correct) by Subject

Participant #	Response Accuracy (% Correct)	Participant #	Response Accuracy (% Correct)
1.	93	18.	91
2.	81	19.	87
3.	93	20.	93
4.	95	21.	88
5.	90	22.	96
6.	97	23.	96
7.	96	24.	91
8.	94	25.	89
9.	96	26.	86
10.	93	27.	96
11.	92	28.	96
12.	90	29.	89
13.	89	30.	90
14.	95	31.	93
15.	86	32.	85
16.	91	33.	85
17.	84	34.	93

The above scores suggest that that the self-ratings provided by the participants on the Language Background Questionnaire are indeed trustworthy for the purposes of this study[41].

[41] The average proportion of "don't know the English word" responses was 1.9%.

Response accuracy (expressed in percent of correct responses) was also calculated for each stimulus type. The numbers are given in *Tables 4.9* and *4.10* below (the percentage of "unsure" responses is also given).

Table 4.9 **Proficiency Check (F-E). Response Accuracy as a Function of Stimulus Type. "YES" responses**

	Stimulus Type	Example	% Correct	% Unsure
1.	Translation Equivalents (TrEq)	*pont – bridge*	94.1	1.5
2.	Cognates (Cogn)	*tulipe – tulip*	97.4	1.2
2a.	Identical Cognates (CognId)	*jungle – jungle*	97.9	0.6
4.	False Friends with Real Translations (FfTr)	*pain – bread*	81.2	6.5
7.	Ambiguous1 (X1, x2) with Translation of X1 (A1Yes)	*livre* (preprimed by *manuscrit) – BOOK*	81.8	2.4
8.	Ambiguous1 (X1, x2) with Translation of x2 (A1No)	*livre* (preprimed by *manuscrit) – pound*	83.5	1.2
9.	Ambiguous 2 (Y1, y2) with Cognate Y1 (A2CYes)	*mille* (preprimed by *kilomètre*) – *MILE*	89.4	3.5
10.	Ambiguous 2 (Y1, y2) with Translation of y2 (A2NcNo)	*mille* (preprimed by *kilomètre*) – *thousand*	86.5	1.8
11.	Ambiguous 2 (y1, Y2) with Cognate y1 (A2CNo)	*mille* (preprimed by *chiffre*) – *mile*	94.8	2.6
12.	Ambiguous 2 (y1, Y2) with Translation of Y2 (A2NcYes)	*mille* (preprimed by *chiffre*) – *THOUSAND*	80.4	3.9

Table 4.10 **Proficiency Check (F-E). Response Accuracy as a Function of Stimulus Type. "NO" responses**

	Stimulus Type	Example	% Correct	% Unsure
3.	False Friends (FfFf)	*pain – pain*	64.1	15.3
5.	Phonologically Similar Words (PhSim)	*sac – suck*	89.3	1.8
6.	Unrelated Words	*poumon – stick*	97.0	1.3

As can be seen from *Table 4.10*, false friends represented the biggest problem for the participants: this stimulus group has the lowest accuracy score and the highest percentage of "unsure" responses. This finding is parallel to that obtained for the Russian-English bilinguals (Section 3.4.3) and is perhaps not surprising since it is known that *faux amis* are a major source of errors among unbalanced bilinguals/second language learners. Also, the fact that on this task, the participants were given the option of answering "unsure" may have decreased the accuracy rate. These results agree with those produced in the two online experiments and with other experiments in the literature.

4.5 Summary of the French-English Experiments

The purpose of this part of the study was to examine word-type effects in the lexical processing of advanced French-English bilinguals and to uncover the combinations of elements at the conceptual and lexical levels of representation that contribute to a greater degree of interlingual activation. In addition to examining the role of semantic and phonological variables, these experiments will later on allow us to look into the effect of script on bilingual processing. In the next chapter, the results obtained in this part of the study for same-script bilinguals will be related to those obtained for different-script bilinguals in the Russian-English experiments described in Chapter 3.

The above-stated objectives were achieved by comparing priming effects and translation recognition response times for various stimulus groups in the two on-line experiments reported above.

The similarities and differences between the results of the priming and translation recognition experiments are summarized in *Table 4.11* below:

Table 4.11 **French-English Experiments 1 & 2: Results Compared**

Experiment		Comparison of Results
Primed Lexical Decision	**Translation Recognition**	
No cognate advantage	Cognates were processed faster than non-cognates	Different
Identical cognates had a processing advantage over non-identical ones	No difference in processing between identical and non-identical cognates	Different
No significant difference in the activation of a word's false friend and its real translation	N/A	N/A

Processing advantage of regular translation equivalents over those that have a potential false friend	Processing advantage of regular translation equivalents over those that have a potential false friend	Similar
False friends were processed faster than unrelated words	False friends were processed slower than unrelated words	Different
Phonologically similar words were processed slower than unrelated items	Phonologically similar words were processed slower than unrelated items	Similar
Cross-linguistic multiple meaning activation for ambiguous words	Cross-linguistic multiple meaning activation for ambiguous words	Similar
No advantage for the activation of the unprimed ambiguous word meaning when it is expressed in a cognate in L2	Cross-linguistic activation of the unprimed ambiguous word meaning occurs easier when L2 expresses it in a cognate	Different
Ambiguity does not provide a processing advantage	Non-ambiguous words have a processing advantage compared to ambiguous words	Similar

Word pairs that share conceptual and/or lexical representational elements showed interlingual activation. However, the facilitative effect of shared lexical features was more pronounced on the translation recognition task, which may be attributable to the more explicit, metalinguistic nature of this task which involves a direct comparison of L1 and L2 items, emphasizing shared elements in the two languages.

Overall, these experiments have demonstrated that bilingual lexical processing is affected by word type (i.e., by how form is mapped onto meaning in the two languages). Different combinations of representational elements at the conceptual and lexical levels result in different degrees of processing difficulty in terms of Kroll & De Groot's distributed lexical/conceptual feature model.

The French-English experiments have revealed five major tendencies regarding word-type effects in bilingual lexical processing:

1) Both interlingual conceptual and lexical feature overlap (i.e., meaning and form similarity) facilitate bilingual lexical processing.

2) The role of lexical overlap is non-uniform in the two tasks employed in this study: the facilitative effect of such features is more pronounced in the translation recognition task.
3) Spreading activation from an L1 to an L2 word caused by lexical feature overlap may slow down the activation of its true L2 translation equivalent, i.e., interfere with the activation of a link based on conceptual overlap.
4) Both meanings of an ambiguous word are activated no matter which of them was primed, and this multiple meaning activation spreads across the language barrier, resulting in the activation of both translations in the second language.
5) Greater interlingual activation results from semantically unambiguous words than from ambiguous ones.

More generally, the results from these experiments indicate that bilingual lexical processing is not fundamentally different from monolingual processing, reflecting the fact that both bilingual and monolingual lexicons are structured along the lines of form and meaning similarity. The finding that words in one language facilitated the processing of related words in the second language may suggest that lexical items are connected in a single cross-referenced network, no matter whether they belong to the same or different languages. Finally, the varying degrees of processing difficulty reported in this chapter for different interlingual word types indicate that the lexicon of each bilingual is non-uniform, containing representations that are shared to various extents.

CHAPTER FIVE

GENERAL DISCUSSION:

RUSSIAN-ENGLISH AND FRENCH-ENGLISH EXPERIMENTS COMPARED

5.1 Introductory Remarks

As was mentioned at the outset of this thesis, the main purpose of the study was to examine word-type effects in bilingual lexical processing as they are affected by script similarity/difference and language distance. To achieve this objective, the two sets of experiments described above were conducted using identical methods and stimulus types. The first set involved different-script bilinguals (Russian-English experiments, Chapter 3), and the second one focused on same-script bilinguals (French-English experiments, Chapter 4).

A comparison between these two groups of bilinguals makes it possible to examine the role of semantic, phonological, and especially orthographic considerations in bilingual lexical processing. The two alternative hypotheses proposed in the introductory part of this thesis (Section 2.4.3) were that script difference may be a disadvantage for bilingual processing since lexical-level overlap in this case includes phonological but not orthographic features; or, on the contrary, different scripts may actually facilitate processing, acting as an additional cue that helps narrow down lexical search. These issues are discussed below, along with across-group differences for individual word-type effects (based on the hypotheses put forward in Section 2.4.3) and, related to this, the involvement of conceptual- and lexical-level features in processing.

5.2 Overall Response Times and Priming Effects Across the Groups

Overall, the French-English participant group showed faster response times compared to those of the Russian-English group. The average response times for each task for both participant groups are given in *Table 5.1*.

Table 5.1 **Mean Response Latencies Per Task Per Participant Group (ms)**

Experimental Task	Participant Group	
	Russian-English	French-English
1) Cross-linguistic Priming	*790*	*624*
2) Translation Recognition:		
• 'Yes' responses	*1031*	*712*
• 'No' responses	*1219*	*838*

This pattern may be indicative of a proficiency difference. However, based on the information supplied by the participants in the Language Background Questionnaire *(Appendix B)*, the two groups were not fundamentally different in terms of their language history (see Sections 3.2.1 and 4.2.1). Bilinguals in both groups are L1-dominant and had acquired their respective mother tongues prior to learning English as L2. All the participants in both groups rated themselves in excess of 5 on a seven-point proficiency scale and reported few difficulties with English vocabulary and very small attrition effects in their L1 vocabulary use. Both groups have reported receiving the same amount

of L2 classroom instruction. One of the differences that could have contributed to the above pattern of results is the fact that most bilinguals in the French group first started learning L2 (English) in the L2 environment, while most Russian participants started learning L2 in the L1 environment, and they also did it slightly later than their French counterparts (the average starting age for L2 learning was 12 and 9 respectively). However, the Questionnaire also showed that the Russian-English bilinguals in this study had spent more time in the L2 environment compared to the French-English ones (the average of 5 and 3 years respectively), and that they used English on a somewhat more frequent basis (on-the-job use, see Section 4.2.1).

A more fundamental difference between the two bilingual groups may provide another explanation for the above response times pattern. Both tasks were based on visual word recognition. Whereas French-English bilinguals did not have to switch between scripts on those cross-linguistic tasks since their two languages use the same script, Russian-English bilinguals had to process words in two different scripts, depending on the language. This may have resulted in longer response times for the Russian-English group. These results may indicate that the words of the two languages are stored more separately in the lexicon of different-script bilinguals than they are in the lexicon of same-script bilinguals. In terms of Kroll and De Groot's distributed lexical/conceptual feature model (Section 2.3.1), in the lexicon of same-script bilinguals, lexical items would show a greater overlap at the lexical feature level since it is both phonologically- and orthographically-based, while for different-script bilinguals, there is no orthographic feature overlap possible. Since the overlap is smaller, there is less interlingual activation and, therefore, longer response times.

Despite the overall cross-group difference in mean response times described above, a significant overall priming effect was obtained for *both* groups on the cross-linguistic primed lexical decision task (as shown in *Figure 5.1* below). In other words, although it took Russian-English bilinguals longer to process L2 targets, they benefited from the prior presentation of a related L1 prime to the same or even slightly greater extent than their French-English counterparts did (this difference in priming effects for the two groups may be attributed to a 'floor effect' in the case of French-English bilinguals).

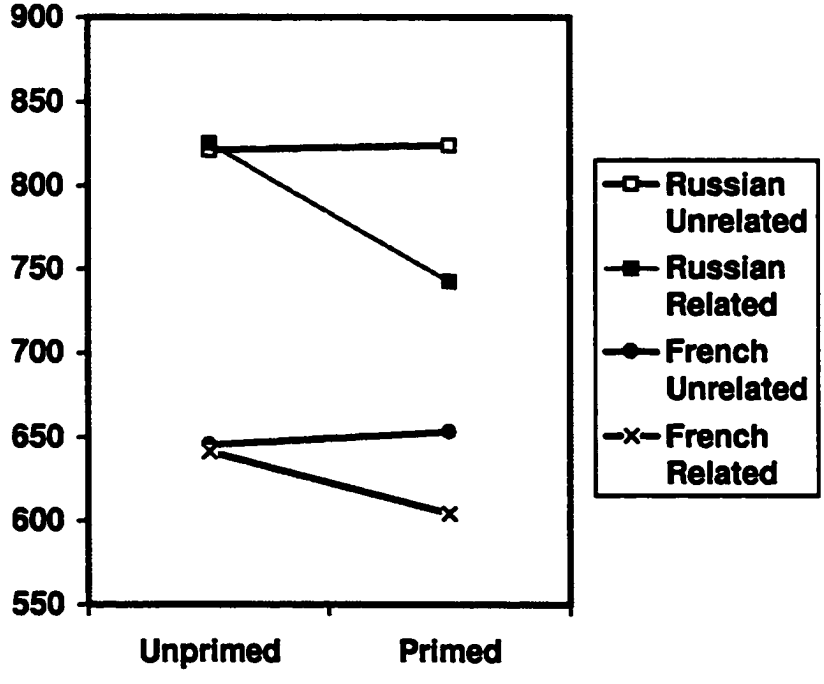


Figure 5.1 **Overall Priming Effects: Russian-English vs. French-English**

The above pattern suggests that although related words may have a more separate representation in the lexicon of different-script bilinguals compared to same-script bilinguals, such separation is by no means complete (as indicated by the interlingual

priming effect obtained for Russian-English bilinguals). Different scripts used in a bilingual's two languages do not prevent words of one language from activating semantically and/or phonologically similar words of the other language.

This further suggests that it is more plausible to speak about various degrees of shared representations in bilinguals rather than common vs. separate storage as two polar alternatives. This takes us back to the discussion in Section 2.2.1 of the literature review about the history of this argument in the psycholinguistic literature on bilingualism and a transition to the view of the bilingual lexicon that allows variable, non-uniform representations. One such model is Kroll and De Groot's (1997) distributed lexical/conceptual feature model that was presented in Section 2.3.1. Such mixed, variable representations exist across bilingual individuals (as evident from the between-group comparison in this study) as well as within a bilingual (as can be seen from the examination of word-type effects presented in the next section).

5.3 Individual Word-Type Hypotheses Across the Two Groups

5.3.1 Summary of Hypotheses and Results

The primary purpose of this study was to uncover the combinations of features at the conceptual and lexical levels of representation that contribute to the greatest degree of interlingual activation in same- and different-script bilinguals or, vice versa, cause inhibition. To achieve this, a number of specific questions regarding word-type effects were formulated in Section 2.4.3. These questions are repeated in *Table 5.2* below, and

the answers obtained for these questions on the two experimental tasks are provided for each bilingual group[42].

[42] French-English examples only are used in this table for space and ease considerations.

Table 5.2 **Summary of Issues and Results**

#	Question	Test Type	Control Type	Russian-English		French-English	
				Prim.[43]	Transl.[44]	Prim.	Transl.
1.	Does overlap at the lexical feature level give cognates a processing advantage compared to non-cognate translations?	Cognates *(tulipe – tulip) (jungle – jungle)*	Translation Equivalents *(pont - bridge)*	YES	YES	NO	YES
2.	Does interlingual overlap at the lexical level give false friends a processing advantage similar to that for cognates?	Cognates *(tulipe – tulip) (jungle – jungle)*	False Friends *(pain – pain)*	NO	n/a	NO	n/a
3.	Does lexical feature overlap result in the same degree of interlingual activation (IA) as conceptual overlap? (i.e., are a word's false friend and its true translation activated with equal ease?)	False Friends *(pain – pain)*	False Friend in L1 and its real L2 Translation *(pain – bread)*	YES	n/a	YES	n/a
4.	Is interlingual activation based on conceptual feature overlap inhibited when there is a competing candidate based on the lexical feature overlap? (i.e., is IA between a word & its translation equivalent increased when the word does not have any 'false friends'?)	Translation Equivalents *(pont - bridge)*	False Friend in L1 and its real L2 Translation *(pain – bread)*	YES	YES	YES	YES
5.	Can lexical feature overlap alone result in interlingual activation?	False Friends *(pain – pain)*	Non-Translations *(poumon – stick)*	YES	YES	YES	YES
6.	Is there a processing difference between unrelated items and words that show some degree of phonological overlap?	Phonologically Similar *(sac – suck)*	Non-Translations *(poumon - stick)*	NO	NO	YES	YES

[43] Priming task
[44] Translation recognition task

7.	Is multiple meaning activation carried over across languages? (if 'yes', this would also be evidence for multiple activation in L1)	Ambiguous L1 Words & Contextually *Un*primed L2 Translations *(livre - pound,* preprimed by *manuscrit)* *(mille - thousand,* preprimed by *kilomètre)* *(mille– mile,* preprimed by *chiffre)*	Non-Translation *(poumon - stick)*	YES	YES	YES	YES
8.	Is IA of the contextually *un*primed ambiguous word meaning more likely to occur when there is interlingual lexical feature overlap (i.e., when L2 expresses this meaning in a cognate)?	Ambiguous L1 Word & Contextually *Un*primed L2 Cognate Translation *(mille - mile,* preprimed by *chiffre)*	Ambiguous L1 Word & Contextually *Un*primed L2 Translation *(livre - pound,* preprimed by *manuscrit)*	YES	NO	NO	YES
9.	Is there an ambiguity disadvantage effect for items that show interlingual conceptual overlap?	Ambiguous L1 Word & Contextually Primed L2 Translation *(livre - book,* preprimed by *manuscrit)*	Translation Equivalents *(pont - bridge)*	NO	YES	YES	YES
10.	Is there an ambiguity disadvantage effect for items that show both interlingual conceptual and lexical overlap?	Ambiguous L1 Word & Contextually Primed L2 Cognate Translation *(mille - mile,* preprimed by *kilomètre)*	Cognates *(tulipe – tulip)* *(jungle – jungle)*	YES	YES	NO	YES

5.3.2 Cognate and non-cognate translations

Overall, translations with lexical feature overlap (cognates) showed a processing advantage over those with no such overlap (noncognates). Therefore, interlingual facilitation occurs at both the conceptual and lexical levels. This result is consistent with most experimental studies of cognate processing.

Such facilitation based on shared lexical features occurred for different-script (Russian-English) bilinguals, although in this case lexical-level overlap is purely phonological and non-orthographic. The difference in scripts did not prevent form-based interlingual activation from taking place and giving cognates a processing advantage over non-cognate translations. This result is in line with the few previous studies of cognate processing by different-script bilinguals that have been conducted up to date (e.g., Gollan, Forster, & Frost, 1997). Script does not seem to be a basis for the separation of two languages in such bilinguals.

The only case when cognates failed to show a processing advantage over non-cognate translation equivalents was on the primed lexical decision task performed by French-English bilinguals, although a significant priming effect was still obtained for cognate words. Several possible explanations could be offered. One is that on this task, the advantage derived by cognates from having lexical in addition to conceptual overlap may be offset by the time it takes same-script bilinguals to identify such an item as belonging to just one of their two languages (they had to decide whether the word on the screen was a real *English* word). Another possibility is the 'floor effect' mentioned in Section 5.2 above which did not allow the cognate advantage to surface in the French-

English priming data. And, finally, this difference in the results across the two bilingual groups may be attributable to the special status cognates may have in the Russian-English bilingual lexicon due to their smaller number and, therefore, greater saliency as compared to their French-English counterparts.

On the translation recognition task, cognates showed a processing advantage for both bilingual groups: form similarity contributed to a greater degree of interlingual activation, creating a bias toward the "yes" (correct) response, in line with previous translation studies (e.g., De Groot & Comijs, 1995).

5.3.3 Cognates and False Friends

As it was expected, cognates enjoyed an overall processing advantage over false friends (identical cognates on the French-English task and cognates on the Russian-English task). Although both groups share features at the lexical level, conceptual overlap contributes to a greater degree of interlingual activation for cognates.

However, the fact that on the French-English task, there was no difference between response times for regular cognates and false friends, coupled with the overall strong activation of false friends obtained in this study, leads to a rather interesting conclusion: it would seem that false friends also show a certain degree of conceptual overlap. Although theoretically, false friends should have different, totally non-overlapping conceptual features, the psycholinguistic reality of this phenomenon seems to be different. In fact, bilinguals may form 'false' semantic links of association between false friends. Thus, a bilingual would attribute to an L2 item certain conceptual features that it

does not have based on the fact that its false friend in L1 (i.e., an item with similar lexical features) has these conceptual features. As a result, the two items would now share not only lexical, but conceptual features as well, making their representation very similar to that of cognate words (see *Figure 5.2*). Of course, conceptual overlap would be much more complete in the case of cognates, that is why cognates still have an overall processing advantage over false friends, as the results of this study indicate. It is noteworthy that this processing advantage was smaller for French-English bilinguals than for Russian-English bilinguals. This may suggest that the above 'false' lines of associations are formed more easily by same-script bilinguals, probably, because their expectations of similarity between the two languages are higher than those of different-script bilinguals (c.f. the notion of "perceived" language distance in Kellerman, 1979). Here, it may not be the script *per se* but, rather, the overall language distance that plays the crucial role by creating false expectations of similarity. This effect is well-documented in the second language literature (e.g., Oller & Ziahosseiny, 1970; Ringbom, 1978; Sjoholm, 1976).

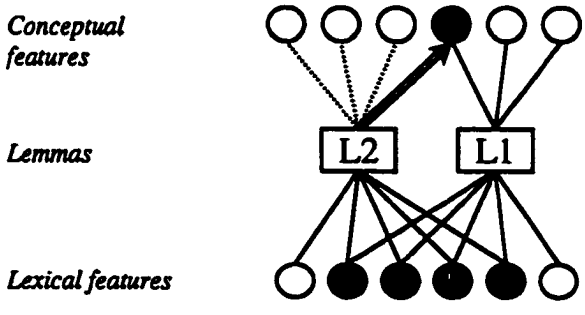


Figure 5.2 **The Formation of 'False' Conceptual Overlap between False Friends**

Another difference between the representation of cognates and false friends is that an item that has a false friend also shares conceptual features with another L2 item, its *real* L2 translation equivalent. This brings us to the next comparison that was tested in this study.

5.3.4 False Friends and Their Real Translations

As was proposed in the previous section, the ease with which interlingual homophones (false friends) are activated in bilinguals may be explained not only by lexical but also by partial (and 'false') conceptual overlap between such items. This would explain why for both bilingual groups, L1 words that have false friends activated their false friends and their real translation equivalents with relatively equal ease[45]. While they only have common conceptual features with the latter, they share lexical and some conceptual features with the former, under the interpretation suggested here (see *Figure 5.3*).

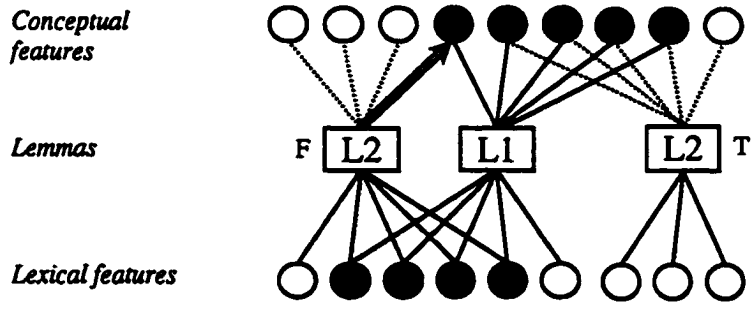


***Figure 5.3* A Word with its False Friend (F) and Real Translation (T)**

[45] In both cases, response times for false friends were even slightly faster, although the difference was not significant.

Another factor here could be the strength of lexical feature based activation that results in a word's false friend getting activated before its real translation. The form-based link between an item and its false friend cannot be shut off or overridden by the meaning-based link between this item and its true translation.

5.3.5 Words with and without False Friends and Their Translations

Directly linked to the above discussion is another result obtained across the board in all the experiments in this study. Words that do not have false friends activate their translation equivalents faster than words that do. As described in the previous two sections (see *Figure 5.3* above), the activation of a word's false friend based on lexical and, possibly, some conceptual overlap cannot be suppressed. Therefore, an L1 word that has a false friend activates two L2 items: a false friend and a real translation. It follows from this that response time for the real translation of such an item is increased compared to the translation of a lexical item that does not have any potential false friends.

5.3.6 False Friends and Unrelated Items

Lexical features shared by false friends also result in them being processed faster compared to unrelated items on the primed lexical decision task, where an interlingual priming effect was obtained for false friends. In all the experiments conducted in this study, false friends never patterned like unrelated items. Again, the form-based link (phonological for Russian-English bilinguals and phonological and orthographic for

French-English bilinguals) cannot be shut off, resulting in the interlingual activation of false friends. Also, according to the interpretation proposed in the previous sections, a 'false' conceptually-based link formed by bilinguals between false friends may contribute to such activation.

On the translation task, the above led to inhibition rather than facilitation: it took both same- and different-script bilinguals longer to reject false friends as translations than it took them to do the same with unrelated items. Lexical (and possibly some conceptual) overlap between false friends biased their responses toward the "yes" instead of "no" answer, increasing translation time. This result is in line with a previous study by De Groot & Comijs (1995) cited above. The same line of reasoning accounts for the results of the next comparison.

5.3.7 Phonologically Similar and Unrelated Items

Parallel to the translation recognition results obtained for false friends and described in the previous section, "phonologically similar" items showed some inhibition compared to regular unrelated items. Lexical overlap, although much more limited than that of false friends, biased the bilinguals' response toward the "accept" instead of "reject" answer, increasing processing time. However, such inhibition was much smaller than that shown by false friends.

The results were more ambiguous on the priming task where "phonologically similar" items patterned differently from false friends. No priming effect was found for "phonologically similar" items, which would be explained by a much more limited

interlingual overlap. And, whereas false friends were responded to more quickly than unrelated items, phonologically similar words took the same amount of time (Russian-English group) or longer (French-English group) to process when compared with unrelated items. This again could be the result of the very superficial nature of phonological overlap these items show. Inhibition in the case of French-English bilinguals could be explained by the discrepancy between phonological and orthographic properties of these words: while they share some phonological features, there is little orthographic overlap, which would be contrary to the expectations of same-script bilinguals and may interfere with processing. In the case of different-script bilinguals, there is no such expectation, no conflict between the phonological and orthographic representation, and therefore no inhibition.

5.3.8 Unprimed and Primed Ambiguous Word Translations

The results obtained for both bilingual groups on both tasks indicate that for ambiguous items, multiple meaning activation occurs that is carried over to L2. In other words, an ambiguous L1 word activates both of its L2 translations. A parallel can be drawn between this result and the results for false friends described in Sections 5.3.4 and 5.3.5: when a word shows interlingual overlap with two items in the other language (a false friend and a real translation), both of those items get activated. Likewise, in this case an ambiguous word sharing conceptual features with two items in the other language activates both of these items, even though a bilingual is preprimed for only one of them. This effect is illustrated in *Figure 5.4* below.

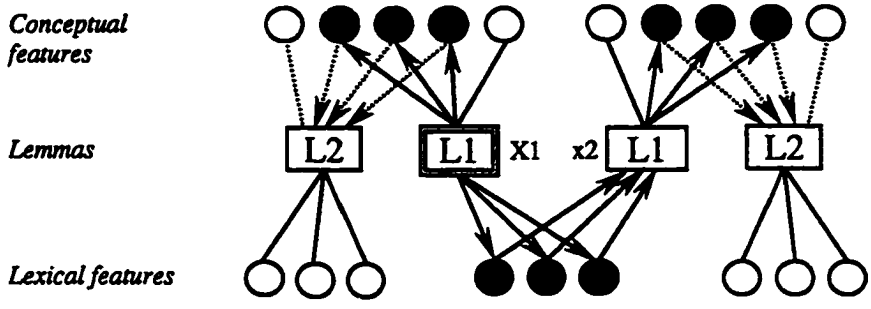


Figure 5.4 **Interlingual Activation of Ambiguous Word Translations (Ambiguous1 (X1, x2))**[46]

As was proposed in Chapter 2 (Section 2.3.6), an ambiguous word may be represented as two L1 lemmas showing *intra*lingual lexical overlap, and *inter*lingual conceptual overlap with two different L2 items (and, if one of the ambiguous word translations is a cognate, there will also be interlingual lexical overlap). The translation of the unprimed meaning was always activated along with that of the primed one, as follows from faster response times obtained for such translations in comparison with unrelated items on the priming task. Also, on the translation recognition task, primed and unprimed translations of ambiguous words were processed with equal ease.

Figure 5.4 shows that the activation of both translations, irrespective of the priming context, necessarily implies that multiple meaning activation first occurred *intra*lingually, i.e., in L1. As was described in Section 2.3.6, the issue of multiple meaning activation has been studied extensively in the monolingual literature, with most experimental results supporting multiple activation (e.g., Swinney, 1979; Onifer & Swinney, 1981; Seidenberg, Tanenhaus, Leiman, & Bienkowski, 1982). The results of the present study

[46] As before, the contextually "appropriate", or preprimed, ambiguous word meaning is capitalized and double-framed.

therefore demonstrate that bilingual processing of ambiguous words is essentially no different from monolingual.

It is noteworthy that the translation of the unprimed meaning was easier to activate when it also showed interlingual lexical overlap with the ambiguous L1 item, i.e., when it was a cognate. The only exception was the French-English priming task, where no such trend was observed. This result is parallel to that obtained in the comparison of unambiguous cognate and non-cognate translations (Section 5.3.2 above) and can be interpreted in the same way.

5.3.9 Unambiguous and Ambiguous Items

Overall, translation equivalents of unambiguous words were processed with greater ease in these experiments than translation equivalents of ambiguous items. This effect would be predicted based on the multiple meaning activation results described in the previous section and illustrated in *Figure 5.4* above. Since an ambiguous word activates both of its translations irrespective of the priming context, processing proceeds more slowly because there are two items competing for activation. Ambiguity thus seems to disadvantage bilingual processing. This effect was significant on most of the tasks conducted within the framework of this study[47].

As was described in Section 2.3.6, the ambiguity (dis)advantage effect has been a longstanding issue in monolingual psycholinguistic research, and no definitive answer for

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[47] In the few cases where there was no such effect, ambiguity was never shown to facilitate processing when compared with unambiguous items, i.e., it never provided a processing advantage.

this problem has been found so far. There have been experiments showing that ambiguity can provide a processing advantage, as well as those demonstrating its disadvantage, as in this study. The results of the present experiments suggest that for bilinguals, the fewer alternative candidates an item activates interlingually, the smoother processing is. This applies not only to ambiguous versus unambiguous word processing, but also to items that have false friends. A parallel can be drawn here to the discussion in Section 5.3.5, where reasoning was presented for why words that do not have any false friends activate their translations more strongly than those that do. The same line of reasoning was used in this section to explain the ambiguity disadvantage effect obtained in this study.

Overall, it would seem that bilingual processing proceeds best when there is a lot of interlingual feature-sharing at both levels of representation, but ideally, an item should show such overlap with only one lemma in the other language; overlap with several alternative candidates slows down processing instead of facilitating it.

5.4. General Conclusions and Discussion

5.4.1 Relative Involvement of Conceptual and Lexical Features in Processing

Overall, the results shown by the Russian-English and French-English participant groups suggest that both conceptual- and lexical-level features are factors in bilingual processing. For both groups, the general tendency was: the more complete interlingual overlap is at either level, the stronger the resulting interlingual activation is. The situation is clear-cut when two lemmas (an L1 and an L2) show such overlap at one of the two levels of representation. However, when more than one lemma gets involved and/or when

there are shared features at both levels, the above 'rule' does not seem to always work in a straightforward fashion.

Overall, the interaction of conceptual- and lexical-level processing can be summarized in the following way:

1) In general, the presence of lexical in addition to conceptual overlap between two lemmas facilitates interlingual activation.
2) Interlingual activation resulting from lexical overlap in the absence of conceptual overlap will lead to inhibition rather than facilitation on meaning-based tasks such as translation recognition.
3) Interlingual activation based on shared lexical features is automatic and cannot be suppressed by parallel conceptual-based activation. It does not seem to be penetrable by explicit knowledge (e.g., false friend activation).
4) Parallel activation of competing L2 lemmas, one based on shared lexical features and the other – on shared conceptual features, slows down bilingual processing.
5) Bilinguals are able to assign to a lemma 'incorrect' conceptual features based on shared lexical features between this lemma and its counterpart in the other language. The activation of such links based on 'wrongly' assigned features cannot be suppressed by explicit knowledge either.
6) Intralingual lexical overlap always results in multiple lemma activation, and L2 words sharing elements with either of these lemmas get activated. Such parallel activation of several L2 items results in slower processing.

5.4.2 The Effect of Script and Language Distance on Bilingual Lexical Processing

In addition to determining the combinations of representational elements at the conceptual and lexical level that facilitate/inhibit interlingual activation, a major purpose of the present study has been to find out how the above are affected by script difference and overall language distance.

As can be seen from the previous discussion, the overall word-type results (see Section 5.3) were largely similar for the two bilingual groups. In other words, whether the two languages of a bilingual use the same or different scripts does not seem to have a qualitative effect on processing. Rather, processing is affected by more general considerations, such as various combinations of conceptual and lexical features across languages.

A cross-linguistic priming effect was obtained for related items in both bilingual groups, suggesting that no matter whether the two languages of a bilingual use the same or different scripts, the words of the two languages are not stored on a separate basis. Neither language nor script is a basis for word separation in a bilingual.

However, there appears to be a quantitative effect, as evident from the overall difference in response times across the two participant groups (see Section 5.2 above). Although within the context of this study it is not possible to determine unequivocally the cause of this quantitative difference, an explanation based on the role of script appears quite plausible.

According to this line of reasoning, the fact that the French-English group showed faster response times compared to the Russian-English group, may suggest that same-

script bilinguals have more fused, overlapping representations for the words of the two languages, while different-script bilinguals have somewhat more separate, less overlapping representations. This supports the previously made point that it makes more sense to talk about mixed representations across different bilingual groups, rather than restricting the discussion to the shared vs. separate storage dilemma.

So far, it can be concluded that at least for visual word recognition which the present study has focused on, interlingual activation occurs faster when a bilingual does not have to process two different scripts. This can also be viewed as functioning within one "script mode" (same-script bilinguals) versus having to switch between "script modes" (different-script bilinguals). It is presumably the time that it takes a different-script bilingual to make this change between script modes that increases the overall response time. Or, following previous proposals in the literature (e.g., Green, 1998) and extending the homogeneity hypothesis of bilingual processing recently proposed by Libben (1999), it can be argued that similar to representation-internal language tags, lexical items may bear script tags, such as "Latin" or "Cyrillic". Under this assumption, French-English bilinguals are able to respond more quickly to L2 lexical items because during the course of an experiment, they receive a greater amount of priming for items with a script tag "Latin", compared to Russian-English bilinguals who receive a smaller amount of priming for such items since part of their stimuli are tagged "Cyrillic". However, a different script-tagging model may be more plausible. In fact, script tagging in addition to language tagging seems to be redundant for same-script bilinguals, since all items in their lexicon would bear the same script tag. However, for different-script bilinguals it would seem that script-tagging performs the same function as language-tagging: for example,

all items tagged "Russian" for language would also bear the script tag "Cyrillic", while all those tagged "English" would also be tagged "Latin" (alphabet). It may therefore be more reasonable to include script tags within language tags, i.e., to make information about script part of the item's language tag.

Under such a view, it would also be possible to explain some between-group differences in this study caused by task-specific demands. One of the explanations suggested in Section 5.3.2 for the absence of cognate advantage on the French-English priming task was that this advantage may be offset by the time it takes same-script bilinguals to identify a cognate word as belonging to one of their two languages (English), as required in the task (since items with two different language tags will be activated at the same time, creating some inhibition). For a different-script bilingual, script will act as a processing cue: since information about script is part of the word's language tag, the cognate with the appropriate language tag will be selected. Such script-based selection of the appropriately tagged cognate is not possible for same-script bilinguals.

As has been previously emphasized, substantial interlingual priming effects obtained in this study make very unlikely the existence of two independent lexical stores in a bilingual. One of the between-group hypotheses discussed in the introductory part of this study (Sections 2.3.5 and 2.4.3) was that script difference may help direct lexical search toward a language-specific lexicon, creating a processing advantage. However, since the existence of language-specific lexicons seems to be very unlikely if not impossible, lexical search cannot proceed according to the above hypothesis. Following some previous proposals, we have argued for an item-internal language-tagging, where a

language tag includes information about script, so that items with the same language tags will be linked by stronger connections and will activate each other to a greater extent. Script difference may indeed create a processing advantage in certain task-specific situations by only activating items with a specific language tag (see above).

Another factor that affects bilingual lexical processing is the *overall distance* between the bilingual's two languages. It seems that languages that are closer to each other (French and English) are easier for a bilingual to process than two very different languages (Russian and English), as this study has shown. Script difference may be one of the factors increasing such distance between languages. However, it may also be plausible to talk about "perceived" language distance here (see Kellerman, 1977, 1979), i.e., the distance between the two languages as it is perceived by bilingual individuals. French-English bilinguals may (quite justifiably) view their languages as more similar compared to Russian-English bilinguals. Although in most cases, a smaller perceived language distance contributes to a greater degree of interlingual activation (see, e.g., Corder, 1978) it may also turn against a bilingual by creating false expectations of similarity (c.f., Oller & Ziahosseiny, 1970; Ringbom, 1978; Sjoholm, 1976). For instance, this study has shown that between the two participant groups, French-English bilinguals seem to have stronger 'false' conceptual links between false friends, so that the gap between response times for false friends and cognates is much smaller than in the case of their Russian-English counterparts. Russian-English bilinguals perceive their languages as less similar, and their expectations of cross-linguistic similarity are therefore lower.

5.5 Directions for Future Experimentation

In this Section, I outline several possible directions for future experimentation that may further contribute to the understanding of word-type effects in different-script and same-script bilinguals. These extensions are based on modifications in the experimental paradigm (a,b), or stimulus types (c), or else they involve different participant groups (d):

(a) Changing the direction of priming (L2 → L1)

Kroll and Stewart (1994) have made a convincing argument for the asymmetric lexico-conceptual relationship between L1 and L2. This is also reflected in Kroll and De Groot's distributed lexical/conceptual model discussed in this thesis, which postulates weaker links from L2 lemmas to conceptual level features. Also, because L2 initially relies on L1 for word meaning processing, L2 items are generally better interlingual primes compared to L1 items. In Kroll and Stewart (1994), this is reflected in weaker lexical-level connections from L1 to L2 than in the opposite direction, going from L2 to L1. Gollan, Forster and Frost (1997) tested different-script (Hebrew-English) bilinguals and reported an asymmetric priming effect for cognates, which was attributed to an overreliance on phonology in L2 reading.

It would therefore be interesting to replicate the present study using a different direction of priming, with L2 words as primes and L1 words as targets (in the experiments presented here, the situation was always the other way around). Comparing the results of such a study to those reported here will provide further insight into word-type effects and into the nature of links between the words of the two languages for different-script and same-script bilingual groups.

(b) Other task types: Cross-modal, production, L2-only

Although two different task types, cross-linguistic priming with lexical decision and translation recognition, were used to collect data for this investigation, certain limitations imposed by them on the interpretability and generalizability of the results could be overcome by using different experimental paradigms in future studies.

First of all, both of these tasks were based on visual perception of stimuli. This imposed some restrictions on the design, specifically, on the way ambiguous word processing was tested. Ambiguous L1 primes could not be embedded in a sentential context because it was important to keep the SOA between the ambiguous prime and the L2 target constant and short in order to avoid post-lexical access effects. We therefore had to opt for the word triplet paradigm previously employed by Schvaneveldt et al. (1976) in their monolingual study. In his monolingual study of ambiguous word processing, Swinney (1979) employed the cross-modal paradigm where participants heard auditorily presented sentences containing ambiguous lexical items and had to respond to target words visually presented at the end of the ambiguity. A similar experimental set-up could be used with bilinguals in an extension of the current study: L1 primes could be presented auditorily in a sentential context, while participants would have to respond to visually presented L2 targets. This would eliminate the need for preprimes (triplets) while keeping the SOA constant and minimal. On the other hand, one of the contributions of this study has consisted in examining the role of script difference in bilingual processing. The proposed set-up would not have the same advantage since it requires the auditory presentation of L1 stimuli. However, if testing was to be done in the different direction (L2 → L1), as proposed in the previous subsection, L1 words would

be used as targets and would therefore be presented visually, which could yield potentially more interesting results.

Second, both tasks employed in the present investigation are comprehension tasks. As is generally the case in psycholinguistic research, the number of production experiments involving bilinguals is much smaller. At the same time, bilinguals' proficiency in their non-dominant language is largely judged by how well they can produce in L2. In a further extension, the hypotheses of this study could therefore be tested using a production task. This could be either a naming latency task where bilinguals are asked to read the target words out loud or a translation production task where they have to produce the translations of lexical items presented to them. Both of these tasks may also have the advantage of being 'more natural' compared to the ones used in this study. However, a word of caution is in order here. There is no question that testing monolingual production is harder than testing comprehension. Even more so, testing L2 production is incomparably harder since it is extremely difficult to avoid confounding variables. One would never know whether he or she is testing the speed of lexical access or the difficulty of articulation unless very stringent controls are imposed on both stimulus selection and participants' proficiency in the non-dominant language. Also, a translation production task may yield a variety of responses which may not lend themselves to a straightforward analysis.

Another way in which this study could be extended is to employ a task that would require bilinguals to function in a 'monolingual mode' in their non-dominant language. This would provide a useful point of comparison since in the experiments reported here, participants were set into the 'bilingual mode', either implicitly (primed lexical decision)

or explicitly (translation recognition). Finding out which word-type effects surface when participants are only presented with L2 stimuli would strengthen the evidence obtained in this investigation. It would also be interesting to see whether such a task reveals differences in performance between bilingual groups.

(c) Further experimentation with ambiguous words

As has been mentioned before, to the best of my knowledge, virtually none of the previous investigations have examined ambiguous word processing by bilinguals (not to be confused with "interlingual homophones", or false friends). In this study, I have tested how bilinguals process ambiguous L1 items that have two different L2 translations – either both non-cognate, or one cognate and one non-cognate translation. If this study was to be modified so that L2 words are used as primes and L1 words – as targets, as I proposed above, it would have to employ *ambiguous L2 words* that have two different L1 translations. Also, in a further study it would be interesting to examine the processing of items that happen to be ambiguous in both languages. To the best of my knowledge, this has not be undertaken before. Another hypothesis that could potentially yield some very interesting results concerns possible connections between the words of one language that both happen to be translations of the same ambiguous item in the other language. For instance, for a Russian-English bilingual, does *marriage* prime *defect* just because both of these words happen to be translations of one word *брак* in Russian? This seems to be an intriguing question that could be tested using the L2-only paradigm outlined above.

(d) Extending the study to other language groups

Finally, the hypotheses of this study could be tested using other bilingual groups. As has been mentioned above, to the best of my knowledge, previous investigations have not

been based on two different bilingual groups, and a limited number of studies have involved different-script bilinguals. Although the results of the present investigation are based on two groups of bilinguals, one same-script and the other different-script, stronger evidence could be obtained if it were extended to include yet another bilingual group, preferably, with a writing system different from both French/English and Russian, such as Chinese-English bilinguals. This would make it possible to better target the role of orthography in the processing of various word types by bilinguals, as well as to generalize the results to a larger number of bilingual populations.

5.6 Summary

Overall, the results of this study suggest that words of a bilingual's two languages are not stored in two independent lexicons. Rather, similar to the lexicon of a monolingual, a bilingual possesses a single lexical store containing items from both languages. Neither language nor script serve as an interlingual barrier. Information about both language and script is internal to a lexical item. Lexical items, no matter whether they are items of the same or different languages, may share features at the conceptual (meaning) or lexical (form) level of representation, or both. The degree to which representations are shared varies both within the lexicon, depending on the word type, and across bilingual lexicons, depending on the bilingual group. Shared representational elements at both levels result in interlingual activation. This study has experimentally shown which combinations of conceptual and lexical representational elements best contribute to interlingual facilitation or inhibition in same- and different-script bilinguals.

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Appendix A
Stimuli

Russian-English Priming[48]

Preprime	Prime	Target	Type
напиток	сок	sock	PhSim
солнце	блик	bleak	PhSim
поляк	пан	pun	PhSim
неделя	год	god	PhSim
корабль	киль	kill	PhSim
острие	кол	call	PhSim
достоинство	честь	chest	PhSim
контейнер	бак	buck	PhSim
гвоздь	клин	clean	PhSim
тьма	свет	sweat	PhSim
дизайнер	мода	mode	FfFf
самолет	трап	trap	FfFf
производство	фабрика	fabric	FfFf
гора	скала	scale	FfFf
театр	декорация	decoration	FfFf
проверка	экспертиза	examination	FfTr
невеста	фата	veil	FfTr
церковь	крест	cross	FfTr
хлеб	батон	loaf	FfTr
тело	корпус	torso	FfTr
дурак	глупость	stupidity	TrEa
педаль	велосипед	bicycle	TrEa
храм	молитва	prayer	TrEa
яблоня	сад	garden	TrEa
промах	ошибка	mistake	TrEa
калитка	забор	fence	TrEa
паспорт	граница	border	TrEa
заяц	кролик	rabbit	TrEa
борьба	сопротивление	resistance	TrEa
курорт	пляж	beach	TrEa
коктейль	бар	bar	CoCn
натура	характер	character	CoCn
мазь	крем	cream	CoCn
справка	документ	document	CoCn
чутье	интуиция	intuition	CoCn
космос	планета	planet	CoCn
тайна	секрет	secret	CoCn
окоп	танк	tank	CoCn
обычай	традиция	tradition	CoCn
бодрость	энергия	energy	CoCn
машина	марка	brand	A1Yes
рот	язык	language	A1No
родник	ключ	spring	A1Yes
дверь	ручка	pen	A1No
молекула	клетка	cell	A1Yes
невечность	конечность	extremity	A1No
личность	лицо	person	A1Yes
глагол	наречие	dialect	A1No
сплетня	слух	hearing	A1No
звезда	месяц	moon	A1Yes
притязание	претензия	pretension	A2CYes
карты	пас	assist	A2NcNo
путешествие	тур	tour	A2CYes
теннис	шлем	helmet	A2NcNo
квитанция	чек	receipt	A2NcYes
физиономия	мина	mine	A2CNo
сотрудник	штат	personnel	A2NcYes
еда	продукты	products	A2CNo
любовь	роман	novel	A2NcNo
настольная	лампочка	bulb	A2NcNo
общество	класс	class	A2CYes
частная	практика	practice	A2CYes
маневр	диверсия	sabotage	A2NcNo
аспект	план	plan	A2CNo
прием	презентация	reception	A2NcYes
дорога	тракт	tract	A2CNo

[48] The stimuli from Versions A & B used for each task are collapsed in this *Appendix* because of the large degree of overlap.

черновик	проект	draft	A2NcYes
странность	оригинал	original	A2CNo
сквозняк	ветер	snake	Unrel
океан	волна	disruption	Unrel
хлеб	масло	explosion	Unrel
вода	жидкость	belief	Unrel
брат	родственник	plumber	Unrel
написание	грамотность	sky	Unrel
колодец	ведро	memory	Unrel
ласточка	гнездо	knife	Unrel
хлам	мусор	grain	Unrel
кухня	плита	basket	Unrel
мыло	нут	sock	NONS-PhSim
воск	утаг	bleak	NONS-PhSim
лебедь	маф	pun	NONS-PhSim
сваха	люг	god	NONS-PhSim
печь	орот	kill	NONS-PhSim
вилка	пус	call	NONS-PhSim
вьюнок	свун	chest	NONS-PhSim
оборот	ког	buck	NONS-PhSim
бочка	арюк	clean	NONS-PhSim
ведьма	слок	sweat	NONS-PhSim
пила	лакс	mode	NONS-FfFf
обозрение	ноно	trap	NONS-FfFf
копыто	парилия	fabric	NONS-FfFf
мистика	дичка	scale	NONS-FfFf
слон	рантавист	decoration	NONS-FfFf
воробей	похтолинта	examination	NONS-FfTr
должник	лыта	veil	NONS-FfTr
стог	аллан	cross	NONS-FfTr
монах	колма	loaf	NONS-FfTr
ветка	кирман	torso	NONS-FfTr
мопед	скаруние	stupidity	NONS-TrEq
разговор	госвеница	bicycle	NONS-TrEq
ученый	мажалка	prayer	NONS-TrEq
поездка	веф	garden	NONS-TrEq
лагерь	риток	mistake	NONS-TrEq
варенье	донка	fence	NONS-TrEq
шутка	поросон	border	NONS-TrEq
ворота	устровение	rabbit	NONS-TrEq
мишень	керец	beach	NONS-TrEq
переправа	снепарат	resistance	NONS-TrEq
липа	гор	bar	NONS-Coqn
гриб	свелток	character	NONS-Coqn
папка	варт	cream	NONS-Coqn
мороз	тибретка	document	NONS-Coqn
уговор	промовец	intuition	NONS-Coqn
авария	викраса	planet	NONS-Coqn
везение	крапта	secret	NONS-Coqn
бутылка	вант	tank	NONS-Coqn
нежность	заввание	tradition	NONS-Coqn
поколение	ведимер	energy	NONS-Coqn
погода	пунок	brand	NONS-A1Yes
перелет	шува	language	NONS-A1No
опасение	дест	spring	NONS-A1Yes
сова	валта	pen	NONS-A1No
обед	зохяин	cell	NONS-A1Yes
полено	онтормиция	extremity	NONS-A1No
положение	гуар	person	NONS-A1Yes
крыса	талемон	dialect	NONS-A1No
рис	пода	hearing	NONS-A1No
память	ташка	moon	NONS-A1Yes
папка	обрайство	pretension	NONS-A2CYes
шалаш	лий	assist	NONS-A2NcNo
пожар	хот	tour	NONS-A2CYes
робость	рень	helmet	NONS-A2NcNo
песня	пуд	receipt	NONS-A2NcYes
ботинок	экра	mine	NONS-A2CNo
правда	стиг	personnel	NONS-A2NcYes
аршин	келитки	products	NONS-A2CNo
стол	сожка	novel	NONS-A2NcNo
величина	вережник	bulb	NONS-A2NcNo
сон	убыск	class	NONS-A2CYes
шило	певелина	practice	NONS-A2CYes
рамка	валаница	sabotage	NONS-A2NcNo
гусеница	диля	plan	NONS-A2CNo
соска	слеветность	reception	NONS-A2NcYes
лекция	копор	tract	NONS-A2CNo
медведь	табота	draft	NONS-A2NcYes
пирог	тарадина	original	NONS-A2CNo
половина	фарек	snake	NONS-Unrel

станок	погот	disruption	NONS-Unrel
сосна	злуба	explosion	NONS-Unrel
волос	свирство	belief	NONS-Unrel
свидание	поисмодение	plumber	NONS-Unrel
метка	пороливость	sky	NONS-Unrel
спад	моска	memory	NONS-Unrel
поручик	торона	knife	NONS-Unrel
гастроли	фетка	grain	NONS-Unrel
чернь	фада	basket	NONS-Unrel
полка	пулат	fas	NONS-NONS
оклад	донек	bave	NONS-NONS
волшебник	кийна	mirl	NONS-NONS
часы	мидарета	zoor	NONS-NONS
угол	кубила	badow	NONS-NONS
телефон	лосо	roose	NONS-NONS
сорочка	бенгарет	astice	NONS-NONS
ширма	ник	dattle	NONS-NONS
апрель	жино	paffic	NONS-NONS
молоток	демалок	accelex	NONS-NONS
кипяток	видия	mipper	NONS-NONS
брожение	ролка	wanaged	NONS-NONS
паук	андель	picarity	NONS-NONS
ром	типярок	bittenful	NONS-NONS
стопка	моф	zildlifes	NONS-NONS
оскал	зомар	ambumition	NONS-NONS
перепел	предоль	fod	NONS-NONS
виноград	ниса	bine	NONS-NONS
пояс	ропвание	mirt	NONS-NONS
судьба	гук	zope	NONS-NONS
вихрь	мирейка	bants	NONS-NONS
истома	велье	slace	NONS-NONS
музыка	хостень	attamp	NONS-NONS
юность	сег	eaxing	NONS-NONS
пальма	юпа	perden	NONS-NONS
обряд	рекло	astices	NONS-NONS
код	флинц	moveron	NONS-NONS
сила	цоборь	wansing	NONS-NONS
хоровод	остец	pighting	NONS-NONS
осень	агра	calcornal	NONS-NONS
рог	нилька	plarternest	NONS-NONS
ведро	ринитка	fov	NONS-NONS
корона	либ	bive	NONS-NONS
медаль	адра	zice	NONS-NONS
шоколад	фесто	zork	NONS-NONS
байдарка	зон	baple	NONS-NONS
клен	садель	slint	NONS-NONS
тайга	орар	baddow	NONS-NONS
материк	рума	emmick	NONS-NONS
поступок	стопидор	zaught	NONS-NONS
металл	угаф	beffect	NONS-NONS
сев	леметь	murdorn	NONS-NONS
крик	верт	wather	NONS-NONS
овес	ирлам	plarter	NONS-NONS
сдача	падилон	cletch	NONS-NONS
бес	ускра	voggle	NONS-NONS
песок	тохон	oan	NONS-NONS
плод	гестрение	bove	NONS-NONS
барабан	бунь	nalt	NONS-NONS
ковш	кальнация	bavel	NONS-NONS
борщ	фребер	slone	NONS-NONS
смех	отлин	barvle	NONS-NONS
берег	укула	entulp	NONS-NONS
орех	побитание	plear	NONS-NONS
индус	кяска	lind	NONS-NONS
осколок	менех	neep	NONS-NONS
кость	бехол	wister	NONS-NONS
призма	бирезнь	prospert	NONS-NONS
лапа	звелог	clortness	NONS-NONS
дядя	кленение	collantiny	NONS-NONS
поход	иктежность	aox	NONS-NONS
кошелек	теоиция	chid	NONS-NONS
болезнь	опсул	nars	NONS-NONS
мед	мез	blept	NONS-NONS
свита	чув	spone	NONS-NONS
крот	икись	bive	NONS-NONS
совесть	траб	eppect	NONS-NONS
сырник	рол	pother	NONS-NONS
влага	ромец	blass	NONS-NONS
спирт	врен	nold	NONS-NONS
огород	трина	zather	NONS-NONS
ветошь	тед	ardonist	NONS-NONS

огурец	рапа	prosturne	NONS-NONS
борьба	летя	compleech	NONS-NONS
бал	фисейка	confossity	NONS-NONS
вор	холорок	lue	NONS-NONS
каток	снода	foce	NONS-NONS
лапта	зилка	pild	NONS-NONS
каста	порка	blinq	REAL-NONS
метро	спор	spurp	REAL-NONS
моряк	больница	bravel	REAL-NONS
овца	перец	escout	REAL-NONS
бокал	свиток	prooth	REAL-NONS
чета	цапля	bottark	REAL-NONS
верх	жаркое	nuqqaqe	REAL-NONS
кабан	огонь	desinter	REAL-NONS
зуб	стихия	queezer	REAL-NONS
бинт	ходьба	electroont	REAL-NONS
укор	пение	corpanny	REAL-NONS
длина	подол	mip	REAL-NONS
идеал	недочет	fout	REAL-NONS
лига	свинья	plew	REAL-NONS
опора	питомник	crimb	REAL-NONS
болото	обаяние	swite	REAL-NONS
иск	зоопарк	clord	REAL-NONS
шапка	пчела	flain	REAL-NONS
скука	гадалка	proter	REAL-NONS
угон	насморк	comfant	REAL-NONS
сельдь	абажур	onimal	REAL-NONS
пытка	выбор	dirstave	REAL-NONS
бык	обод	rabbielt	REAL-NONS
дюна	паром	fappiture	REAL-NONS
крона	каток	pud	REAL-NONS
миска	кнопка	frim	REAL-NONS
лоб	волчок	roak	REAL-NONS
конь	маг	drick	REAL-NONS
вал	кольцо	tirl	REAL-NONS
брод	самурай	frack	REAL-NONS
миг	мотор	reafon	REAL-NONS
иго	голубь	dellery	REAL-NONS
брань	моток	oransin	REAL-NONS
ссора	былина	lindow	REAL-NONS
тапки	чехол	respelch	REAL-NONS
петух	позор	qolstrome	REAL-NONS
пурга	зима	fuqqestion	REAL-NONS
ясень	полотно	zow	REAL-NONS
мешок	кадка	lind	REAL-NONS
кино	вена	zice	REAL-NONS
опрос	сито	rable	REAL-NONS
мария	бунт	zort	REAL-NONS
куница	мечта	darrot	REAL-NONS
трон	король	nomic	REAL-NONS
серп	безумие	zattle	REAL-NONS
мак	услуга	leadler	REAL-NONS
червь	богатырь	voqqle	REAL-NONS
узник	плен	painfurn	REAL-NONS
стирка	таз	vaqtreath	REAL-NONS
мех	шуба	spreach	REAL-NONS
победа	проигрыш	leal	REAL-NONS
бритва	лезвие	zeer	REAL-NONS
квадрат	круг	prock	REAL-NONS
спор	пари	vater	REAL-NONS
котлета	фарш	nivide	REAL-NONS
плетка	кнут	zabies	REAL-NONS
убийство	след	ketter	REAL-NONS
точка	запятая	tullet	REAL-NONS
лекарство	лечение	pachinery	REAL-NONS
задача	решение	vocaster	REAL-NONS
диалог	монолог	tompany	REAL-NONS
момент	секунда	plosserv	REAL-NONS
искусство	творение	koot	REAL-NONS
бархат	маринад	zail	REAL-NONS
краска	цвет	pooth	REAL-NONS
дуновение	каштан	wanse	REAL-NONS
прогулка	парк	nister	REAL-NONS
сказка	быль	velery	REAL-NONS
полотенце	купание	qricken	REAL-NONS
цыган	табор	tister	REAL-NONS
контроль	надзор	ponatto	REAL-NONS
герцог	барон	tarrage	REAL-NONS
глаз	бровь	menticle	REAL-NONS
вилы	грабли	iuck	REAL-NONS
рост	высота	tood	REAL-NONS

столетие	век	minker	REAL-NONS
пюре	картофель	cock	REAL-NONS
гирлянда	елка	twam	REAL-NONS
дизайнер	мода	fashion	FfTr
самолет	трап	ladder	FfTr
производство	фабрика	factory	FfTr
гора	скала	rock	FfTr
театр	декорация	scenery	FfTr
проверка	экспертиза	expertise	FfFf
невеста	фата	fate	FfFf
церковь	крест	crest	FfFf
хлеб	батон	baton	FfFf
тело	корпус	corpse	FfFf
машина	маска	stamp	A1No
рот	язык	tongue	A1Yes
родник	ключ	key	A1No
дверь	ручка	handle	A1Yes
молекула	клетка	cage	A1No
невечность	конечность	finiteness	A1Yes
личность	лицо	face	A1No
глагол	наречие	adverb	A1Yes
сплетня	слух	rumor	A1Yes
звезда	месяц	month	A1No
притязание	претензия	complaint	A2NcNo
карты	пас	pass	A2CYes
путешествие	тур	round	A2NcNo
теннис	шлем	slam	A2CYes
квитанция	чек	check	A2CNo
физиономия	мина	expression	A2NcYes
сотрудник	штат	state	A2CNo
еда	продукты	groceries	A2NcYes
любовь	роман	romance	A2CYes
настольная	лампочка	lamp	A2CYes
общество	класс	grade	A2NcNo
частная	практика	experience	A2NcNo
маневр	диверсия	diversion	A2CYes
аспект	план	perspective	A2NcYes
прием	презентация	presentation	A2CNo
дорога	тракт	route	A2NcYes
черновик	проект	project	A2CNo
странность	оригинал	weirdo	A2NcYes
пила	лакс	fashion	NONS-FfTr
обозрение	ноно	ladder	NONS-FfTr
копыто	парилия	factory	NONS-FfTr
мистика	дичка	rock	NONS-FfTr
слон	рантавист	scenery	NONS-FfTr
воробей	похтолинта	expertise	NONS-FfFf
должник	лыта	fate	NONS-FfFf
стог	алпан	crest	NONS-FfFf
монах	колма	baton	NONS-FfFf
ветка	кирман	corpse	NONS-FfFf
погода	пунок	stamp	NONS-A1No
перелет	шува	tongue	NONS-A1Yes
опасение	дест	key	NONS-A1No
сова	валта	handle	NONS-A1Yes
обед	зохяин	cage	NONS-A1No
полено	онтормиция	finiteness	NONS-A1Yes
положение	гуар	face	NONS-A1No
крыса	талемон	adverb	NONS-A1Yes
рис	пода	rumor	NONS-A1Yes
память	ташка	month	NONS-A1No
папка	обрайство	complaint	NONS-A2NcNo
шалаш	лий	pass	NONS-A2CYes
пожар	хот	round	NONS-A2NcNo
робость	рень	slam	NONS-A2CYes
песня	пур	check	NONS-A2CNo
ботинок	экра	expression	NONS-A2NcYes
правда	стиг	state	NONS-A2CNo
аршин	келитки	groceries	NONS-A2NcYes
стол	сожка	romance	NONS-A2CYes
величина	вережник	lamp	NONS-A2CYes
сон	убыск	grade	NONS-A2NcNo
шило	певелина	experience	NONS-A2NcNo
рамка	валаница	diversion	NONS-A2CYes
гусеница	диля	perspective	NONS-A2NcYes
соска	слеветность	presentation	NONS-A2CNo
пирог	тарадина	weirdo	NONS-A2NcYes
лекция	копор	route	NONS-A2NcYes
медведь	табота	project	NONS-A2CNo

Russian-English Translation Recognition

Preprime	L1 Target	L2 Target	Type
море	кит	kit	PhSim
электричество	ток	talk	PhSim
река	плот	plot	PhSim
маникюр	лак	luck	PhSim
вождение	руль	rule	PhSim
шерсть	клок	clock	PhSim
мышь	кот	caught	PhSim
ранг	чин	chin	PhSim
лес	бор	bore	PhSim
династия	род	rod	PhSim
тело	комплекция	complexion	FfFf
доля	пай	pie	FfFf
портрет	фон	phone	FfFf
суд	адвокат	advocate	FfFf
ухажер	кавалер	cavalier	FfFf
декан	кафедра	chair	FfTr
емкость	баллон	cylinder	FfTr
колючка	шип	thorn	FfTr
обман	афера	fraud	FfTr
торговля	магазин	store	FfTr
сладость	сахар	sugar	TrEq
лайнер	полет	flight	TrEq
окно	занавеска	curtain	TrEq
лосось	рыба	fish	TrEq
внешность	красота	beauty	TrEq
польза	вред	harm	TrEq
богатство	роскошь	luxury	TrEq
косточка	вишня	cherry	TrEq
ствол	дерево	tree	TrEq
книга	страница	page	TrEq
диета	вес	weight	TrEq
врач	здоровье	health	TrEq
долг	ответственность	responsibility	TrEq
почет	уважение	respect	TrEq
местность	район	district	TrEq
работа	труд	labor	TrEq
спрос	рынок	market	TrEq
банкет	зал	hall	TrEq
эмоция	чувство	feeling	TrEq
эпоха	век	century	TrEq
проработка	анализ	analysis	Cogn
турнир	чемпион	champion	Cogn
уступка	компромисс	compromise	Cogn
подробность	деталь	detail	Cogn
почин	инициатива	initiative	Cogn
надежда	оптимизм	optimism	Cogn
природа	пикник	picnic	Cogn
тактика	стратегия	strategy	Cogn
дар	талант	talent	Cogn
разговор	тон	tone	Cogn
макака	обезьяна	simplicity	Unrel
вопрос	ответ	velocity	Unrel
мандарин	апельсин	delay	Unrel
туземец	остров	palace	Unrel
мягкость	твердость	oxygen	Unrel
стужа	холод	vegetable	Unrel
утрата	потеря	relief	Unrel
художник	живопись	confidence	Unrel
кастрюля	сковорода	spoon	Unrel
веселье	праздник	wing	Unrel
небо	птица	advantage	Unrel
сладость	конфета	score	Unrel
табак	папироса	flesh	Unrel
картина	рисование	editor	Unrel
завод	рабочий	infant	Unrel

шум	всплеск	truck	Unrel
клюква	ягода	event	Unrel
охота	добыча	madness	Unrel
неврастеник	психиатр	winter	Unrel
витамин	питание	oil	Unrel
товар	распродажа	damage	Unrel
балет	танец	cattle	Unrel
кашель	простуда	liberty	Unrel
букет	цветок	substance	Unrel
слово	буква	income	Unrel
беда	горе	anger	Unrel
деньги	монета	existence	Unrel
отверстие	дыра	density	Unrel
фотография	снимок	gun	Unrel
юрист	закон	image	Unrel
мерзость	отвращение	direction	Unrel
водка	пьяница	freedom	Unrel
машина	колесо	meaning	Unrel
удар	боль	faith	Unrel
бюрократ	чиновник	blood	Unrel
бедствие	наводнение	clarity	Unrel
суд	приговор	bed	Unrel
прибор	оборудование	size	Unrel
тесто	пирог	hour	Unrel
радость	улыбка	effort	Unrel
напев	мотив	square	Unrel
вагон	поезд	story	Unrel
урожай	село	wall	Unrel
изба	бревно	county	Unrel
приз	конкурс	issue	Unrel
насмешка	издевка	report	Unrel
плащ	зонт	pressure	Unrel
концерт	скрипка	spirit	Unrel
война	мир	peace	A1Yes
стрельба	лук	bow	A1Yes
сорт	вид	type	A1Yes
спиртное	крепость	strength	A1Yes
электричество	разряд	discharge	A1Yes
изъян	брак	marriage	A1No
анкета	пол	floor	A1No
начальник	глава	chapter	A1No
торговля	лавка	bench	A1No
лаборатория	опыт	experience	A1No
оптика	фокус	focus	A2CYes
блюдо	рецепт	prescription	A2NcNo
ряд	серия	part	A2NcNo
обозначение	нотация	notation	A2CYes
скандал	сцена	scene	A2CYes
церковь	пост	fasting	A2NcYes
раковина	кран	crane	A2CNo
тюрьма	камера	cell	A2NcYes
ружье	патрон	patron	A2CNo
корпорация	акция	share	A2NcYes
сознание	материя	matter	A2CYes
Волга	бассейн	pool	A2NcNo
вершины	пики	peaks	A2CYes
министры	кабинет	office	A2NcNo
бумага	лист	leaf	A2CNo
шахматы	партия	game	A2NcYes
дым	клуб	club	A2CNo
корысть	интерес	agenda	A2NcYes
вера	религия	religion	Cogn
гипотеза	теория	theory	Cogn
народ	нация	nation	Cogn
контора	организация	organization	Cogn
положение	статус	status	Cogn
смелость	риск	risk	Cogn
стая	работа	feature	Unrel
прививка	укол	treasury	Unrel
вор	кража	queen	Unrel
август	лето	trial	Unrel
палата	больница	volume	Unrel

чадо	отпрыск	evening	Unrel
тело	комплекция	build	FfTr
доля	пай	share	FfTr
портрет	фон	background	FfTr
суд	адвокат	lawyer	FfTr
ухажер	кавалер	admirer	FfTr
декан	кафедра	cathedral	FfFf
емкость	баллон	balloon	FfFf
колючка	шип	ship	FfFf
обман	афера	affair	FfFf
торговля	магазин	magazine	FfFf
война	мир	world	A1No
стрельба	лук	onion	A1No
сорт	вид	appearance	A1No
спиртное	крепость	fortress	A1No
электричество	разряд	category	A1No
изъян	брак	defect	A1Yes
анкета	пол	gender	A1Yes
начальник	глава	head	A1Yes
торговля	лавка	shop	A1Yes
лаборатория	опыт	experiment	A1Yes
оптика	фокус	trick	A2NcNo
блюдо	рецепт	recipe	A2CYes
ряд	серия	series	A2CYes
обозначение	нотация	reprimand	A2NcNo
скандал	сцена	stage	A2NcNo
церковь	пост	post	A2CNo
раковина	кран	faucet	A2NcYes
тюрьма	камера	camera	A2CNo
ружье	патрон	cartridge	A2NcYes
корпорация	акция	action	A2CNo
сознание	материя	cloth	A2NcNo
Волга	бассейн	basin	A2CYes
вершины	пики	spades	A2NcNo
министры	кабинет	cabinet	A2CYes
бумага	лист	sheet	A2NcYes
шахматы	партия	party	A2CNo
дым	клуб	cloud	A2NcYes
корысть	интерес	interest	A2CNo

French-English Priming

Preprime	Prime	Target	Type
levis	pont	bridge	TrEq
moteur	huile	oil	TrEq
ordinateur	écran	screen	TrEq
rat	piège	trap	TrEq
chat	souris	mouse	TrEq
tireur	fusil	rifle	TrEq
paume	doigt	finger	TrEq
saumon	poisson	fish	TrEq
soleil	plage	beach	TrEq
correction	faute	mistake	TrEq
gouvernement	formalité	formality	Cogn
fleur	tulipe	tulip	Cogn
bureau	poste	post	Cogn
intensité	pression	pressure	Cogn
église	cathédrale	cathedral	Cogn
représentant	délégation	delegation	Cogn
corde	guitare	guitar	Cogn
lin	tissu	tissue	Cogn
peur	terreur	terror	Cogn
atome	élément	element	Cogn
étape	cycle	cycle	CognId
juge	verdict	verdict	CognId
barreau	cage	cage	CognId
seconde	minute	minute	CognId
pays	nation	nation	CognId
jus	orange	orange	CognId
chaise	table	table	CognId
souffrance	torture	torture	CognId
liane	jungle	jungle	CognId
éloignement	distance	distance	CognId
scélératesse	crapule	rabbit	Unrel
plante	racine	fault	Unrel
camion	fourgon	damage	Unrel
air	poumon	stick	Unrel
musique	chanson	pride	Unrel
pied	orteil	sheet	Unrel
limite	bout	trust	Unrel
ferme	grange	duty	Unrel
intermédiaire	courtier	knife	Unrel
naufrage	radeau	bottom	Unrel
destin	poigne	fate	Unrel
couronne	rue	crown	Unrel
plainte	serf	complaint	Unrel
beurre	baleine	butter	Unrel
domaine	tante	estate	Unrel
riz	pointure	rice	Unrel
pouvoir	terre	power	Unrel
détresse	viaduc	distress	Unrel
recherche	poitrine	research	Unrel
regard	faiblesse	glance	Unrel
retraite	rente	rent	FfFf
vélo	casque	casket	FfFf
début	fin	fin	FfFf
foin	ballot	ballot	FfFf
baguette	pain	pain	FfFf
angle	coin	corner	FfTr
citron	zeste	zest	FfTr
achat	magasin	shop	FfTr
poids	balance	scales	FfTr
vin	raisin	grape	FfTr
main	sac	suck	PhSim
eau	bord	bore	PhSim
fourrure	peau	paw	PhSim
lèvre	bouche	bush	PhSim
joie	peine	pen	PhSim
Noël	renne	ran	PhSim
descente	chute	shoot	PhSim

chemise	col	call	PhSim
entreprise	société	society	A2CNo
interdiction	défense	defense	A2CNo
scandal	outrage	contempt	A2NcNo
chose	affaire	affair	A2CNo
politicien	campagne	campaign	A2CYes
kilomètre	mille	mile	A2CYes
méthode	mode	mode	A2CYes
mariage	voile	sail	A2NcNo
assaut	siège	siege	A2CYes
parlement	diète	diet	A2CNo
autobus	dépôt	terminal	A2NcYes
voiture	assurance	insurance	A2NcYes
boutique	rayon	shelf	A2NcYes
repos	somme	nap	A2NcYes
utilité	parti	advantage	A2NcYes
contact	touche	key	A2NcNo
vitesse	train	train	A2CNo
lien	rapport	rapport	A2CYes
jalousie	envie	desire	A2NcNo
synthèse	point	dot	A2NcNo
signature	griffe	stamp	A1Yes
marque	pli	envelope	A1Yes
rebord	arête	ridge	A1Yes
exposition	montre	show	A1Yes
avoine	son	bran	A1Yes
cour	arrêt	stop	A1No
cheveu	coupe	glass	A1No
banque	vol	flight	A1No
manuscrit	livre	pound	A1No
attente	queue	tail	A1No
abolition	chaustu	rent	NONS-FfFf
abus	laufou	casket	NONS-FfFf
abordage	vora	fin	NONS-FfFf
cognac	raut	ballot	NONS-FfFf
clarté	zecacha	pain	NONS-FfFf
clef	rorquegeau	corner	NONS-FfTr
classe	rarras	zest	NONS-FfTr
désarroi	selu	shop	NONS-FfTr
drogue	saux	scales	NONS-FfTr
désastre	tal	grape	NONS-FfTr
marraine	sé	suck	NONS-PhSim
mécompte	quéchauquet	bore	NONS-PhSim
noix	rosevu	paw	NONS-PhSim
nervure	zéchuquet	bush	NONS-PhSim
vareuse	jorca	pen	NONS-PhSim
nombre	capesse	ran	NONS-PhSim
vanne	cauchu	shoot	NONS-PhSim
trésor	sezeau	call	NONS-PhSim
trêve	cova	bridge	NONS-TrEq
tréteau	feuseleau	oil	NONS-TrEq
souffleur	féfuchau	screen	NONS-TrEq
soin	jéposeau	trap	NONS-TrEq
lycée	chapouré	mouse	NONS-TrEq
torchis	teusecou	rifle	NONS-TrEq
moellon	teau	finger	NONS-TrEq
revolver	qué	fish	NONS-TrEq
recueil	télau	beach	NONS-TrEq
ragoût	sauchat	mistake	NONS-TrEq
rafle	tareu	formality	NONS-Cogn
ruelle	zéjo	tulip	NONS-Cogn
rognon	tével	post	NONS-Cogn
suint	lèquepa	pressure	NONS-Cogn
semeur	quérerau	cathedral	NONS-Cogn
pan	jeusé	delegation	NONS-Cogn
minois	réterqueue	guitar	NONS-Cogn
mazout	sétu	tissue	NONS-Cogn
maillot	fesadové	terror	NONS-Cogn
losange	chajurette	element	NONS-Cogn
literie	lopusatte	cycle	NONS-CognId
lopin	tavéjou	verdict	NONS-CognId
jeu	tetuleau	cage	NONS-CognId

jument	sévet	minute	NONS-CogNd
huître	touré	nation	NONS-CogNd
épinette	caucho	orange	NONS-CogNd
égard	neurou	table	NONS-CogNd
décompte	furachet	torture	NONS-CogNd
coquillage	lustucou	jungle	NONS-CogNd
appel	zastepelle	distance	NONS-CogNd
ampoule	forteau	rabbit	NONS-Unrel
altesse	chastu	fault	NONS-Unrel
coton	pasqué	damage	NONS-Unrel
aine	séreau	stick	NONS-Unrel
acquit	chaulu	pride	NONS-Unrel
cenellier	loutoutelle	sheet	NONS-Unrel
censure	vufouseau	trust	NONS-Unrel
cellule	técheusou	duty	NONS-Unrel
cave	topajou	knife	NONS-Unrel
liseré	fovéqueu	bottom	NONS-Unrel
jambe	vaustafou	fate	NONS-Unrel
jarre	zépeau	crown	NONS-Unrel
hangar	vésert	complaint	NONS-Unrel
grillon	fassé	butter	NONS-Unrel
gradin	feurcou	estate	NONS-Unrel
graine	jeau	rice	NONS-Unrel
dent	pée	power	NONS-Unrel
front	pêve	distress	NONS-Unrel
fumet	sarot	research	NONS-Unrel
frayeur	lécou	glance	NONS-Unrel
faisan	requai	society	NONS-A2CNo
étui	teufau	defense	NONS-A2CNo
entaille	resteu	contempt	NONS-A2NcNo
frein	seuf	affair	NONS-A2CNo
remblai	rouc	campaign	NONS-A2CYes
égide	lupe	mile	NONS-A2CYes
croupion	sasorté	mode	NONS-A2CYes
remords	tepourquet	sail	NONS-A2NcNo
crossette	sautajeu	siege	NONS-A2CYes
pigeon	cupochevé	diet	NONS-A2CNo
jujube	péqueste	terminal	NONS-A2NcYes
piéton	rojou	insurance	NONS-A2NcYes
endenture	cusée	shelf	NONS-A2NcYes
chicot	couté	nap	NONS-A2NcYes
gomme	quertet	advantage	NONS-A2NcYes
effet	fauvetau	key	NONS-A2NcNo
œuf	raulécou	train	NONS-A2CNo
puce	lert	rapport	NONS-A2CYes
chair	reau	desire	NONS-A2NcNo
pleur	fert	dot	NONS-A2NcNo
pavot	fré	stamp	NONS-A1Yes
joyau	feau	envelope	NONS-A1Yes
incendie	lésequet	ridge	NONS-A1Yes
vœu	jopert	show	NONS-A1Yes
souhait	veujaqué	bran	NONS-A1Yes
solde	télou	stop	NONS-A1No
pensée	chulau	glass	NONS-A1No
pignon	lestaufeu	flight	NONS-A1No
plafond	quezavé	pound	NONS-A1No
sourire	fefauleu	tail	NONS-A1No
pens	crou	fas	NONS-NONS
pennon	fleu	bave	NONS-NONS
phoque	chot	miri	NONS-NONS
palinod	couque	zoor	NONS-NONS
retour	têve	badow	NONS-NONS
saie	quertôt	roose	NONS-NONS
tyrannie	pauve	astice	NONS-NONS
mante	jerrou	dattle	NONS-NONS
ascète	rofé	paffic	NONS-NONS
deuil	poufa	accelex	NONS-NONS
gens	lurté	mipper	NONS-NONS
ennemi	fétit	wanaged	NONS-NONS
maki	lesqué	picarity	NONS-NONS
peinard	lercaud	bittenful	NONS-NONS
peignée	tajou	zildlifes	NONS-NONS

plume	suru	ambumition	NONS-NONS
salle	sescau	fod	NONS-NONS
saison	surtève	bine	NONS-NONS
salade	caufeu	mirt	NONS-NONS
lac	quèvau	zope	NONS-NONS
déboîtage	cauchet	bants	NONS-NONS
clafouti	jerçu	slace	NONS-NONS
civilité	cortou	attamp	NONS-NONS
claquette	sosou	eaxing	NONS-NONS
égalité	fepou	perden	NONS-NONS
greffe	seusteur	astices	NONS-NONS
lustre	perca	moveron	NONS-NONS
routine	taveau	wansing	NONS-NONS
notaire	choupou	pighting	NONS-NONS
pluralité	tauquenne	calcomal	NONS-NONS
rodage	japot	plarternest	NONS-NONS
dédain	reurtu	foy	NONS-NONS
envoi	joufette	bive	NONS-NONS
huée	terché	zice	NONS-NONS
humidité	follet	zork	NONS-NONS
imagerie	lestèsepot	baple	NONS-NONS
infirmière	faufertétu	slirt	NONS-NONS
jetée	pourteteustet	baddow	NONS-NONS
monarde	lerqueneule	emmick	NONS-NONS
peste	quertelauteu	zaught	NONS-NONS
galère	pusouléchau	beffect	NONS-NONS
canot	vestévartu	murdom	NONS-NONS
porte	terquefercau	wather	NONS-NONS
soldat	jufejorqué	plarter	NONS-NONS
barde	fépocapeu	cletch	NONS-NONS
baril	furevet	voggle	NONS-NONS
moulée	zustéchert	gan	NONS-NONS
moufle	cauretégeau	bove	NONS-NONS
divan	sourtesauselle	nait	NONS-NONS
dizeau	tercupanteau	bavel	NONS-NONS
fleuve	péchasouvé	slone	NONS-NONS
école	fuleuvortette	barvle	NONS-NONS
sil	quetté	entulp	NONS-NONS
taupe	feuseau	plear	NONS-NONS
prospérité	rerquet	lind	NONS-NONS
prothèse	fuchou	neep	NONS-NONS
privation	courret	wister	NONS-NONS
plet	chégeau	prospert	NONS-NONS
viridité	laufé	clortness	NONS-NONS
vestibule	sofau	collantiny	NONS-NONS
vibrion	vévert	gox	NONS-NONS
trépas	sétu	chid	NONS-NONS
sagard	festeu	nars	NONS-NONS
platinage	suzé	blept	NONS-NONS
loriot	chechou	spone	NONS-NONS
culotton	verco	bive	NONS-NONS
firme	vaucheu	eppect	NONS-NONS
cassage	rétot	pother	NONS-NONS
castor	quéla	blass	NONS-NONS
bambou	quesu	nold	NONS-NONS
farine	feuchou	zather	NONS-NONS
souillard	veuret	ardonist	NONS-NONS
poignard	fucu	prostume	NONS-NONS
frère	chequet	compleech	NONS-NONS
mesure	rejot	confossity	NONS-NONS
mésange	chaseur	lue	NONS-NONS
examen	retête	fope	NONS-NONS
crue	soustert	pild	NONS-NONS
cosurce	farquet	pildablep	NONS-NONS
cohue	poufa	eletch	NONS-NONS
aigreur	luru	plaweldop	NONS-NONS
aissette	surteu	moble	NONS-NONS
archipel	fequelle	plewapoy	NONS-NONS
ardeur	chegeau	plove	NONS-NONS
argile	sauzé	roakatid	NONS-NONS
bagnole	cherteau	clord	NONS-NONS
bâfreur	cheusu	scayodir	NONS-NONS

billion	lucart	mought	NONS-NONS
bure	lerteau	sharodrick	NONS-NONS
buttée	zaupeu	pooth	NONS-NONS
contrainte	porca	sianopood	NONS-NONS
conteur	véseau	ciort	NONS-NONS
gerboise	chéchête	soomafroke	NONS-NONS
urne	sertesse	nist	NONS-NONS
surprise	toutu	tudsovang	NONS-NONS
soupière	fitu	prock	NONS-NONS
revue	lauté	vingazil	NONS-NONS
rallonge	vougeot	comble	NONS-NONS
copain	ami	bling	REAL-NONS
consulat	ambassade	spurp	REAL-NONS
félicité	délice	bravel	REAL-NONS
dédain	insolence	escout	REAL-NONS
âme	esprit	prooth	REAL-NONS
terre	monde	bottark	REAL-NONS
colline	vallée	nuggage	REAL-NONS
est	ouest	desinter	REAL-NONS
arôme	exhalaison	queezer	REAL-NONS
futaille	baril	electroont	REAL-NONS
four	pâtisserie	corpanny	REAL-NONS
fracture	bris	mip	REAL-NONS
crainte	angoisse	fout	REAL-NONS
passage	couloir	plew	REAL-NONS
loi	droit	crimb	REAL-NONS
chaîne	captivité	swite	REAL-NONS
but	rêve	clord	REAL-NONS
brouillard	éclat	flain	REAL-NONS
brise	vent	proter	REAL-NONS
bravade	défi	comfant	REAL-NONS
carafe	bouteille	onimal	REAL-NONS
boule	balle	dirstave	REAL-NONS
terme	borne	rabblelt	REAL-NONS
boisson	aliment	fappiture	REAL-NONS
cafard	bigot	pud	REAL-NONS
arc	dôme	frim	REAL-NONS
vigueur	ardeur	roak	REAL-NONS
placard	armoire	drick	REAL-NONS
chambrière	fouet	tirl	REAL-NONS
déclin	aurore	frack	REAL-NONS
culte	foi	reafon	REAL-NONS
esquisse	dessin	dellery	REAL-NONS
tête	crâne	oransin	REAL-NONS
époux	ménage	lindow	REAL-NONS
coiffure	boucle	respeich	REAL-NONS
ouverture	trou	goistrome	REAL-NONS
chagrin	colère	fuggestion	REAL-NONS
amulette	mascotte	zow	REAL-NONS
dépense	frais	lind	REAL-NONS
goût	saveur	zice	REAL-NONS
salon	boudoir	rable	REAL-NONS
tenture	tapis	zort	REAL-NONS
bœuf	viande	darrot	REAL-NONS
enfant	jumeau	nomic	REAL-NONS
miracle	prodige	zattle	REAL-NONS
mythe	légende	leadler	REAL-NONS
don	présent	voggle	REAL-NONS
sujet	matière	painfurn	REAL-NONS
panneau	vitrail	yagtreath	REAL-NONS
chenil	cheptel	spreach	REAL-NONS
dÎhévotion	écale	leal	REAL-NONS
ébène	grille	zeer	REAL-NONS
mairie	rade	prock	REAL-NONS
rôlage	séchoir	yater	REAL-NONS
sculpture	sifflet	nivide	REAL-NONS
toupie	ustion	zabies	REAL-NONS
veau	sil	ketter	REAL-NONS
signe	oronge	tullet	REAL-NONS
osmose	frutille	pachinery	REAL-NONS
fumage	écaille	vocaster	REAL-NONS
cure	alliage	tompany	REAL-NONS

gare	adverbe	plossery	REAL-NONS
cuscute	fructose	koot	REAL-NONS
mitre	lacet	zail	REAL-NONS
laine	épée	pooth	REAL-NONS
doléance	couplet	wanse	REAL-NONS
loge	pelouse	nister	REAL-NONS
revanche	trognon	velery	REAL-NONS
trousseau	poire	gricken	REAL-NONS
plumage	poigne	tister	REAL-NONS
branle	achalandage	ponatto	REAL-NONS
abeille	bouton	tarrage	REAL-NONS
garni	sterne	menticle	REAL-NONS
maille	rein	juck	REAL-NONS
relève	soie	tood	REAL-NONS
sœur	suppôt	minker	REAL-NONS
échine	burette	gock	REAL-NONS
bouffée	azote	twam	REAL-NONS
amorce	retard	bavelfash	REAL-NONS
laisse	jute	loman	REAL-NONS
désastre	évêque	fovame	REAL-NONS
patère	dérision	barvie	REAL-NONS
patrouille	touage	gacktwam	REAL-NONS
directeur	coup	maggle	REAL-NONS
charrette	régate	lamatood	REAL-NONS
redingote	tresse	lound	REAL-NONS
soute	milan	mirlazoor	REAL-NONS
manoir	herse	biving	REAL-NONS
gréail	décor	mirtizope	REAL-NONS
entrain	braise	maught	REAL-NONS
aile	briquet	nakenait	REAL-NONS
ride	brigand	niers	REAL-NONS
mue	jeton	narsineid	REAL-NONS
plaie	malaise	bove	REAL-NONS
aigle	rite	neptancy	REAL-NONS
mare	teigne	mirk	REAL-NONS
soif	ail	nividem	REAL-NONS
ricin	seuil	ploth	REAL-NONS
moineau	oiseau	fate	Unrel
asphalte	rue	crown	Unrel
seigneur	serf	complaint	Unrel
harpon	baleine	butter	Unrel
oncle	tante	estate	Unrel
forme	pointure	rice	Unrel
globe	terre	power	Unrel
chemin	viaduc	distress	Unrel
corps	poitrine	research	Unrel
débilité	faiblesse	glance	Unrel
angle	coin	coin	FfFf
citron	zeste	zest	FfFf
achat	magasin	magazine	FfFf
poids	balance	balance	FfFf
vin	raisin	raisin	FfFf
retraite	rente	income	FfTr
vélo	casque	helmet	FfTr
début	fin	end	FfTr
foin	ballot	bundle	FfTr
baguette	pain	bread	FfTr
autobus	dépôt	deposit	A2CNo
voiture	assurance	assurance	A2CNo
boutique	rayon	ray	A2CNo
repos	somme	sum	A2CNo
utilité	parti	party	A2CNo
contact	touche	touch	A2CYes
vitesse	train	speed	A2NcYes
lien	rapport	report	A2NcNo
jalousie	envie	envy	A2CYes
synthèse	point	point	A2CYes
entreprise	société	company	A2NcYes
interdiction	défense	prohibition	A2NcYes
scandal	outrage	outrage	A2CYes
chose	affaire	thing	A2NcYes
politicien	campagne	country	A2NcNo

kilomètre	mille	thousand	A2NcNo
méthode	mode	fashion	A2NcNo
mariage	voile	veil	A2CYes
assaut	siège	seat	A2NcNo
parlement	diète	assembly	A2NcYes
cour	arrêt	decree	A1Yes
cheveu	coupe	cut	A1Yes
banque	vol	theft	A1Yes
manuscrit	livre	book	A1Yes
attente	queue	line	A1Yes
signature	griffe	claw	A1No
marque	pli	fold	A1No
rebord	arête	bone	A1No
exposition	montre	watch	A1No
avoine	son	sound	A1No
abolition	chaustu	coin	NONS-FfFf
abus	laufou	zest	NONS-FfFf
abordage	vora	magazine	NONS-FfFf
cognac	raut	balance	NONS-FfFf
clarté	zecacha	raisin	NONS-FfFf
clef	rorquegeau	income	NONS-FfTr
classe	rarras	helmet	NONS-FfTr
désarroi	selu	end	NONS-FfTr
drogue	saux	bundle	NONS-FfTr
désastre	tal	bread	NONS-FfTr
jambe	vaustafou	fate	NONS-Unrel
jarre	zépeau	crown	NONS-Unrel
hangar	vésert	complaint	NONS-Unrel
grillon	fassé	butter	NONS-Unrel
gradin	feurcou	estate	NONS-Unrel
graine	jeau	rice	NONS-Unrel
dent	pée	power	NONS-Unrel
front	pêve	distress	NONS-Unrel
fumet	sarot	research	NONS-Unrel
frayeur	lécou	glance	NONS-Unrel
faisan	requai	deposit	NONS-A2CNo
étui	teufau	assurance	NONS-A2CNo
entaille	resteu	ray	NONS-A2CNo
frein	seuf	sum	NONS-A2CNo
remblai	rouc	party	NONS-A2CNo
égide	lupe	touch	NONS-A2CYes
croupion	sasorté	speed	NONS-A2NcYes
remords	tepourquet	report	NONS-A2NcNo
crossette	sautajeu	envy	NONS-A2CYes
pigeon	cupochevé	point	NONS-A2CYes
jujube	péqueste	company	NONS-A2NcYes
piéton	rojou	prohibition	NONS-A2NcYes
endenture	cusée	outrage	NONS-A2CYes
chicot	couté	thing	NONS-A2NcYes
gomme	quertet	country	NONS-A2NcNo
effet	fauvetau	thousand	NONS-A2NcNo
œuf	raulécou	fashion	NONS-A2NcNo
puce	lert	veil	NONS-A2CYes
chair	reau	seat	NONS-A2NcNo
pleur	fert	assembly	NONS-A2NcYes
pavot	fré	decree	NONS-A1Yes
joyau	feau	cut	NONS-A1Yes
incendie	lésequet	theft	NONS-A1Yes
vœu	jopert	book	NONS-A1Yes
souhait	veujaqué	line	NONS-A1Yes
solde	téiou	claw	NONS-A1No
pensée	chulau	fold	NONS-A1No
pignon	lestaufeu	bone	NONS-A1No
plafond	quezavé	watch	NONS-A1No
sourire	fefauleu	sound	NONS-A1No

French-English Translation Recognition

Preprime	L1 Target	L2 Target	Type
chaleur	haleine	breath	TrEq
jambe	genou	knee	TrEq
rupture	cassure	crack	TrEq
balai	poussière	dust	TrEq
rhume	grippe	flu	TrEq
garage	outil	tool	TrEq
taille	grandeur	size	TrEq
vache	bétail	cattle	TrEq
raison	tort	harm	TrEq
feuille	arbre	tree	TrEq
pomme	fruit	fruit	Cognld
mer	océan	ocean	Cogn
légume	carotte	carrot	Cogn
vedette	célébrité	celebrity	Cogn
médicament	remède	remedy	Cogn
modèle	exemple	example	Cogn
rôle	fonction	function	Cogn
énigme	mystère	mystery	Cogn
mot	vocabulaire	vocabulary	Cogn
lieu	région	region	Cogn
entente	pacte	pact	Cogn
genre	style	style	Cognld
gâteau	dessert	dessert	Cognld
stèle	monument	monument	Cognld
choix	option	option	Cognld
artère	tension	tension	Cognld
piano	note	note	Cognld
tolérance	patience	patience	Cognld
habitude	tradition	tradition	Cognld
temps	moment	moment	Cognld
eau	piscine	snake	Unrel
veston	cravate	disruption	Unrel
tailleur	jupe	fence	Unrel
confins	douane	belief	Unrel
vengeance	haine	sky	Unrel
presse	hâte	needle	Unrel
tableau	craie	curtain	Unrel
prière	oraison	basket	Unrel
visage	teint	candle	Unrel
bijoux	orfèvre	score	Unrel
nuage	pluie	flesh	Unrel
sel	poivre	wing	Unrel
épice	muscade	truck	Unrel
combat	lutte	cake	Unrel
appartement	logis	madness	Unrel
esclave	fouet	winter	Unrel
bruit	fracas	spoon	Unrel
oiseau	nid	anger	Unrel
femme	mari	soil	Unrel
promesse	parole	feature	Unrel
bombe	obus	request	Unrel
herbe	persil	queen	Unrel
trace	piste	threat	Unrel
soupe	potage	friend	Unrel
dégât	ravage	kitchen	Unrel
nuit	soir	expense	Unrel
ennui	souci	dream	Unrel
caisse	tiroir	smile	Unrel
peinture	toile	knowledge	Unrel
animosité	mépris	blanket	Unrel
rondeur	boule	ceiling	Unrel
support	soutien	goal	Unrel
note	calepin	fellow	Unrel
rosier	épine	shelter	Unrel
année	siècle	moon	Unrel
coeur	amour	potato	Unrel
lavabo	évier	weapon	Unrel

navire	bateau	title	Unrel
dette	créance	hill	Unrel
entrée	vestibule	steel	Unrel
vacance	congé	cup	Unrel
aiguille	talon	depth	Unrel
marteau	scie	milk	Unrel
douche	bain	iron	Unrel
université	doyen	finger	Unrel
sucre	douceur	brain	Unrel
livre	lecture	lecture	FfFf
jonc	bague	bag	FfFf
timidité	gêne	gene	FfFf
renvoi	destitution	destitution	FfFf
chien	dresseur	dresser	FfFf
vêtement	habit	clothes	FfTr
fromage	râpe	grater	FfTr
tristesse	déception	disappointment	FfTr
maison	case	hut	FfTr
usine	fabrique	factory	FfTr
demoiselle	dame	dumb	PhSim
sport	stade	stud	PhSim
humain	loque	lock	PhSim
chasse	cor	core	PhSim
foie	bile	bill	PhSim
animal	bête	bet	PhSim
meuble	laque	luck	PhSim
auto	panne	pun	PhSim
résultat	facteur	postman	A2NcNo
vie	expérience	experiment	A2NcNo
particularité	détail	detail	A2CYes
niveau	degré	step	A2NcYes
golfe	baie	berry	A2NcNo
fureur	accès	access	A2CNo
habileté	adresse	address	A2CNo
foule	assistance	audience	A2NcYes
voyage	tour	tour	A2CYes
pot	vase	vase	A2CYes
géométrie	figure	face	A2NcNo
manière	étiquette	label	A2NcNo
maladie	affection	disease	A2NcYes
blague	farce	farce	A2CYes
souvenir	mémoire	memory	A2CYes
orphelin	pupille	pupil	A2CNo
neveu	parent	relative	A2NcYes
appareil	engin	engine	A2CNo
côté	sens	direction	A2NcYes
domination	empire	empire	A2CNo
beauté	allure	appearance	A1Yes
or	argent	silver	A1Yes
théâtre	pièce	play	A1Yes
orignal	élan	elk	A1Yes
monnaie	coupure	denomination	A1Yes
syndicat	grève	shore	A1No
fatigue	détente	trigger	A1No
consentement	agrément	pleasure	A1No
balai	manche	sleeve	A1No
grammaire	nom	name	A1No
lune	siècle	moon	Unrel
arme	évier	weapon	Unrel
titre	bateau	title	Unrel
colline	créance	hill	Unrel
tasse	congé	cup	Unrel
profondeur	talon	depth	Unrel
lait	scie	milk	Unrel
fer	bain	iron	Unrel
oreille	doyen	ear	Unrel
cerveau	douceur	brain	Unrel
vêtement	habit	habit	FfFf
fromage	râpe	rape	FfFf
tristesse	déception	deception	FfFf
maison	case	case	FfFf
usine	fabrique	fabric	FfFf

livre	lecture	reading	FfTr
jonc	bague	ring	FfTr
timidité	gêne	constraint	FfTr
renvoi	destitution	dismissal	FfTr
chien	dresseur	trainer	FfTr
géométrie	figure	figure	A2CYes
manière	étiquette	etiquette	A2CYes
maladie	affection	affection	A2CNo
blague	farce	stuffing	A2NcNo
souvenir	mémoire	thesis	A2NcNo
orphelin	pupille	ward	A2NcYes
neveu	parent	parent	A2CNo
appareil	engin	device	A2NcYes
côté	sens	sense	A2CNo
domination	empire	influence	A2NcYes
résultat	facteur	factor	A2CYes
vie	expérience	experience	A2CYes
particularité	détail	retail	A2NcNo
niveau	degré	degree	A2CNo
golfe	baie	bay	A2CYes
fureur	accès	outburst	A2NcYes
habileté	adresse	skill	A2NcYes
foule	assistance	assistance	A2CNo
voyage	tour	tower	A2NcNo
pot	vase	mud	A2NcNo
syndicat	grève	strike	A1Yes
fatigue	détente	relaxation	A1Yes
consentement	agrément	approval	A1Yes
balai	manche	handle	A1Yes
grammaire	nom	noun	A1Yes
beauté	allure	speed	A1No
or	argent	money	A1No
monnaie	coupure	cut	A1No
orignal	élan	impetus	A1No
théâtre	pièce	room	A1No

Appendix B
Language Background Questionnaire (Russian-English)

1. a) What language (Russian or English) do you use more often at present?

Please check *one* off: ❒ Russian ❒ English

b) For each situation, please check off the language that you use more often:

- at home: ❒ Russian or ❒ English
- at work: ❒ Russian or ❒ English
- socially (e.g., with friends): ❒ Russian or ❒ English
- other (please specify):_____ ❒ Russian or ❒ English

c) What other languages besides these two do you speak?_____

2. a) How old were you when you first started learning English?_____

b) How did you learn English?

❒ in a classroom setting

❒ as a result of living in the English language environment

❒ other (please specify)_____

c) How many years did you spend learning English in a formal setting? _____

d) How many years have you spent in the English language environment? ___

e) How would you rate your overall English language proficiency on the following scale (where 1 corresponds to 'least proficient' and 7 to 'very proficient')? Please circle *one* number:

——————————————————————————>

1 2 3 4 5 6 7

least proficient very proficient

f) How often do you come across an English word that you do not know?

Please check *one* off:

❒ rarely

❒ sometimes

❒ often

❒ most of the time

3. How often do you forget Russian words or their meanings as a result of having spent a long time in the English-speaking environment? Please check *one* off:

❒ never

❒ rarely

❒ sometimes

❒ often

Language Background Questionnaire (French-English)

1. a) What language (French or English) do you use more often at present?

Please check *one* off: ❒ French ❒ English

b) For each situation, please check off the language that you use more often:

- at home: ❒ French or ❒ English
- at work: ❒ French or ❒ English
- socially (e.g., with friends): ❒ French or ❒ English
- other (please specify):_____ ❒ French or ❒ English

c) What other languages besides these two do you speak?_____

2. a) How old were you when you first started learning English?_____

b) How did you learn English?

❒ in a classroom setting

❒ as a result of living in the English language environment

❒ other (please specify)_____

c) How many years did you spend learning English in a formal setting? _____

d) How many years have you spent in the English language environment? ___

e) How would you rate your overall English language proficiency on the following scale (where 1 corresponds to 'least proficient' and 7 to 'very proficient')? Please circle *one* number:

——————————————————————————>

1 2 3 4 5 6 7

least proficient very proficient

f) How often do you come across an English word that you do not know?

Please check *one* off:

❒ rarely

❒ sometimes

❒ often

❒ most of the time

3. How often do you forget French words or their meanings as a result of having spent a long time in the English-speaking environment? Please check *one* off:

❒ never

❒ rarely

❒ sometimes

❒ often