Early studies of the bilingual lexicon

Since the 1960s, much research has addressed the issue of how the two languages of a bilingual are cognitively represented. This early research, mostly during the 1960s and 1970s, posed the question as one versus two separate stores. Not all, but a large part of these studies focused specifically on the organization of the lexicon and these will be concerned here. Some researchers suggested entirely separate lexicons (Kolers, 1963). Much of this research was influenced by the three types of bilingualism originally proposed by Weinreich (1953). In what he labeled a *coordinate structure*, both meaning and form are completely language specific. In a *compound structure*, meaning is shared and form is language specific. In a *subordinate structure*, the form representation in the weaker language is attached to the form in the dominant language, and not directly to the meaning component.

With time, the coordinate structure has received less support, because it is considered unlikely that a word meaning is so divergent in two languages that they require completely separate representations[1]. This leaves us with three components; one for shared conceptual representation and two for language dependent form representations[2]. A large body of the subsequent research addressed the issue of how these three components relate to each other.

Potter, So, von Eckhardt and Feldman (1984) investigated how form and meaning of a second language are connected and reintroduced two of Weinreich (1953) models under new names. In one model, L2 forms are associatively linked to the first language (L1) form representation. They call this *the word association hypothesis* (similar to Weinreich's subordinate structure). In a second proposal, second language (L2) word forms are linked directly to the conceptual level of representation, regardless of level of proficiency. This was called *the concept-mediation hypothesis* (similar to Weinreich's compound structure). Potter et al. (ibid.) added a developmental perspective by assuming that lower levels of L2 proficiency involves processing by means of word association links, whereas higher levels of L2 proficiency second language word forms are processed in terms of concept-mediation.

Kroll and Sholl (1992; see also Kroll & Stewart, 1994) introduced a model which included both types of processing as co-existing within the same speaker. In their model, *the revised hierarchical model*, the links

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[1] De Groot (2002) suggests a less simplified solution in which a words meaning representation is distributed over several components. This is then not a question of language specificity or not, but one of overlap or divergence of meaning components.

[2] Sometimes referred to as the *three component model*.

connecting the three components are asymmetrical in strength. L1 words have strong links to conceptual information, while second language words have strong links to corresponding L1 words at the lexical level. As level of L2 proficiency increases, conceptual links are assumed to replace or weaken the lexical links. According to this, learners should go from predominantly processing their L2 by means of word-association to processing by means of concept mediation as a function of increased proficiency.

The revised hierarchical model also predicts translation directional differences. Translation from L1 to L2 (forward translation) is assumed to take longer time than from L2 to L1 (backward translation). This is because L1-word forms are more likely to activate concepts than L2-word forms. L2 is not conceptually mediated, and backward translation restricts processing to the lexical level. This explains why it is faster and why it is less sensitive to the influence of semantic factors.

However, the model has received much criticism. Many studies have failed to replicate the difference in direction of translation predicted by the model (De Groot et al., 1994: Experiment 1; De Groot & Poot, 1997; La Heij, Hooglander, Kerling, & Van der Velden., 1996). But more importantly, several studies have demonstrated that even beginning learners mediate L2 words conceptually (Altarriba & Mathis, 1997).

The studies supporting the revised hierarchical model have also received criticism based on methodological shortcomings. One shortcoming is that only concrete words and concepts have been included in the tests. It has been shown in a number of studies that concrete and abstract words are processed differently. One difference is that concrete words are associated with meaning to a larger extent than abstract words in initial stages of learning (De Groot, 1992, 1993).

Another line of early research has focused less on the issue of separate versus common storage for the bilingual’s two languages, and paid more attention to the mechanisms involved in switching between the languages and keeping them separate. These studies are closely associated with neurology and much of them to a large extent based on observations of code switching and aphasic symptoms. A general assumption in these early switch studies was that a language could be either on or off, depending on contextual settings.

Penfield and Roberts (1959) proposed that in order to switch between languages the bilingual needs to make use of a corresponding mental switch mechanism. MacNamara and Kushnir (1971) proposed different switch mechanisms for input and output to account for bilinguals speaking in one language while listening in the other. One problem with these models was that they could only account for switches on a large-scale basis. A language was either on or off and nothing in between. Because of this they failed to account for intrasentential switching and interference effects.

Current research of the bilingual lexicon

Towards the end of the 1980s, two major sources of influence contributed to a general revise of research questions and models of the bilingual lexicon and lexical access. The first is the account of activation spreading, stemming from the connectionist paradigm (Rumelhart & McLelland, 1986).

Models of activation spreading retain the idea of network architecture of the mental lexicon. Words are represented as nodes in the network and depending on the excitatory or inhibitory nature of the signal, words are activated or suppressed. When sufficient activation is achieved, the threshold is exceeded, and the item with the highest activation level is selected and retrieved. The links connecting the nodes are based on semantic, phonological and associative information. A stimulus activates a node in the network, and activation spreads by means of the links to other concepts and diminishes gradually. Dell's (1986) interactive activation model of monolingual language production has had deep impact on the modeling of bilingual language processing.

Paradis (1987, 2004) accounted for the bilingual lexicon in spreading activation terminology in his *subsystem* (or *subset*) *hypothesis*. According to this hypothesis, words from the two languages are stored together in one single system. But because items of the same language tend to appear in the same contexts, links between these items will be reinforced through extended usage. This results in semi-independent language networks that can be activated and inhibited separately by a language independent conceptual system. Intention to speak in one language rather than the other raises the activation level of all nodes in that language network while decreasing activation level of the other network. This organization eases selection and retrieval within one language.

Further, the degree of deactivation depends on how frequently a language is used. A language that is used frequently can never be completely deactivated. Thus, speakers can restrict usage to one language at the time because the activation level of words in that language is higher than the activation level of words in the other language. Several models of the bilingual mental lexicon and lexical access adopt the subsystem hypothesis (De Bot, 1992; De Bot & Schreuder, 1993; Green, 1986, 1993, 1998) (see Poulisse & Bongaerts, 1994, for a different proposal).

The second source of influence on research of bilingual processing is Levelt's (1989) "Speaking" model. This is a model of monolingual speech production, but has been highly influential on bilingual models. It was directly adapted by De Bot (1992; see also De Bot and Schreuder, 1993) to bilingual speech production. Poulisse and Bongaerts (1994) also based their bilingual model on Levelt's monolingual model.

Levelt's (1989, 1999) model depicts the production process as passing through a series of stages passing through conceptualization, formulation and articulation. Formulation consists of two stages, one where semantic and syntactic information (i.e. a *lemma*) is encoded and one where phonological information (i.e. a *lexeme*) is encoded. Lexical access occurs at the lemma level. Bock and Levelt's (1994) model of the mental lexicon is a spreading activation model, which includes phonological, syntactic and morphological information. Thus, though the overall architecture of this production model is serial, it incorporates a spreading activation account of lexical access. The stage of lexical access is critical to the theory, this is where the target lexical node is selected, and it is assumed that lexical selection is performed by means of competition. The computationally explicit formula is stated in terms of Luce choice ratio (reference ?). According to this principle, the probability of the target lexical node to be selected, is a function of its level of activation divided by the levels of activation of all lexical nodes in the lexicon.

As the spreading activation account has become the basic framework for modeling the mental lexicon, the research questions have changed from those posed in earlier bilingual research. The issue of one versus two storages has become irrelevant. New questions arise, such as which factors influence lexical organization, and if items in the two lexicons can be activated simultaneously. And if simultaneous activation is the case, then what parts, or what items does this include? Focus has shifted towards the mental processes underlying production of words.

As already implicitly mentioned, there are two classes of language production models: parallel models (Dell 1986) and serial models (Levelt, 1989; Levelt et al. 1999). Both models assume word encoding to occur at two processing stages[3], a lemma and a lexeme encoding stage. A serial approach assumes that lemma selection precedes lexeme encoding. This means that only the selected lemma is sent to the lexeme encoding stage (Levelt, Schriefers, Vorberg, Meyer, Pechmann, & Havinga, 1991; Levelt, Roelofs & Meyer, 1999). A parallel approach assumes that lexeme encoding can start before lemma selection is completed. This means that any lemma considered for selection is automatically encoded phonologically. This is referred to as the *cascade view* (Humphreys, Riddoch & Quinlan, 1988; Peterson & Savoy, 1998).

Some researchers further assume that in addition to the processing overlap of lemma and lexeme encoding, the processing at lexeme level can exert influence on processing at the lemma level. Thus, phonological encoding can influence lemma selection. This is referred to as the *interactive view* (Dell, 1986; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997). Many studies have investigated this issue of seriality versus interaction in production.

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[3] See Caramazza & Miozzo (1997) for a different proposal.

During the 1990s, this was investigated with the picture-word interference paradigm, which was refined for this purpose by manipulation with stimuli onset asynchronies (SOA). This is based on the assumption that effects of semantically related distractor words is located at the lemma level and the effect of phonologically related distractor words is located at the lexeme level of processing. Based on these assumptions, serial and interactive models predict different results concerning the effects and their lapse of time.

The studies that support a strict serial view have observed absence of phonological effects at early SOAs (Schriefers, Meyer, & Levelt, 1990; Schriefers & Meyer, 1990). But studies supporting a cascaded or an interactive processing view are in majority (Damian & Martin, 1999; Dell et al., 1997; Peterson & Savoy, 1998; Starreveld & La Heij, 1999). In short, these studies have not found evidence of a serial time course corresponding to semantic and phonological effects.

However, Starreveld (2000) made a series of experiments that demonstrate that onset of phonological effects can be manipulated (see Starreveld, 2000: Experiments 2 and 6). He argues that this demonstrates that experimental results of the time course of phonological and semantic effects cannot be taken to reflect stages of processing. This is a continuing debate, and the last word has not yet been said. Although this is an intriguing question, it is not the primary aim of the present study, and will therefore not be further discussed here.

Models of the bilingual lexicon

Current models of the bilingual lexicon which depict lexical access as language non-selective are Green's (1986, 1993, 1998) Inhibitory control (IC) model, and the models by De Bot and Schreuder (1993) and Poulisse and Bongaerts (1994). The model of language selective bilingual lexical access by Costa, Miozzo, & Caramazza (1999) will also be reviewed in this section.

The language non-selective models all three assume that words from both languages are activated and compete for selection during lexical selection. All three models adopt the notion of regulation by activation, but the details vary. Green (1986, 1993, 1998) and De Bot and Schreuder (1992) adopt the subsystem hypothesis. In these models, the conceptual specification[4] contains a language cue, which raises the overall activation state of the corresponding lexical subsystem relative to the other.

Poulisse and Bongaerts (1994) propose a somewhat different solution, which entails the hypothesis of lemma tags. This account is also adopted by

[4] The *preverbal message* in Levelt's (1989) terminology.

Green (ibid.) who adopts both the hypotheses of subsystems and lemma tags. They argue that, in addition to language specification in the conceptual representation, all lexical items in the lexicon are also tagged for language. When the intention is to produce a word in one of the languages, the item that best matches the conceptual representation is selected. Thus, the language specifications in the conceptual representation interact with the corresponding lemma labels.

The models by De Bot and Schreuder (1993) and Poulisse and Bongaerts (1994, see also Poulisse, 1999) are based directly on Levelt's (1989) "Speaking" model for language production[5]. Accordingly, these models assume that the locus of lexical selection occurs at the lemma level and that selection is achieved through competition between lemmas. These models rely on the notion that the activation level of items in the target language will always exceed items in the non-target language. The activation level of the non-targeted items affects selection latencies according to a mathematical rule.

In contrast to the account for lexical selection based on Levelt, Green's (1986, 1998) IC model introduces multiple levels of inhibitory control that regulate language use. A message is generated in a conceptualizing component. This process of message generation is mediated by a language independent "Supervisory Attentional System" (SAS) together with the lexico-semantic system and task schemas. A task schema is a network detailing sequences of actions. Different types of schemas control different types of actions and complex actions require multiple layers of schemas.

Control and inhibition operates at two levels. SAS regulates activation levels of selected schemas. And schemas regulate activation levels within the lexico-semantic system where lemmas are selected. Hence, schemas are activated and inhibited by SAS and lemmas are activated and inhibited by task schemas.

The conceptual specification activates the relevant network and items with the corresponding language tag are activated. To assure that the right lemma is selected, Green (1998) adopts the "binding-by-checking" principle as proposed by Levelt et al. (1999). After checking has occurred, the lemma (or lemmas) with incorrect language tag is suppressed, allowing for the correct lemma to proceed to phonologic encoding. A crucial feature of this process is that inhibition is reactive. Lemmas with a higher degree of activation require stronger suppression. Lemmas in the more dominant language are assumed to have a higher level of activation from the outset because of more extended usage (Green, 1986, 1998; see also De Bot 1992).

In contrast to these language non-selective models, Costa et al. (1999) present a language selective view. They anchor their research within the

[5] Green's (1986, 1998) IC model focuses more on the lexicon component only, and does not model the complete production process.

framework of the three-component model by assuming one single conceptual component and separate language specific lexicons. Instead of assuming two separate stages of lemma and lexeme encoding, they argue that each lexical node is linked to its grammatical and phonological properties. There is only one lexical layer where this information is linked to each node. Selection is regulated by activation levels in the nodes. Selection is achieved by means of a mechanism that selects the most activated item. Further, selection is delayed by competing items, but this does not include items from the non-target language. In contrast to De Bot (1992) and Green (1986, 1998), this model does not assume inhibition of the non-target lexicon.

Although a crucial feature of the model is that items in both lexicons are activated, Costa et al. (1999) and Costa and Caramazza (1999) argue to have sufficient evidence that between language items do not compete for selection. Costa et al. (1999) carried out picture-word interference experiments and found facilitation effects with a between-language distractor which was identical to the picture. They argued that the distractor word's translation equivalent in the language selected for production (i.e. the target word) is activated via a language-independent conceptual system. Thus, the distractor activates words in the non-target language, but these do not compete for selection.

In the same experiment, a semantically related between-language distractor induced interference effects. This was interpreted as the result of the semantically related distractor activating its translation equivalent in the target language via the language-independent conceptual system. This word then competes for selection. Thus, what really occurs is that only words within the language selected for production compete for selection. According to this account, what seems to be between-language competition is really within language competition.

Distributed conceptual representations in bilingual memory…

Language selective versus non-selective access

A majority of the studies of comprehension indicate that words in both languages are activated in response to a picture stimulus. Results from studies of production are somewhat more contradicting, but the majority of these studies also indicate a tendency of simultaneous activation of items in both lexicons.

Studies indicating language selective processing

Several of the studies that have indicated that lexical access is language selective have used tasks including a component of language-switching. Grainger and Beauvillian (1987) studied lexical access in comprehension with a lexical decision test that contained English/French language switches. Words and non-words were presented either in pure lists (with words from only one language) or mixed lists (with words from both languages). Participants were required to answer “yes” if the letter string was a real word in either English or French. It was clear that language switches produced longer response times.

These results were interpreted as evidence that the language context directs processing to the appropriate language by means of a switch mechanism. This language is searched for a match, and only when a match is not found, the other language is searched. When a change of language is required, the switch mechanism redirects input to the correct language system. Switching takes time, and this was assumed to explain the extra time to process mixed language input.

Processing selectivity is a matter of degree

Grosjean (1997: 250) remarks that slower processing of mixed input does not imply the existence of a switch mechanism. The processing delay can be due to other factors. One factor, which may affect degree of language selectivity, is the L2 proficiency level. Assuming that lexical access is non-selective implies that in lower levels of L2 proficiency, L2 words should interfere less with word recognition in L1. As level of L2 proficiency increases, interference of L2 on L1 word-processing should also increase.

A second factor is similarity of stimulus across the bilingual’s two languages. A high degree of similarity, in both form and meaning, is expected to induce strong effects on processing. Similarly, language specific encoding of a non-target word is expected to result in weak influence on processing. Especially if the language specific encoding is structurally forbidden in the target language. This factor of potential cross-linguistic influence has been frequently examined through the use of cognates and homographs in experimental tasks. Homographs overlap in form (orthography) and cognates overlap in both form and meaning. There is a general tendency that a higher degree of overlap implies a higher degree of influence from the non-target language on processing (for a review, see De Groot, 2002).

A third factor that may affect language selectivity is the experimental task design (Grosjean, 1997). Particularly important is the distinction between data-driven and concept-driven tasks. A data-driven study focuses on structural properties of stimuli, examples are word fragment completion and letter search tasks. Concept-driven tasks, on the other hand, focus on semantic properties of the stimuli, examples are free recall and categorization of words. Durgunoglu and Roediger (1987) found that data-driven tasks result in response patterns which indicate language selectivity while concept-driven tasks tend to induce response patterns indicating a language non-selective organization.

As a fourth factor, Grosjean (1997) mentions the presence of one or two of the bilingual's languages in the experimental situation. This determines degree activation of the two languages. If an experiment includes word stimuli from both languages, then both languages are active. This may result in a higher degree of cross-linguistic influence, and hence, the response patterns reflect a non-selective access processing. If the experiment only includes words from one language, the non-target language is active to a lesser extent. This would result in a higher degree of language selective access. Grosjean (1985, 1989, 1997) considers this last aspect in what he refers to as the *bilingual language mode*.

One important point with the bilingual mode continuum is that the non-target language varies in degree of activation across the continuum but it is never completely switched off. This implies that we can expect some degree of interference even in the most unilingual situation (note the similarity to what the subsystem hypothesis predicts).

The importance of discerning phonology from orthography

Many studies involving interlingual homographs have been carried out (Beauvillian & Grainger, 1987; De Groot, Delmaar, & Lupker, 2000; Dijkstra, Van Jaarsveld, & Ten Brinke; 1998; Dijkstra, Grainger, & Van Heuven, 1999). These studies show that interlingual homographs are processed differently from other words. Many of these studies interpret the results as evidence for the three-component model. Homographs and cognates are processed faster and more accurate, which is taken as indication of overlapping semantic representations in the two languages. Others interpret it as evidence of language non-selective processing and homographs and cognates are taken to activate each other in the two languages.

Several studies with cognates and homographs have manipulated the frequency variable. There is evidence that the relative frequency of cognates and homographs in the bilingual's two languages affects lexical access. Dijkstra, Timmermans and Schriefers (2000) demonstrated that cognates and homographs show patterns of response reflecting language non-selective lexical access when the words had low frequency in the target language and high frequency in the non-target language (see also Gerard and Scarborough, 1989). Such a *cognate* and *homograph effect* supports the language non-selective view of lexical access, since it assumes that representations in both of the bilingual's lexicons have been activated.

The homograph effect has proven not to be as strong, and not as robust as the cognate effect. Much results of homograph processing are contradicting. Dijkstra et al. (1999) studied bilingual lexical access in one progressive demasking task and one visual lexical decision task. The stimulus words included were controlled in terms of orthographic, phonologic and semantic overlap in English and Dutch. The results revealed facilitation for orthographic and semantic overlap but inhibition for phonologic overlap.

According to Dijkstra et al. (ibid.), the lack of homograph effects in studies of lexical access can be attributed to the fact that the majority of these studies do not make a distinction between phonology and orthography. It may well be the case that the facilitation induced by orthographic similarity and the inhibition induced by phonological similarity neutralize one another. This explains studies with no homograph effect.

Similarly, Scarborough, Gerard and Cortese (1984) found evidence for language selective access in a lexical decision task with Spanish/English bilinguals. They found that subjects rejected the words of the non-target language equally fast as regular non-words. This was true for their L1 as well as their L2. Grainger (1993) later concluded that these findings could be explained by the fact that the subjects used orthographical cues to reject the non-target words. This was possible because Spanish/English spellings are more divergent than Dutch/English spellings. So there was no cross-linguistic phonological influence in lexical access since non-phonological cues were used as a strategy in rejecting the non-words.

It seams that bilingual subjects can use orthography as a means to discard language non-selective processing by preventing the non-matching language from being activated. When language specific orthography is present in a stimulus word, equivalent items in the non-target language do not compete for selection. But when no such cues are present, processing cannot be exclusively selective.

Studies indicating language non-selective processing

Not many studies have considered phonology in lexical access. Several of the studies that have considered phonology have made use of interlingual pseudohomophones (Nas, 1983; Brysbaert, Van Dyck & Van de Poel, 1999) and homophonic non-cognates (Doctor & Klein, 1992; Gollan, Forster & Frost, 1997; Tzelgov, Henik, Sneg & Baruch, 1996). These studies have investigated whether phonological similarity of a stimulus word in the bilingual‘s two languages affect lexical access.

Nas (1983) examined Dutch/English bilinguals in a lexical decision task performed in English. Results of the first experiment showed that Dutch words took longer to reject than non-words. In his second experiment, Nas included interlingual pseudohomophones. These are words written with English spelling-to-sound rules and which therefore appear to be English in their orthography. But when sounding them out according to the English rules they form Dutch words. One example is the word SNAY, which pronounced according to English rules sound like the Dutch word SNEE (*cut* in Dutch). The results revealed that it took longer to reject pseudohomophones compared to non-words. Nas (ibid.) concluded that words from the bilingual's two languages are stored together, in a single storage.

Brysbaert et al. (1999: Experiment 1) used a masked phonological priming experiment and found evidence for a cross-linguistic homophone effect. A homophone is spelled differently in two languages but have the same pronunciation, for example *wait* and *wijd* (Dutch for *wide*). The expectation of cross-linguistic phonological priming effects is based on the assumption that written input requires automatic phonological encoding before lexical selection is performed (c.f. Grainger, 1993). When this phonological encoding takes place, interference can occur if items show cross-linguistic similarity. In Brysbaert et al.'s (1999) study, when an L1 word was used as prime, there was a processing effect on the corresponding L2 homophone word.

Moreover and especially interesting, Brysbaert et al. (1999) found that this phonological priming effect was equally large within as across languages. This is evidence that when processing word recognition in the target language, the non-target language phonology is activated and exerts influence on processing. The priming effect occurred both for L1 as well as L2, even if the effect was somewhat smaller when L2 was the target language. This strongly supports a language non-selective view of lexical access. The authors conclude that initial stages of word recognition are language non-selective, before the word from the non-target language must be neglected (at some point in the process).

Evidence of cross-linguistic importance of phonological influence in bilingual lexical access comes from a study performed by Gollan, Forster and Frost (1997). They let English/Hebrew and Hebrew/English bilinguals perform a lexical decision task in their L2. The test included translation priming, in which a target word is primed by its translation equivalent in L1. There was a convincing translation priming effect for all words, and particularly large for cognates. This is especially compelling evidence because there is no orthographic similarity across the two languages of the study. This indicates that the shared phonology of cognates must be responsible for the priming results.

In recent studies, Marian and Spivey (1999, 2003) have tested the performance of Russian/English bilinguals and monolingual English speakers using eye tracking. This method combines linguistic input and visual input and hence allows the testing of activation of lexical items in one language without overt use of this language in the experimental situation. In each experimental condition, subjects were presented with several objects. In the within language trials objects were included that overlap phonologically within the language of instruction, for example *speaker* and *spear* in English. In the between language competition objects were included that overlap in

Russian and English, for example such as *shark* and balloon (*shar*ik in Russian).

So, in the between language competition trial subjects were presented with a napkin, a horse, a shark and a balloon and instructed in English to “pick up the shark”. If the eye tracking device registers visual fixation on the object which name in Russian overlaps phonologically with the target object (i.e. the balloon) before picking up the shark, there is evidence of activation of the Russian lexical item *shar*ik even though neither this item nor this language was ever mentioned in the testing situation. These results support the between language activation account.

Both monolingual and bilingual subject’s performance was influenced by within language overlapping names in English (such as *speaker* and *spear*), supporting within language activation. However, only the bilingual group was affected in the between language condition. This strongly supports a non-selective view bilingual language activation view. The results from this new type of instrument suggest that the result of parallel language processing is a genuine feature of bilingual cognition, and not an artifact of biased experimental design.

The picture-word interference paradigm

There is a genuine (I hermans (2000) star det att det finns lite forskning, hmm) tradition of picture-word interference studies of bilingual lexical access. I will review one of the later studies here. Hermans (2000) performed a series of experiments with picture naming in the weaker language paired with within and between language distractor words that were either identical to, semantically or phonologically related to the picture. Hermans based his thesis on a language non-selective perspective and expected to find an interference effect in the identity condition as presupposed by Costa et al. (1999).

However, he found that between-language identical distactors produced significant facilitation effects in three of four experiments (experiments 4.1, 4.2, and 4.3). In one experiment (experiment 4.4) the production language varied with a cue preceding each picture naming trial. This mixing of language was assumed to make it impossible for the subjects to predict the name of the picture, and consequently, this experiment resulted in interference effects. Hermans (2000) argue that this is evidence that the between-language identity facilitation is not automatic. Rather, it seems to be the result of the experimental context.

Hermans (2000) also found interference effects in trials with a between-language semantic distractor (Experiments 4.1, 4.4). Semantic interference was also found by Costa et al. (1999), who explain this within a language selective model (see previous chapter). According to this model, a semantically related between-language interfering stimulus word activates its translation equivalent in the target language via the language-independent conceptual system.

Hermans (2000) points out that this proposal could theoretically be correct. However, the semantic interference in Hermans data do not differ in time-course and magnitude within- and between-language trials. It is realistic to assume that an L1 distractor activates the lexical representation of its translation equivalent as quickly and as strongly as does the L2 word itself. If the language-selective account was correct we should observe some differences in within- and between-language conditions, and there is no such difference. Therefore, Hermans concludes that the semantic interference is true evidence of between-language competition.

Limitations of the picture-word interference paradigm

They show that monolingual participants are faster in naming a picture (bed) when presented an IS related by association (sleep), compared to unrelated ISs (shoot).??

The classic picture word interference paradigm effects are semantic interference and phonological facilitation in both monolingual, bilingual single word production. The interference effect is only captured when the interfering stimuli is from the same semantic category as the target word. When the interfering stimuli is associatively related to the target, but is a member of a different category (bee, ?), there is no interference effect observed (reference?). This pattern is problematic for models of the bilingual lexicon because according to these models, selection is by competition and this competition should not be restricted to categorical relations.

When a semantically related IS is a member of the same category as the target word (i.e. mouse-dog) there is a semantic interference effect. But when the IS and the target word are associatively related (i.e. mouse-cheese) there is a facilitation effect (La Heij ?, Alario et al. 2000). When participants have to give a category name to pictures of objects (for example saying “animal” when presented with the picture of a dog) and the IS is semantically related to the target word (i.e. mouse) there is a facilitation effect (Glaser & Glaser, 1989). Since there is not only a lack of semantic interference effect but also a facilitation effect in these conditions, Costa et al. (2003) comments on how important category-level information is in lexical processing within the picture-word naming paradigm. There is also evidence that subordinate target words (poodle) are not interfered by basic-level ISs (dog), but by subordinate-level ISs (spaniel) (Vitkovitch & Tyrrell, 1999). Costa et al. (2003) tested a monolingual group of native speakers of English in picture naming with unrelated distracters. They found a greater interference effect in category naming (animal) when the IS was also a category name (vehicle) compared to a basic-level name (car). This leads to the conclusion that semantic interference effects are restricted to instances in PWI experiments when target word and IS are word from the same category level and belong to the same semantic category. Costa et al. (2003) restates the semantic interference effect as a “semantic coordinate interference effect”.

The importance of category-level information can be interpreted as follows. When the IS is a coordinate from the same category, there is no category information that discards the IS as a competitor. The semantic representation of the target word would receive activation from both the picture and the IS which leads to a faster response relative an unrelated condition. This line of reasoning suggests that lexical selection is categorically restricted since IS from a category different from the target word does not spread activation to its semantic representation.

One alternative explanation to the differences in experimental effects of same-category IS and different-category IS is that these to experiments are very different in design (Roelofs, 1992). Roelofs concludes that the experiments in which the participant names the category of the picture usually has much fewer response items and these are repeated more times during the experiment, compared to a basic-level naming experiments. To test this possibility, Costa et al. (2003) performed a category-naming experiment which was identical in design as an experiment based on category naming which produced interference effects (Caramazza & Costa, 2001). The results of this experiment showed that category naming of a picture (i.e. the picture of a dog is named “animal”) when combined with a semantically related basic-level distractor (cat) produced facilitation effects. This is very different from the interference effects induced by the experiment with identical design but requiring basic-level responses (Caramazza & Costa, 2001). Hence, the semantic interference in category-naming experiments is not the consequence of experimental design.

Costa et al. (2003) conclude that category information exerts influence on lexical access in the PWI paradigm, the assumption being that category-level information is used in the process of determining which semantic representations compete for selection. According to this, only representations at the target category level compete for selection, and hence, target category level information has the function of restricting the competition among lexical items. These findings can lead to the conclusion that the picture-word interference paradigm suppresses the expression of the expression of the category constraint in single-word production. Further research is needed to understand what processes the picture-word interference experiment exactly investigates.

The picture-word interference paradigm operates on the assumption that lexical selection is a process in which activation is spread to the target representation and related representations. The IS activates semantically related representations to such an extent that they compete for selection with the target word, and longer naming latencies are observed. There is actually an alternative view to this, presented by Mahon et al. (2007), according to which lexical selection must not be by competition. They show that monolingual participants name pictures faster (horse) when the IS is semantically close and overlap categorically (zebra) compared to ISs which overlap categorically but are semantically more distant to each other (whale). Interpreted within the PWIP, these results conclude that as IS are becoming semantically closer to the target name, naming latencies are facilitated. According to Mahon et al. (ibid.), this requires us to rephrase two fundamental operating principles of the PWIP; that lexical selection is not by competition, and that semantic interference effects do not reflect a process at the lexical level.

Determinants of bilingual lexical representation

Different factors influence the structure of the bilingual lexicon. Early research (referenser) reported differences in performance in different groups of bilinguals and ascribed these differences to levels of maturation of the bilinguals' two languages (?ska detta stå här och hur???). Later research has started looking at language development from a word-to-word-perspective. Researchers started investigating what factors where responsible for the many different experimental tasks. These factors are determinants of how bilingual lexical structures develop.

Word-type effects

Concreteness

One of the best studied word-type effects is concreteness. Concrete words are responded to faster and more accurately than abstract words (ref.). Studies including only nouns as stimulus words have shown that concrete words are translated faster than abstract words both in fluent bilinguals (De Groot 1992a; Van Hell & De Groot 1998 (Van Hell och De Groot 1998)) as well as beginners (Van Hell & Candia Mahn 1997 (se van hell & De Groot 1998).

Cognate status

The cognate facilitation effect (CFE)

Another word-type effect is the cognate effect. Cognates are words sharing meaning and phonological (and sometimes orthographical) form in different languages. Cognates can be historically related, or be borrowed into one of the language to the other, or from a third language. Swedish/Spanish cognate words are typically of Latin origin. A very strict definition implies historic affinity between words in two languages (referens ?). In this thesis, cognates will be defined as “lexical items from different languages which are identified by bilinguals as somehow being ‘the same thing’” (Carroll, 1992:94). Cognates have traditionally been of interest to second language research because they appear to facilitate long-term learning (ibid.). Recently, cognates have regained interest because of their special statues in terms of processing effects in bilingual production and comprehension. When building a model of the bilingual lexicon, cognates play a central part because they raise the issue of cross-linguistically shared representations.

Cognates have proven to give an effect on cognitive processing in many different tasks. It is well established in the research literature that there is a processing advantage associated with cognate words, involving both production and comprehension. This advantage is generally called *the cognate facilitation effect*; bilinguals produce and recognize cognates faster than non-cognates. In studies on cognate effects across languages, priming tasks are the most frequently used. In these tasks, it is tested whether a word in one language (the prime) facilitates the recognition of another word (the target). When these words are cognates, facilitation is greater compared to when there is no cognate relation between the prime and target (Gollan, Forster & Frost 1997?kolla!). This is evidence that cognates activate and affect each other in processing in different languages.

Other evidence supporting the cognate status and its effect on parallel language activation is that cognates are translated faster than non-cognates (De Groot, 1992; De Groot, Dannenburg & Van Hell, 1994).

In picture naming studies, cognates have proven to be processed faster than non-cognate words. In one experiment, Costa, Caramazza & Sebastian-Gallés (2000) let Catalan-Spanish bilinguals and Spanish monolinguals name pictures which were either cognates (e.g. Spanish *gato* and Catalan *gat* for “cat”) or non-cognate names (e.g. Spanish *mesa* and Catalan *table* for “table”). The bilingual group named cognates faster than non-cognates, and this effect was not present in the monolingual group. In a subsequent experiment, Costa, Caramazza and Sebastian-Gallés let two groups of bilinguals, one dominant in Catalan and one dominant in Spanish, name pictures in Spanish. Both groups named cognates faster than non-cognates, but this effect was larger for the group dominant in Catalan, i.e. the non-dominant group.

A similar effect was obtained in a recognition study by Dijkstra, Grainger and Van Heuven (1999). They perform one progressive demasking task (participants are presented with a target word which is alternated with a mask, and press a button when they recognize the target word) and one lexical decision task with Dutch-English bilinguals. Target words overlapped either semantically, orthographically or phonologically in Dutch and English. The results revealed that participants recognized words with semantic and orthographic overlap (i.e. cognates and interlingual homographs) faster than control words. Words with phonological overlap (i.e. false friends) on the other hand produced longer recognition latencies.

Dijkstra, Grainger and Van Heuven (ibid.) interpret these findings within an extension of the Bilingual Activation Model (BIA), favoring a parallel activation perspective. They explain the cognitive and interlingual homograph facilitation as the result of shared lexical and sublexical orthographic representations across languages. Because they share representations at orthographic level, there is a stronger activation of these representations, and this leads to faster response latencies. They follow De Groot (1992) in assuming that the meanings of words are represented as distributed semantic features. The cognate facilitation effect is then explained by the activation of shared semantic features. The longer response latencies associated with phonological overlap is explained as a consequence of the activation of two different representations at the lexical level, which compete for selection.

Dijkstra and Van Hell (2001) also found cognate facilitation in a lexical decision task performed with Dutch-English-? trilinguals. They found that recognition was faster for L1 target words with cognates in L2 relative non-cognates. They also found a small facilitation effect for L1 target words with cognates in L3 relative non-cognates. In word association experiment with the same population, Dijkstra and Van Hell (ibid.) also found that L1 words with cognates in L2 were responded to faster relative non-cognates, and L1 words with cognates in L3 were responded to somewhat faster than non-cognates.

In an earlier studie, Van Hell and De Groot (1998) also show cognate facilitation effects in word association. Their word association task is within and between languages and the results reveal that cognates have greater facilitation effects between languages than non-cognates. The authors determine that cognates share conceptual features between languages. Sherkina (2003) points out that not all cognates share all their semantic features across languages. Some cognates have a more narrow interpretation in one language, and others have a wider interpretation. One example is the Russian word *gospital* which only refers to a military hospital, and *restoran* which refers only to restaurants with waiters. This leads Sherkina to conclude that the CFE is likely to occur in the recognition component, and not in the association. This would explain the similarity in results in the lexical decision task and the word association task.

Strijkers et al. (2010) investigate the frequency effect and the cognate effect with ERP methodology. They wish to establish the locus of these to effects in bilingual picture naming.

How to account for cognate effects within models of the bilingual lexicon

A model of the bilingual lexicon must be able to account for two things; cross-linguistic effects, and how the bilingual manages to use one language at the time. Generally, models assume representational levels at three stages; conceptual, lexical and phonemic, and the last two are assumed to be part of the lexicon. Most researchers assume that the conceptual level is common for the two languages of the bilingual, this is based on a large amount of experimental evidence (referenser), and models differ in how they describe the lexicons. All models concerned with cognates, explain the CFE by applying shared representations on one of, or on both the semantic and lexical levels.

The Cascaded Activation Model (Caramazza, 1997) assumes three levels of representation for entries in the mental lexicon; representations are distinct at the conceptual, lexical and phonological level. Representations can not be shared across the bilinguals' two languages at the lexical level, only at the conceptual and the lexical level. The bilingual has a common conceptual store and two language-specific lexicons. The lexicons contain a level of lexical representations and a level of phonemes. The production process is assumed to a selected concept activates its form in both lexicons. The lexical representation in the target language is selected and spreads activation to its phonemes. The lexical representation in the non-target language is inhibited (?kolla?) but spreads some amount of activation to its phonemes as well. Since cognates share phonemes the target phonemes are activated more strongly compared to other words, these are produced faster (Costa, 2000).

This model is based on data from bilingual speakers of Catalan and Spanish. These languages are typologically close and the phonemes of cognates are truly similar. This is a problem with this model, it is assumed that the phonemes of cognates in the two languages are similar to such extent, that it speeds up production.

The model developed by De Groot and Nas (1991), also assumes common conceptual storage and separate lexicons. The lexical representations of cognates have direct links between them, similar to words within the same language which are linked because of phonological similarity. This can explain the priming effect of cognates (?) but not the CFE.

In a different model, De Groot and Van Hell (1998) describe lexical entries as distributed representations. A word is represented as a pattern of activation in a network of interconnected features. The meaning of a word consists of an activation pattern at the conceptual level, the form consists of an activation pattern at the lexical level. Words with overlapping meaning or form have overlapping activation patterns on the pertinent processing levels, within and across languages. Degree of overlap varies with each word adding a nice flexibility to the model which is favorable since not even cognates are always completely similar in meaning or form across languages. One problem with the model is however, the fact that bilinguals tend to keep their languages apart is not explained.

Wilson (1999) has developed a model, the Overlapping Distributive model, which is based on the same basic assumptions as De Groot and Van Hell (1998). Representational nodes are interconnected within and between levels languages, within and between languages, and feedback is allowed (gäller också De Groot och Van Hell?). Wilson adds a clustering feature to the model, which allows explaining how parts of networks and whole networks are linked closer together. In short, more complex parts of the network are clustered together. The clusters form as a natural consequence of the spreading activation architecture of the processing system because links are strengthened when nodes are activated together.

This model can successfully explain the word frequency effect since nodes that are often activated together have stronger links, and stronger links means faster activation. Nodes which tend to be used together activate each other to a higher extent compared to nodes which are usually not activated together with them. The model can also explain how bilinguals succeed in separating their languages. Since words from one language tend to be used together, the links between them are stronger. This explains why the between-language effects are weaker than within-language effects. The CFE is a consequence of the same processing architecture; since most of the features of a cognate, at all levels, are activated together in both languages, links are strengthened between them.

Neither Van Hell and De Groot (1989), nor Wilson (1999) account for a syntactic level of processing in their models. This is a result of basing the model on experimental data which includes isolated word production and/or recognition. Nevertheless, this is a problem with the models since isolated single word production is very rare in natural speech production and comprehension. Bordag (2003)…

The word frequency effect

Learning context

Factors determining language selectivity

It is a widely accepted fact that bilingual language processing activates representations of different languages in parallel. This non-selectivity is a matter of degree and may vary with language-internal factors (i.e. word type effects, the word frequency effect, the cognate facilitation effect, word length effects) and language-external factors (language proficiency in both L1 and L2, context of learning, immediate context of language use).

Cross-linguistic influence is harder to detect when bilinguals use their first language compared to when they use their second language (Haigh & Jared, 2007). This is similar to the way language context influences the degree to which the two languages of a bilingual are activated simultaneously.

According to the bilingual language mode hypothesis (?) by Grosjean 2000) the bilingual…

L2 learning in the natural setting of the target language is generally a more successful way to learn a second language than learning in the classroom. Link, Kroll & Sunderman (2009) tested two groups of native speakers of English who was learning Spanish as a second language. One group was immersed and one group learned in the classroom. They

Language proficiency

As described above, earlier research reported results from picture naming and word translation in bilingual adults of different proficiency levels. The results were interpreted to support a subordinate structure in low-proficient bilinguals and a compound structure in high-proficient bilinguals. Level of proficiency was seen as determining the overall structure of bilingual lexical memory and the developmental shift from one structure to another was based on maturational processes affecting the lexicon as a whole.

Later research has revised the maturational hypothesis and today evidence has been presented that supports a word-by-word-perspective. Words are

Outline of the present study

As described in the research overview in the previous chapter, cross-linguistic activation is an uncontroversial issue. Research is focusing on different activational aspects and on factors in the experimental setting which may have possible impact on test results. Too little research has investigated how different participant groups differentiate on the same tasks. In pursuing this line of inquiry, this thesis investigates cross-language interference effects of different stimuli pairing in a bilingual picture-word setting. The results show differences in lexical processing as a consequence of word type effects (cognate status) and participant groups with different amount of time spent in an informal setting with natural L2 input. The following research questions are explored:

A. Word type effects on bilingual lexical processing:
   - How are semantic and phonological interfering stimuli processed, compared to unrelated conditions, by bilinguals?
   - Does cognate status have an impact on this type of bilingual lexical processing?

B. Is there a difference in bilingual lexical processing depending on the length of L2 immersion?

Two cross-modal picture-word interference tasks were designed to address the research questions. Both experiments have an overtly bilingual design as they were performed in the L2 of Swedish/Spanish successive and balanced bilinguals. Experiment 1 includes concrete, high frequency nouns. The second experiment is built both out of stimuli from experiment 1, and Swedish/Spanish cognate words. These experimental designs address research question A. Participants have spent differing amount of time in a natural L2 setting. By running the test results according to two groups depending on amount of natural L2 exposure counted in months, research question B will be answered.

Population

All participants in the present study were selected from three Swedish universities[6]. The 37 bilingual participants were approached on course time

[6] The author is deeply grateful to the universities of Uppsala, Stockholm and Gothenburg for help with data collection.

of Spanish at different levels. Twenty one were recruited from the first semester, 10 from the third semester, and 6 from the fourth semester.

The majority of the participants, 30, are successive second language learners of Spanish. They are native speakers of Swedish, with Swedish speaking parents, and they have learned Spanish as a foreign language at school. Seven of the participants are highly balanced Swedish/Spanish bilinguals; they have one or two Spanish speaking parents and they have been exposed to Spanish at home. For six of the highly balanced bilinguals, both languages were introduced simultaneously. For one of them, Swedish was introduced first and Spanish was introduced at the age of three. At the time of the present study, they all report Swedish to be their dominant language, but they consider their proficiency in Spanish to be almost as good.

It is hard to find young people in Sweden who know Spanish as a second language. For the balanced participants in the present study, Spanish is clearly their L2. For the successive learners however, the situation is different. To be accepted to study Spanish at university level, studies at compulsory school or upper secondary school are required, and these include English training from very early on. Here is a brief description of the language training that all foreign language learners receive previous to studies at university level (the information in this section is taken from the website of the Swedish National Agency for Education: www.skolverket.se).

The Swedish primary and secondary school system consists of nine years of regular compulsory schooling, between 7 and 16 years of age[7]. Before year 2000, English training was introduced in the fourth grade; this is the case for all participants in this study[8]. In seventh grade (at 13 years of age), Spanish among other subjects is offered as optional language studies. Which languages are offered as optional studies differ between schools, but the most common languages are Spanish, German and French. Since by this time, the students' English is well established, Spanish must be considered their third language. Students can also choose to start studying Spanish later, in non-compulsory school, and for students who has already studied a third language, Spanish them becomes their fourth language. The point to be made here is that although Spanish is referred to as an L2 throughout this thesis, it is rather a third or a forth language for the successive second language learners. Since English is introduced so early in school, it is impossible to find enough participants who have Spanish as their second language. It also proves difficult to find enough participants who know only English and Spanish, apart from their mother tongue. Some of the participants know other languages as well. This will be explained in detail below.

[7] Most students continue three years of upper secondary school which is non-compulsory.
[8] Today it is generally introduced as early as in the second grade. But this does not apply to any of the participants of this study.

Compulsory and upper secondary school offer language studies in Spanish from level 1 to 7. To gain access to Spanish at basic university level students are required to have attended courses corresponding to level 3. An estimation of teaching hours corresponding to level 3 is between 250 and 300 (one hour equals 60 minutes)[9]. The university offers courses from basic to advanced levels which are distributed over four academic semesters. During the last two semesters, all students write papers which grant them with a university degree such as a bachelor of arts and/or a master of arts in their third and fourth semester respectively.

It is very common among students, to spend time in Spain, or South America, as part of their education, or with intentions to improve their level of proficiency outside of course requirements. This leads to a situation where there is no correspondence between university course level and proficiency level. A student might have spent a year working in Spain and then starts studying Spanish at the University in Sweden. This student will be at the same university course level as a student who comes directly from upper secondary school, who has never been to a Spanish speaking country. The proficiency level of these two students will differ significantly, especially from a processing point of view. It is widely accepted that the context of immersion enhances L2 processing (see chapter 1 for an overview). Because of this, it is not a fruitful approach to divide the learners into groups according to their corresponding course level. Therefore, this study is based on the division into two bilingual groups depending on their length of L2 immersion, counted in months.

Twenty three of the participants have been to a Spanish speaking country for 12 months or less, and 14 of the participants have spent more than 12 months in a Spanish speaking country. This group division intersects the division of participants corresponding to course levels. The less immersed group consists of 14 participants at the first semester, 7 participants at the third and fourth semester, and 2 balanced participants. The more immersed group consists of 2 participants at the first semester, 7 participants at the third and fourth semester, and 5 balanced participants. See table 1.

To obtain a full understanding of the participants' individual language backgrounds, they were subjected to a language background questionnaire for prior language experience and proficiency information (see appendix A for an English translation of the questionnaire). Ages across all participants varied from 19 to 40, with a mean of 24.65 (SD = 4.62), and the majority are females (83%). The information gathered with this questionnaire is summarized in table 1, following Brown & Gullberg (2008). The information is presented for two bilingual groups, one with participants who have had less L2 immersion and one group with participants who have had more L2 immersion.

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[9] The teaching plans differ somewhat between schools depending on local authorities.

Table 1: Summary of biographical information, bilingual participants

Language background	**Less immersed group**	**More immersed group**
Mean AoE[a]	16.53 (range: 12-25)	0.43 (range: 0-3)
Mean usage[b]	19.52 (range: 1-70)	26.79 (range: 10-45)
Mean self-rating	2.59 (range: 1-4)	3.64 (range: 3-4)
Mean test score[c]	45.78 (range: 27-59)	54.43 (range: 42-60)
Mean length of immersion[e]	4.52 (range: 0-12)	37.57 (range: 13-144)

[a]Age of exposure to L2
[b]Mean usage of L2 in percentage of a regular day
[c]Mean score on Spanish proficiency test. Maximum test score is 64.
[d]Length of L2 immersion counted in months

Language proficiency was measured in two different ways; subjective proficiency ratings and a language proficiency test. The results of both of these measures support the group division depending on length of immersion in months, as presented in table 1 above. The proficiency test was distributed at the last experimental session, and participants were requested to complete the test at home and send it back to the researcher. They were encouraged to complete the test individually, in a quit room, and not exceed the time limit of 60 minutes. The test was composed by different parts of available online tests from language websites (see appendix B for an English translation of the test). The test measures grammar, vocabulary and reading comprehension in four different sections. Test scores differed significantly between the two bilingual groups (F (1, 35) = 11.93, p = .001), suggesting that the group with more L2 immersion have a higher degree of L2 proficiency compared to the group of participants with less L2 immersion.

As part of the language background questionnaire, participants had to rank their overall proficiency in all their languages from 1 to 5 (5 being the highest ranking). All learners ranked their proficiency in Swedish as 5. The difference in subjective proficiency rating in Spanish differed significantly between the two groups of participants (F (1, 35) = 22.58, p = .000), suggesting that the group with more L2 immersion perceive themselves as more proficient than the group of participants with less L2 immersion.

Participants had to give information about the amount of their regular usage of Spanish, including both Spanish class time and the rest of their day. The question was: *Try to estimate your total usage of Swedish and Spanish in percentage.* This information shows that all participants used Spanish on a daily basis at the time of this study. It also reveals that the group who has spent more time in a Spanish speaking country uses Spanish slightly more in their everyday life.

Since the bilingual population in this study is actually multilingual, one important piece of information to gather in the language background questionnaire is how many languages each participant knows and how well they perceive themselves to know each language. Out of the 37 participants, 17 participants know no other language a part from Swedish, English and Spanish. Thirteen participants know one additional language, and 7 know two additional languages. These additional languages are French, German, Portuguese, Norwegian, Italian and Hebrew. Since the most common optional languages offered in secondary school a part from Spanish are German and French, it is natural that these languages are the most common among the additional languages of the population (see appendix C for detailed information about the participants' additional languages and their subjective proficiency ratings of each language.

Eleven participants (29.7%) report knowing German. Their mean subjective proficiency ranking is 2. Nine participants (24.3%) report knowing French. Their mean ranking of proficiency is 2.3. Only two participants know both German and French. Out of the 20 participants who know one or two additional languages, 17 participants report to have lower proficiency in their additional language/languages than in Spanish, 1 participant report the same proficiency level in Spanish as additional languages, and 4 participants report one of their additional languages to be somewhat higher in proficiency than Spanish.

As described in chapter 1, recent research has successfully demonstrated that a third language can exert some degree of influence on second language processing (referenser?). Since so many of the participants know German (a Germanic language just like the participants' L1) and so many know French (a Latin language, just like the participants' L2 and the target language of the study), the possible crosslinguistic influence form French and German must be examined. Therefore, this division of participants into three groups is employed in a post hoc analysis to scrutinize whether there might be some influence from a third and a fourth language during L2 processing.

Eighteen subjects participated in the control group. They are native speakers of Swedish, and they reported having no knowledge of Spanish, French, Italian or Portuguese. They were recruited at the faculty of languages at Uppsala University and they received a cinema ticket for participation. Mean age in the control group is 25.72 (range: 20-61, SD 9.37). All bilingual participants are tested in their L2, and the control group is tested in their L1. Because of this, the results of the control group are not directly comparable with the bilingual results. However, they serve as a control of the experiment and the picture stimuli.

The monolingual group seems fairly straight forward. However, this is not the case. This group is not really monolingual, since they were all subjected to the Swedish school system, they are all highly proficient in

English. Eight of them are also proficient in German, and several know additional languages, such as Arabic, Chinese, Norwegian and Swahili.

Unique features of the present study

Five important features make this study unique, and we can therefore expect at least some degree of deviance in results compared to what is generally reported in the research literature. (1) Participants are grouped according to length of L2 immersion. This is highly unusual in experimental studies. Usually, participants are approached at different course levels at university, which reflects differences in proficiency. As was described above, this approach is not fruitful with the participants in this study since it is quite common among young people to travel to Spanish speaking countries and study the language in a natural environment. So some of the participants who study the first semester of Spanish at the university have been to Spain for a year and some of the participants who are at the third semester have never been to a Spanish speaking country. This makes the grouping by means of length of immersion a more natural one.

In many studies, participants are divided in different proficiency groups based on scores from a target language proficiency test. In these studies, a well established proficiency test is used, which make the grouping comparable across studies. The language proficiency test in this study was composed for the present experimental study alone, and the scores cannot be used to compare participants across studies. This is why test scores were not used for grouping of bilingual participants.

(2) A second feature which makes this study unique is that the L2 proficiency level of the less immersed group is much lower than what is usual in bilingual studies in general, and the picture word-interference paradigm (PWIP) in particular. Usually, studies within the PWIP do not examine picture word-interference across proficiency at all. It is more usual just to look at one group of bilinguals, and this group is always highly proficient in their L2. The participants in this study are not equally fluent. The participant group with more L2 immersion is well to highly proficient. But the less immersed group is much less proficient than what is common in this type of research. They are not only low proficient; they are rather at the very beginning stages of acquisition. The results of the present study can give us important insights into what happens at the very early stages of acquisition in bilingual lexical processing.

(3) All participants in this study have none to very little prior experience with experiments. Only three participants report ever being part of an experiment before and it was very different from the present experiment. The rest of the participants had never been in an experimental situation before at all. Most bilingual experimental studies are performed in a permanent university laboratory, and participants are recruited several times

during their education[10]. These participants are highly familiar with everything about an experimental setting. This was very different for the participants in this study.

(4) Most studies within the PWIP are based on language pairs which are typologically close to one another to such an extent that they are referred to as cognate languages. Cognate languages share 70% of their lexicon (referens?). Many studies involve English and Dutch (referenser). Others involve Spanish and Catalan (referenser). There are very few studies on English and Spanish (Sunderman & Schwartz, 2008) and one on English and Chinese (Hoshino & Kroll, ?). The language pair in the present study is unique in two ways. First, there is no previous bilingual experimental study involving Swedish and Spanish. Secondly, Spanish and Swedish are typologically distant. Kellerman (1983) talks about perceived distance between languages and argues that this can affect how a second language is processed.

(5) A fifth feature which makes this study unique is that many of the participants are highly multilingual; all of them are proficient in three languages, 32.43% are proficient in four and 18.92% are proficient in five languages. By coincidence, most of the participants who are proficient in four languages know German (8 out of 12), and most of the participants who are proficient in five languages know French (6 out of 7). This is very interesting since German is typologically close to the L1 and French is typologically close to the L2. This makes this study unique because we have the opportunity to investigate crosslinguistic influence from a third language in L2 processing.

The experimental task design

The experiments used in this thesis are two cross-modal picture-word interference tasks with different composition of picture stimuli. The picture-word interference task is a modified version of the Stroop task. It is developed to include stimuli from different languages in order to tap competition between words in L1 and L2 in single word production. Naming latencies are measured in milliseconds and are assumed to vary as a function of the relationship between the interfering stimuli (IS) and the picture.

When the test is performed with only visual stimuli, the IS is written across the picture. When it is performed in a cross modal fashion, the IS is presented over headphones. Normally, the data consists of response times and error rates. In a comprehension task, subjects respond by pressing a button to react to something, for example if the stimuli pairs are congruent (same language) or incongruent (different languages). In a mixed modal

[10] Usually there is a limitation as to how often students are allowed to participate in experiments. This is to ensure that no experimental effects are transferred between studies.

task, subjects respond by producing the name of the picture in the instructed language while being auditorily exposed to the IS. This kind of task combines production and comprehension.

The present study is bilingual and cross-modal. Participants are presented with pictures and are required to name them in L2; Spanish. At the same time, they hear words in L1 over headphones. Picture names and ISs are related in different ways; this will be referred to as different types of ISs. See table 2 for examples of types of ISs. Each picture is presented once with a semantically related word, once with a word which is phonologically related to the target word, once with a word which is phonologically related to the name of the picture in the non-target language, and once with a word which has a neutral relationship to the word. Of course, in the experiment including cognates, there is only one phonologically related IS.

The task is designed to investigate whether response times vary as a function of the relation between target word and the IS. If they do vary, this is assumed to reflect the different types of lexical processing for different types of lexical items. See table 2 for examples of picture names and related ISs in Experiment 1, and table 3 for Experiment 2. The semantically related IS is assumed to generate longer naming latencies, compared to an unrelated condition. This is assumed to reflect competition between lexical items. The IS which is phonologically related to the target word is assumed to shorten the naming latency, compared to an unrelated condition. An IS which is phonologically related to the non-target name of the picture (i.e. the L1 translation equivalent of the picture name) is assumed to longer the naming latencies even more than the semantically related condition, because the L1 name of the picture is assumed to be activated to such extent that competition occurs.

Table 2: Examples of picture names and ISs; Non-cognates

Picture name	**Four types of interfering stimuli**			
	Unrelated	Semantic	Phonological, target word[a]	Phonological, non-target word[b]
<u>Mu</u>ñeca/<u>Do</u>cka (doll)	Lampa	Nalle	<u>Mo</u>rot	<u>Do</u>lk
<u>Nu</u>be/<u>mo</u>ln (cloud)	Gaffel	Himmel	<u>No</u>s	<u>Må</u>ltid

[a]An IS which is phonologically related to the target name of the picture
[b]An IS which is phonologically related to the L1 translation equivalent of the name of the picture

Table 3: Examples of picture names and ISs; Cognates

Picture name	**Four types of interfering stimuli**		
	Unrelated	Semantic	Phonological
Muñeca/Docka (doll)	Lampa	Nalle	Morot
Nube/moln (cloud)	Gaffel	Himmel	Nos

Experimental material

Pictures were chosen from the battery of 290 pictures compiled by Pérez & Navalon (2003). These are standardized for Spanish according to the five variables proposed by Snodgrass & Vanderwart (1980): name-agreement, image-agreement, familiarity, visual-complexity and image-variability. Pérez and Navalon (2003) added a sixth variable to their study which describes age of acquisition. See appendix F and G for the pictures chosen for the two experiments.

All picture names in the experiments are high frequency words known to all participants. To establish variations in degree of familiarity among the picture names, subjective measures are used. These depend on participants ratings of how well they know the words included in the experiment (see appendix D for familiarity ratings). Participants were given a list of all the target words together with a rating scale from 1 to 7. They were asked to rate their familiarity for each word and report 1 if they had never heard the word before, and 7 if it was a word they use quite often. This way to establish word frequency is more reliable in bilingual studies than using large language corpora (Van Hell, personal communication). No familiarity rated mean is below 3. The lowest mean is for the picture *camello* (camel), rated 3.37, by the group with less L2 immersion. This means that all words are well known to the participants. See appendix E for a presentation of the subjective familiarity ratings for each target word, and summarized for the two bilingual groups of participants.

The related ISs were chosen carefully as to match the picture names as much as possible in terms of concreteness, frequency, word length and in the case of phonological overlap; phonetic similarity. It was a challenge to find Swedish words which would match the Spanish picture names on these criteria. Concerning phonologically related IS, overlap with target word consists of the first two phonemes (RANA (frog) - *rabatt* (flower bed))[11], or in the case of initial consonant clusters, three phonemes (FLECHA (arrow) – *fläkt* (fan). This is followed as much as possible. However, when it has not been possible to find ISs fitting the criteria, more overlap has been allowed (as in the following: PANTALÓN (pant) – *panna* (frying pan), TENEDOR (fork) – *tändsticka* (match), LÁMPARA (lamp) – *lamm* (lamm). Concerning the semantically related ISs, a strong associative relation has been avoided as much as possible (for a description of the problems involved in cases of strong associative strength between semantically related ISs and the name of the picture, see La Heij, Dirkx & Kreamer, 1990). Care was taken that the semantically related ISs were not phonologically related to the picture name in either L1 or L2. Care was taken not to include pictures with high frequency synonyms. And semantically related ISs were never phonologically related to any synonyms of the name of the pictures.

Swedish and Spanish are typologically quite different from one another concerning the structure of words. Swedish has a fairly high tolerance to consonant clusters, while Spanish hardly allows them at all. This fonotactic difference between the languages generates a considerable difference in general word length. Spanish words are generally longer than Swedish words, and this is impossible to avoid in building the experiment. This makes it difficult to match picture names and the interfering words on number of phonemes and syllables. The ISs are matched so as to differ only in one syllable, as much as possible.

The words from the semantically and the phonologically related conditions were repaired with other pictures in order to serve as the unrelated condition. This means that the Swedish word *morot* (carrot) is used as a phonologically related IS to the picture MUÑECA (doll) and is then repaired with the picture REINA (queen) as the unrelated condition. Care was taken that there was no semantic or phonological relation to either L1 or L2 picture name and the unrelated ISs.

Apparatus

The experiment is programmed using Superlab Pro 2 software, developed by Cedrus Corporation (www.cedrus.com). The experiment is run on an IBM T40 notebook. Auditory stimuli are presented over headphones at a comfortable listening level. The subjects name the pictures into a microphone attached to the headset. The stimuli pairs of pictures and words

[11] When picture names and ISs are described, the following conventions are adopted. Target word is presented in capital letters: RANA, this is followed by the English translation in parenthesis (frog). The IS is presented in lower-case italic letters: *rabatt*, followed by the English translation in parenthesis (flower bed). Phonological overlap is marked by underlined segments.

are synchronized and the measurement of response time is measured from the stimuli onset until the onset of the subjects' naming response. Naming latencies are measured by means of a voice key with an accuracy of 1ms. Words and pictures are presented simultaneously and the pictures remain on the screen for 3000 Ms. After 3000 Ms the next picture and IS appears automatically.

Procedure

Participants were tested individually in a quiet room. Before the experiments, all participants filled out the language background questionnaire. Then they were seated in front of a portable computer for their first experimental session. Test instructions were given orally in Swedish. The majority of the participants were not used to taking part in experiments[12] and oral instructions were chosen to create an environment which would make the subjects relax. Participants were told that they would be presented with pictures on the computer screen and at the same time they would hear single words in Swedish through the head phones. They were instructed to name the pictures by their pre-specified name in Spanish as quickly and as accurate as possible while ignoring the distracter words.

Before starting each test, all pictures were presented offline and the participant was asked to name them in Spanish. This was to make the participant aware of which pictures would appear in the experiment and establish their correct names. After this offline familiarization, participants were familiarized with the online task during a short warm-up training session consisting of 8 trial pictures paired with unrelated Swedish distracter words. None of the pictures or distracter words in the warm-up session was included in the actual experiments.

Additional instructions were provided during or after the practice session if required. The experimenter remained in the room throughout the experiment. Order of experiments were counterbalanced such that half of the participants concluded Experiment 1 (with only non-cognates) in their first experimental session and experiment 2 (which included cognates) in the second session. The other half concluded the experiments in the opposite order. Following the second experimental session, participants filled out the form for familiarity assessment of all the picture names in the L2 included in both experiments.

The non-cognate experiment took 7 minutes and the cognate experiment took 5 minutes to complete. Together with the questionnaire and frequency assessment, each session took about 15 to 20 minutes for each participant. At

[12] Only a handful of the participants had ever participated in an experiment before, and never in any kind of experiment even closely related to the ones used in this study.

the end of the second experimental session, the participants received a L2 proficiency test. They were asked to complete the test at home, in a quiet room, within the time limit of one hour. They were given pre-stamped envelopes with the experimenters' addressed, and asked to post it as soon as they could. Participants received one cinema ticket for both experimental sessions. An additional ticket was sent to them (together with the L2 proficiency test result) as they sent in the L2 proficiency test. Only a few students did not complete the language proficiency test. These were not included in the study.

Experiment 1, non-cognates

Statistics

The statistics chosen for this study is a one between and one within repeated measures design. The between-subjects factor is length of L2 immersion, counted in months. This factor divides subjects into two groups, participants having spent one year or less in a Spanish speaking country and participants having spent more than one year in a Spanish speaking country. The within-subjects variable is the relation between target word and IS, which can be either unrelated, semantically related, phonologically related to the target word or to the translation equivalent of the target word.

Since some word type factors known to affect monolingual and bilingual processing were not managed to be completely controlled for in this study, such as word length and log frequency, an extra source of variability is expected in the data. This will be controlled for by means of an Anova with item as random factor. Hence, separate analyses were conducted with participants and items as dependent variable, yielding $F1$ and $F2$ statistics, respectively.

In the participant analysis of experiment 1, target word-relation was within-subjects variable, and length of L2 immersion was the between-subjects factor. In the item analysis, target word-relation is the between-items factor and length of immersion is the within-items variable. Planned comparisons are conducted to establish significance among levels of the within-subjects variable and the between-subjects factor.

Method

The experiment consists of 16 pictures[13], each picture is presented 6 times during the whole experiment. Simultaneous with the picture, there is an auditorily presented IS which is related to the target name in three ways; semantically, phonologically to the target name, or phonologically related to the non-target picture name (i.e. the L1 name of the picture). These three types of ISs are repaired to create unrelated filler conditions. Care was taken that there was no semantic relation to the picture or any phonological similarity between the IS and the picture name in L1 and L2 in the unrelated condition. This yields 144 trials for each participant; 16 semantically related, 16 phonologically related to the target picture name, 16 phonologically related to the non-target picture name and 48 unrelated. Picture and IS-pairs were arranged in a semi-randomized order, the same order for all participants. No word or picture appeared with less than 6 items in between its several appearances.

When the data was collected, the unrelated ISs were reduced to equal the experimental conditions in number. All experimental items were divided into three sections, based on trial order in which they appeared in the experiment; beginning, middle and end. The same amount of items was randomly deleted within each section. A list was generated with randomized numbers which was used to delete 32 unrelated conditions equally distributed over the three sections (http://www.random.org/integers/). Once reduced to the same size as the other experimental conditions, the naming latencies produced in the unrelated conditions could be compared to the semantically and phonologically related conditions. The analysis of experiment 1 is based on 64 trials, 16 x 4 experimental conditions.

Results

Accuracy scores

All trials with null responses were eliminated. Some of these were due to subjects' insufficient proficiency and others where due to technical problems. In addition; responses naming latencies deviating more than 2 SDs from the item mean in the relevant condition were deleted. A total of 14.86% of the data are eliminated, out of which 3.04% are outliers, 5.79% are technical errors and 6.08% are true errors. The remaining part is treated as accuracy scores, 85.14% of all naming responses. See table 4 for accuracy score percentages for the two bilingual groups.

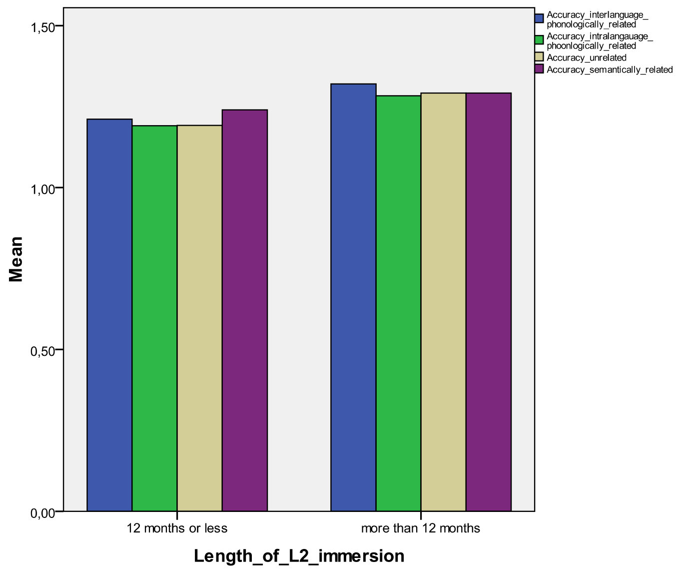
[13] Eight pictures had to be eliminated from the original set of 24 pictures because they induced too many errors (over 30%).

Table 4: Mean accuracy percentages, bilingual groups, Experiment 1

Picture IS-relation	**Bilingual groups**	**Mean accuracy %**
Interlanguage phon	Less input	83.70
	More input	88.84
Unrelated	Less input	81.79
	More input	88.84
Semantically related	Less input	84.24
	More input	89.29
Between lang phon	Less input	81.52
	More input	88.84

Analysis of variance was conducted on the accuracy scores. IS serves as within-subjects variable and group assignment in terms of amount of L2 immersion serves as between-subjects factor. To obtain data with a normal distribution, the analysis is based on Arcsine values of accuracy score percentages, following Howell (2002). The following formula was used in Excel: =ASIN(SQRT(cell/100)). The main effect of accuracy reached significance in the item analysis only, ($F1$ (3, 33) = .56, p = .644, Z .049, $F2$ (1, 60) = 17.17, p = .000, Z .222). No interaction effect emerged in either analysis ($F1$ (3, 33) = .24, p = .867, Z .021, $F2$ (3, 60) = .15, p = .929, Z .008).

Planned comparisons were performed to further investigate the main effect of accuracy scores on experimental condition. Since there was no interaction effect of accuracy and bilingual group, the analyses are performed on all participants. (Här borde jag kanske göra planned comparisons på alla deltagare.) Graph 2 illustrates the difference in accuracy scores between the bilingual groups.



Graph 1: Accuracy scores percentages, bilingual groups, Experiment 1

Discussion

Due to very high sensitivity of the experimental equipment, the total loss of responses contains a high amount of technical errors. This could be the reason that the accuracy scores do not reach significance. However, there are some interesting trends to mention. The more immersed bilingual group has a slightly higher degree of accuracy for all experimental conditions compared to the less immersed group. This follows the expected pattern.

Accuracy scores for the more immersed group are equal across conditions, with one exception. The condition with an IS which is phonologically related to the target name has slightly higher accuracy scores than the other conditions. This tendency is also present in the less immersed group, however somewhat smaller. The less immersed group has higher accuracy scores on the semantically related condition. I want to underline that these are only behavioral trends, since no statistical significance was reached to support the differences.

Given that higher accuracy scores is interpreted as facilitated processing, we should expect shorter naming latencies in the target-phonologically related condition in both bilingual groups and in the semantically related condition in the less immersed group. Analysis of the naming latencies will reveal whether these predictions are corroborated.

Control group; Analysis of accuracy scores

Data from the monolingual control group was given the same treatment as the data for the bilingual groups in terms of elimination of null responses and outliers. A total of ?% of the data are eliminated, out of which ?% are outliers, ?% are technical errors and ?% are true errors. The remaining part is treated as accuracy scores, 83.07% of all naming responses. See table 5 for accuracy score percentages for the monolingual control group.

Table 5: Mean accuracy percentages, monolingual group, Experiment 1

Picture IS-relation	**Mean accuracy %**
Interl. phon	85.76
Unrelated	81.73
Semantic	83.89
Between pho	85.10

Analysis of variance was conducted with IS as within-subjects variable. The analysis is based on Arcsine values of accuracy score percentages in order to obtain data with a normal distribution, following Howell (2002). The following formula was used in Excel: =ASIN(SQRT(cell/100)). There was no significant main effect of accuracy in either participant or item analysis, ($F1$ (3, 15) = .904, p = .462, Z .153, $F2$ (3, 60) = 1.18, p = .325). The monolingual control group has very similar accuracy scores on all experimental conditions. In other words, type of relation between picture and IS, does not affect processing to such an extent that it influences monolingual accuracy. Based on these results, we can not expect large differences in monolingual naming latencies.

Naming latencies

The bilingual groups

Analyses on naming latencies are based on accurate naming responses only. Table 6 shows the distribution of mean response latencies as a function of target word and IS. Analysis of variance was conducted with participants and items as random factors and type of IS as within-subjects variable and amount of L2 immersion as between-subjects factor. A main effect of distracter type was observed ($F1$ (3, 33) = 3.66, p = .022, Z .250, $F2$ (1, 60) = 20.52, p = .000, Z .255). The interaction effect between type of distracter and bilingual group was significant in the subject analysis and nearly significant in the item analysis ($F1$ (3, 33) = 3.15, p = .038, Z .223, $F2$ (3, 60) = 2.58, p = .062, Z .114).

Table 6: Mean naming latencies, bilingual groups, Experiment 1

Target word IS-relation	**Bilingual groups**	**Mean naming latencies**	**SD**
Interlanguage phonologically related	Less immersed	999.30	92.31
	More immersed	933.37	123.21
Unrelated	Less immersed	980.55	105.79
	More immersed	937.33	133.93
Semantically related	Less immersed	969.42	94.01
	More immersed	961.63	131.11
Between-language phonologically related	Less immersed	1012.88	110.74
	More immersed	987.34	129.39

To further investigate the two-way interaction, planned comparisons were performed with a Bonferroni correction. For the group with less L2 immersion, the naming latencies for the semantic condition were significantly longer compared to the between-language phonological condition (t (22) = 2.46, p = .022). For this participant group, two other condition pairings nearly reached significance; naming latencies for the between-language phonological condition was longer compared to the unrelated (t (22) = 2.08, p = .050) and the naming latencies for the within-language phonological condition was longer compared to the semantic condition (t (22) = 2.041, p = .053).

For the group with more L2 immersion, the inter-language phonological condition was significantly shorter compared to the semantic condition (t (13) = -3.41, p = .005) as well as compared to the between-language phonological condition (t (13) = -2.51 p = .026). The between-language phonological condition was slightly longer than the unrelated which nearly reached significance (t (13) = 1.98 p = .069). Graph 3 displays the naming latencies for all experimental conditions separately for the two participants groups. See table 7 and 8 for results from planned comparisons for the two bilingual groups.

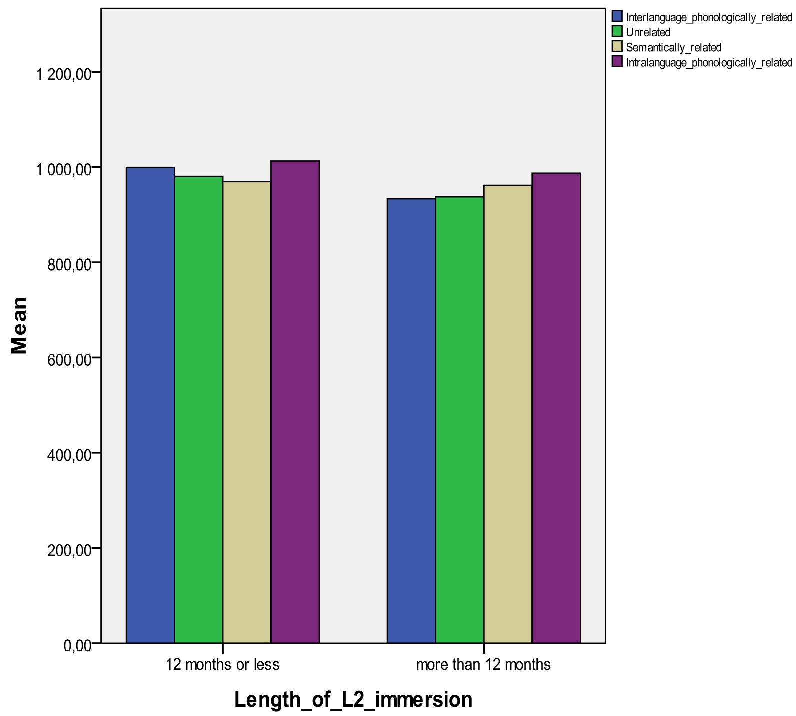
Table 7: Planned comparisons, naming latencies, less immersed group, Experiment 1

Type of IS	Df	T	Sig. (2-tailed)
BetweenPhon[a]-semantic	22	2.46	.022
BetweenPhon-unrelated	22	2.08	.050
WithinPhon[b]-Semantic	22	2.04	.053

[a]BetweenPhon = phonologically related to the non-target name of the picture
[b]WithinPhon = phonologically related to the target name of the picture

Table 8: Planned comparisons, naming latencies, more immersed group, Experiment 1

Exp. Cond.	Df	T	Sig. (2-tailed)
WithinPhon-Semantic	13	-3.41	.005
WithinPhon-BetweenPhon	13	-2.51	.026
BetweenPhon-unrelated	13	1.98	.069



Graph 3: bilingual naming latencies, experiment 1

To investigate possible crosslinguistic influence from English, analyses of variance were performed with English cognate status as between subject factor. See table 9 for word type information on English cognate status. No significance was achieved in the analysis (*F*2 (1, 62) = 2.80, p = .099, Z .043). However, there is a trend present in the naming latency pattern revealing longer naming latencies for the less immersed group on target words which are similar in form to the English name of the picture.

Table 9: English form similarity

Target word-groupings	Bilingual group	Mean naming latency	SD
Similar to English[a]	Less immersed	969.46	54.40
	More immersed	943.68	74.98
Not similar to English[b]	Less immersed	1002.40	66.98
	More immersed	946.35	78.70

[a]Thirty four of the target words are similar in form to the English picture name

[b]Thirty of the target words are similar in form to the English picture name

Concerning word effects such as word length, neighborhood and familiarity effects, and separate Anovas was performed to investigate whether these characteristics exert any influence on the data. Word length in Swedish was nearly significant $F2$ (1, 62) = 2.8, p = .099, Z .043) but not the analysis of Spanish word length $F2$ (1, 62) = .012, p = .912, Z .000). This suggests that the L1 name of the picture is activated during lexical processing. Jag måste kola vilken grupp som star för trenden…Detta avsnitt är inte alls färdigt.

Control group; analysis of naming latencies

Table 10 shows the distribution of mean response latencies as a function of the relation between the target word and IS for the monolingual control group. Analysis of variance was conducted with participants and items as random factors and type of IS as within-subjects variable. No effect of distracter type was not observed ($F1$ (3, 15) = 1.21, p = .341, Z .195, $F2$ (3, 60) = 1.19, p = .322). This is in line with the analysis on accuracy scores. It seems the control group does not differ in lexical processing depending on target word and IS-pairing. Even if not significant, there is a small trend toward longer naming latencies in the phonologically related condition. Let me remind that what is phonologically related between languages in the bilingual experiment is actually phonologically related within language in the monolingual experiment. The names have not been changed to avoid confusion. A phonologically related Is is expected to induce shorter naming latencies, counter to the present trend. As was mentioned in method chapter, the monolingual group is actually not at all monolingual, but rather bilingual. Crosslinguistic effects might blur the results and subsequent analyses were made to map probable effects.

Table 10: Mean naming latencies, control group, Experiment 1

Target word IS-relation	Mean naming latency	SD

Within phon	934.59	74.70
Unrelated	938.89	51.81
Semantic	932.21	59.80
Between phon	968.68	60.21

To investigate possible crosslinguistic influence from English, pictures were divided into two groups, one which did not have any form similarity to the English name of the picture, and one which was similar in form to the English name of the picture. See table 11 for an example of similarity between Swedish and English picture names. There is quite large variation in degree of phonological similarity between different pictures. But picture names with varying degree of phonological similarity are collapsed into the same category in this analysis (jag kanske borde ha ett appendix på detta?).

Table 11: Example of pictures and phonological similarity in English, Experiment 1

Target picture name	**No phonological overlap**	**Phonological similarity**
Drottning	Queen	
Docka		Doll
Träd		Tree

Analysis of variance was conducted, with naming latencies as dependent variable and status of phonological similarity to English as factor. There was no significant effect of phonological similarity to the English picture name (*F* (1, 62) 2.75. p = .102). However, there was a small trend, the pictures similar in form to the English name are named slightly faster compared to the pictures with no form similarity to the English name. This suggests that there is some degree of crosslinguistic facilitation from English; however this is not statistically significant.

Eight of the participants are proficient in German (44.44%). This language background must be tested for possible influence. Hence, an anova was performed with target words divided into two groups depending on their form similarity to the German word for the picture. See table 12 for information about this. However, this was not significant (*F* (1, 62) .001. p = .974).

Table 12: German cognates, Experiment 1, monolingual group

Target word-groupings	**Number**	**Mean naming latency**	**SD**
Similarity to German	32	943.34	71.75

No similarity to German	32	943.85	54.40

Concerning target word characteristics, the monolingual group was tested as to how sensitive they are to this type of influence during lexical processing. See table 13 for information about word length of all target words in Experiment 1.

Table 13: Target word-length effects, Experiment 1, monolingual group

Target word-groupings	**Number**	**Mean naming latency**	**SD**
1 syllable	29	947.93	71.75
2 syllables	35	940.00	54.40

An Anova was performed with naming latency as dependent variable and target word length as within group factor. The difference in naming latency between words with one and two syllables did not differ significantly (F (1, 62) .252. p = .617).

Table 14: Target word neighborhood effects, Experiment 1, monolingual group

Target word-groupings	**Number**	**Mean naming latency**	**SD**
> 2 neighbors	27	929.57	71.41
< 2 neighbors	37	953.83	49.64

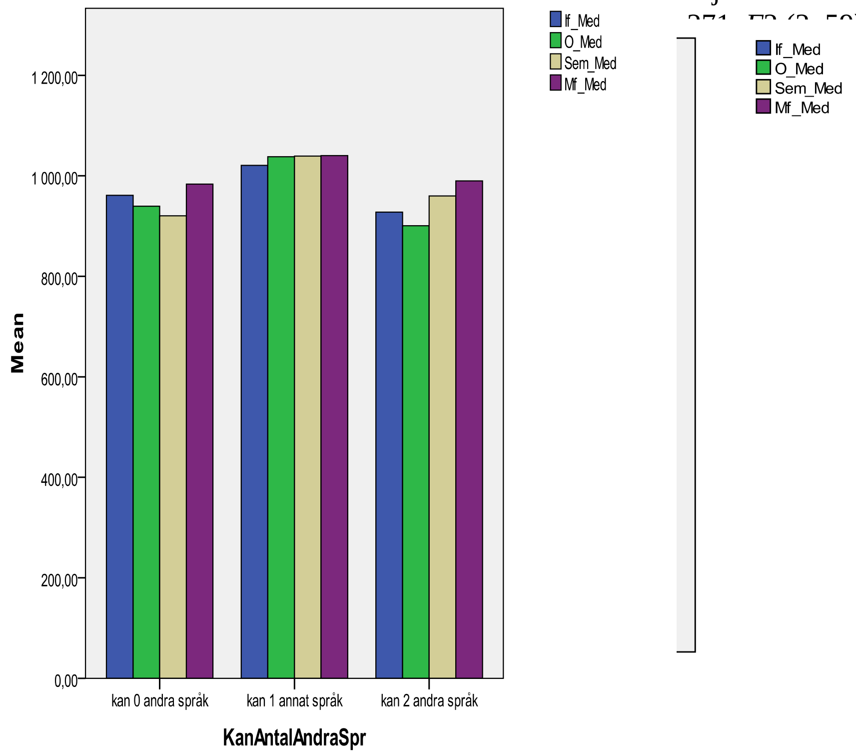
An Anova was performed with naming latency as dependent variable and number of neighbors as within group factor. The difference in naming latency between words with one and two syllables did not differ significantly (F (1, 62) 2.41 p = .126). Even if this difference is not significant, a small trend is present. Words with 2 neighbors or more are named slightly faster than words with less than 2 neighbors. This is strange!

Analysis of crosslinguistic effects

A post hoc analysis of the naming latencies was carried out with the same bilingual participants as above but regrouping them into three new groups based on how many languages they know in total. In the language background questionnaire, participants had to state how many languages they know apart from Swedish, English and Spanish. Twelve participants know one additional language and 7 know two additional languages. This new participant grouping was used as between-subjects factor and word-distracter type was used as within-subjects variable (the same as in the omnibus anova). It was revealed that whether participants know additional languages or not have an effect on the mean response latencies of the different distracter types.

Naming latencies

A repeated measure was performed with type of distracter as within-subjects variable and number of known languages as a between-subjects factor. A



If_Med
O_Med
Sem_Med
Mf_Med

MÅste göra planned comparisons här…

Discussion

The results of the post hoc analysis with participant regrouping suggest that crosslinguistic influence is a major aspect contributing to the results. The group who knows no additional languages displays a very similar pattern to the less immersed group in the previous section. The group who know one additional language (for most participants this language is German) processes all experimental conditions fairly similar. And the group who knows two additional languages (for most participants this language is French) displays a pattern very similar to the more immersed group.

It seems that when no additional language can interfere in the lexical process, one pattern appears. When there are additional languages, it depends on their similarity to the L1 or the L2 how they affect the lexical process. The majority of the participants in the group with hardly any processing difference in any experimental condition know a language which is very close to L1, the non-target language. This might reinforce the activation of the L1, and cancel out the effects of the experimental conditions. While in the group in which almost all participants know a language quite close to the target language, this reinforces the activation of the target language and enlarges the effects induced by the experimental conditions. This group displays a naming latency pattern which is very close to that reported in the research literature for highly proficient or balanced bilinguals.

General discussion

The pattern of the mean naming latencies for the experimental conditions for the participant group with more L2 immersion is similar to that documented in the research literature. The mean naming latency for the within-language phonological condition was the shortest, revealing a classic phonological facilitation effect. The phonologically related IS in the non-target language (i.e. *morot* (carrot) paired with the picture MUÑECA (doll)) activates the relevant phonemes and speeds up the response. The mean naming latency for the within-language phonological condition was significantly shorter than for the semantic condition. The semantic condition (i.e. *nalle* (teddy bear) paired with the picture MUÑECA (doll)) indduces interference since the semantically related word is also activated and competes for selection in the speech production system.

The between-language phonological condition (i.e. *dolk* (dagger) paired with the picture MUNÑECA (doll)) is the experimental condition which produces the longest mean response latency. This is interpreted as an extended semantic interference effect caused by the IS (*dolk*, dagger) which activates the semantically related word in the non-target language (docka, doll) which competes for selection and induces an interference effect. This lemma is a stronger competitor than in the semantically related condition, because it also receives activation from the picture. So it is completely natural that this condition produces the largest degree of interference effects.

The accuracy scores for the more immersed group reflect the patterns of the mean naming latencies. The experimental condition with the shortest naming latencies has the highest accuracy scores and the experimental condition with the longest naming latencies has the lowest accuracy scores, even if this does not reach significance.

The pattern of mean naming latencies for the group of participants with less L2 immersion looks somewhat different. This group has no phonological facilitation effect because the within-language phonological condition is longer than both the unrelated and the semantically related condition. There is no semantic interference effect either, since the semantically related condition has produced the shortest mean naming latency. The between-language phonological condition was the longest reflecting an interference effect from the L1 translation equivalent at the lemma level. The difference between this condition and the semantic condition reaches significance. It seems that the less immersed group has not yet developed the lexical retrieval system to the extent that interference and facilitation effects can be induced within a spreading activation account such as the bilingual three-store models do (Costa, Dijkstra). The cause for this must be the very low level of proficiency that this group has. The only effect emerging for this group is the prolonged semantic interference effect as induced by the between-language phonologically related IS. This is nothing less than competition for selection between the translation equivalent (*docka*, doll) and the L2 target word (MUNÑECA, doll). The lemma of the translation equivalent reaches such a high level of activation that it can compete for selection because it receives activation from the IS (*dolk*, dagger), which is phonologically related to it. For such a low proficiency level, this is expected to be the only word type effect to reach significance since the IS is related the L1 translation equivalent which is the word sharing the most features cross-linguistically.

The longer naming latencies for the phonological condition cannot be explained in terms of interference effects or facilitation effects. If we talk about it in terms of the hierarchical model we might see something interesting. According to the revised hierarchical model, L1 words have strong links to conceptual information, while second language words have strong links to corresponding L1 words at the lexical level. This can be reflected in the data of this study by means of the longer naming latencies for the phonologically related condition. The longer latencies are caused by the longer way to travel, since the L1 form representation has to be accessed before the conceptual representation can be accessed.

According to the revised hierarchical model, conceptual links are assumed to replace or weaken the lexical links as level of L2 proficiency increases. This predicts that the learners should go from predominantly processing their L2 by means of word-association to processing by means of concept mediation as a function of increased proficiency. This, in turn, predicts that the phonologically related condition shall become shorter, as proficiency increases. If we compare the results of the two participant groups, we can see that this is exactly what happens, since the naming latencies of the phonologically related condition are the shortest of all conditions, in the more immersed group. The participants in this group have gone from form-based processing to concept mediation.

If we want to interpret these findings within a three-store lexical model founded on activation spreading following Costa et al. (2000) and Dijkstra et al. (1999), we would assume that the long response latencies in the phonologically related condition indicate that non-selected lexical level representations are not activated. However, this does not explain why the semantically related condition produces the shortest latencies of all conditions. There seems not only to be a lack of phonological facilitation, there appears to be phonological interference. Therefore, I do not find it possible to explain these findings within such a model. One reason that these results have never appeared in the research literature can be that the less immersed group is at a very beginning stage of acquiring their L2, and such a participant group has not been investigated within this research framework before. The less group is less influenced by semantic factors (referens Kroll), therefore there is no semantic interference effect in this study.

The challenge for all bilingual models should be to include the earlier stages of acquisition in order to account for what happens in the beginning of L2 learning. According to the findings in the present study, this development needs to incorporate the ideas behind the revised hierarchical model into the three-store spreading activation models. Learning starts with a form prone stage, in which lexically based links are established and used in processing. This domination of lexical processing gradually diminishes as the semantic processing takes over. The revised hierarchical model describes this in terms of lexical links weakening, and conceptually related links getting stronger, but still with both processing types co-existing within the same speaker.

So how do we incorporate the static ideas of word association into a bilingual model of processing flows? To account for my findings within a processing paradigm, we can adopt several perspectives. First, to account for longer naming latencies, there are several lines of explanation. The first one is that the response latency is caused by a longer route for the signal to travel. The revised hierarchical model assumes that this is what happens in early stages of L2 learning, the participant has no link directly to the conceptual level, so the signal travels from the conceptual representation, via the L1 form and then the L2 form representation is accessed. This explains the findings in Experiment 1, that the phonologically related condition produces longer latencies than the semantically related and the unrelated. According to this argument, the longer response latency is caused during the recognition process (?).

The semantically related condition produces shorter response latencies because there is no need to activate the L1 form representation of the L2 target word. The L2 target word is receiving activation from its semantically related IS and hence responded to faster than the phonologically related. In the latter, there is some delay because an additional representation (the L1 form) is activated, which consumes processing effort ant time. So the delay is explained by activation of additional components, which is completely in line with the spreading activation account. Therefore, the answer could be to reinterpret the revised hierarchical model to processing flows within a spreading activation paradigm. As far as the between-language phonological condition, this does not pose a problem for the revised hierarchical processing account. This condition produces an interference with between the L1 IS and the L1 translation equivalent of the target word. This interference is so strong because it happens in the first language.

According to the revised model, the form-based processing and the concept-based processing co-exist within the same speaker. I assume that the low proficiency group is so low in proficiency that they are still prone to form-based processing. What happens in this experiment is that the different ISs are activating the two types of processing. The phonologically related IS induces lexical processing and the semantically related induces conceptual processing. The bilingual at this early stage is unstable from a processing point of view, and when manipulating with form-based ISs, this activates processing via word-association links.

The second approach is that there is no activation of lexical representations. It is based on the assumption that the selected lemma spreads activation to its phonological representation, but this does not happen for the IS because it is part of the processing system that the non-selected lemma does not spread activation to its phonological representation. This would explain the lack of facilitation effects as part of the production process. However, this explanation is problematic for the finding in this experiment that the semantically related condition is the shortest.

Accuracy scores for the less immersed group also follow the expected pattern, except for the accuracy scores for the semantic condition which are higher than expected.

The pattern of results appearing in the post hoc analysis reveals the importance of cross-linguistic influence. The participant group who knows no additional languages has a naming latency pattern which is identical to the participant group with less L2 immersion. The group who knows German has the longest of naming latencies of the three groups (=significant?). These participants process all four word types equal, except for the within-language phonologically related word type, but this difference is not close to reach significance. And the third group, who knows French has a pattern which is identical with the more immersed group, except that this group has slightly longer naming latencies for the unrelated condition.

The longer naming latencies for the group who knows German suggests interference. Since German is perceived as close to L1, the non-target language, this additionally activates the L1 representations and the expected differences in naming latencies among word types are evened out. For the group who know French, the representations of their L2 are additionally activated, and this magnifies the differences in processing speed among the word types. This can be interpreted as such that knowing a languages which is perceived as close to the L2, facilitates L2 processing.

The monolingual control group does not differ significantly in lexical processing of semantically, phonological or unrelated features. However, there is a small trend toward phonologically related ISs to prolong the lexical retrieval. This goes against what is reported in the research literature (see chapter 1). Phonologically related ISs usually speed up the naming process. But the monolingual group in this study is showing tendencies towards some interference effect in the phonologically related condition. There is now obvious reason for this unexpected pattern. However, there is one possible explanation in the fact that this group is not at all monolingual.

This supposedly monolingual group is bilingual and multilingual to a large extend and this brings significant variability to the data. One important trend in the naming latencies is the fact that target words which have some amount of phonological similarity with the English picture name are named somewhat faster compared to target words with no such crosslinguistic overlap. This suggests that there is some amount of crosslinguistic influence from English in this experiment. A large part of this participant group is proficient in German and this might also influence the data and make them fuzzier. This was not significant though.

Experiment 2, cognates

Statistics

The statistics chosen for this study is a one between and two within repeated measures design. The variables have six and two levels respectively. Half of the picture names consist of Spanish/Swedish non-cognates, these are taken directly from Experiment 1, and half consist of Spanish/Swedish cognate words. The IS and target word is related semantically, phonologically or unrelated. See table 15 for an example of picture names and ISs, and appendix G and I for a complete list of stimuli for Experiment 2. The between-subjects factor has two levels (the same as in Experiment 1): participants who have spent 12 months or less in a Spanish speaking country, and participants who have spent more than 12 months in a Spanish speaking country.

Table 15: Example of target picture names and related ISs

Target word	**Word status**	**Semantically related**	**Phonologically related**	**Unrelated**
<u>SO</u>FÁ[a](sofa)	Cognate	Fåtölj	<u>So</u>cka (sock)	Jacka

		(armchair)		(jacket)
TENEDOR (fork)	Non-cognate	Kniv (knife	Tändsticka (match)	Baggage (luggage)

[a]Phonological similarity is highlighted through the underlining of overlapping segments

Since some word type factors known to affect monolingual and bilingual processing were not managed to be completely controlled for in this study, such as word length, an extra source of variability is expected in the data. This will be controlled for by means of an Anova with item as random factor. Hence, separate analyses were conducted with participants and items as dependent variable, yielding $F1$ and $F2$ statistics, respectively. In the participant analysis of experiment 2, target word-relation (IS) and cognate status are within-participant variables and length of L2 immersion was between-participants. In the item analysis, target word-relation and cognate status are the between-items factors and length of immersion is within-items. Planned comparisons with a Bonferroni correction are conducted to establish significance among levels of the within participant variable and the between-subjects factor.

Method

Each picture is presented 4 times, twice as experimental conditions (related semantically or phonologically to the picture name) and twice as fillers. The filler conditions consist of the same ISs as in the related conditions but repaired with other pictures. Hence, all ISs appear twice in the same experiment but with different pictures, once as a related IS and once as a filler. Care was taken that the filler items did not overlap semantically with the picture name or phonologically with the name of the picture name in either language. Picture and IS-pairs were arranged in a semi-randomized order, the same order for all participants. No word or picture appeared with less than 4 items in between its several appearances.

The cognate words shared on the average 4.3 phonological segments (range = 3-7) between languages. All cognates (but one) shared at least the whole first syllable. One cognate did not; the second phoneme in *zebra* is different in Spanish and Swedish, but the rest of the word is similar. There was no obvious phonological overlap between translation words of the non-cognate words in the experiment. None shared their first phoneme and only 1 out of 18 shared the first vowel (TALLRIK - plato (plate)).

Results

Accuracy scores

Bilinguals

All trials with null responses were eliminated. Some of these were due to subjects' insufficient proficiency and others where due to technical problems. In addition; responses naming latencies deviating more than 2 SDs from the item mean in the relevant condition were deleted. A total of 22.12% of the data are eliminated, out of which 4.3% are outliers, 8.11% are technical errors and 9.66% are true errors. The remaining part is treated as accuracy scores, 77.88% of all naming responses. See table 16 and 17 for accuracy score percentages for the two bilingual groups.

Table 16: Accuracy percentages, Less immersed group, Experiment 2

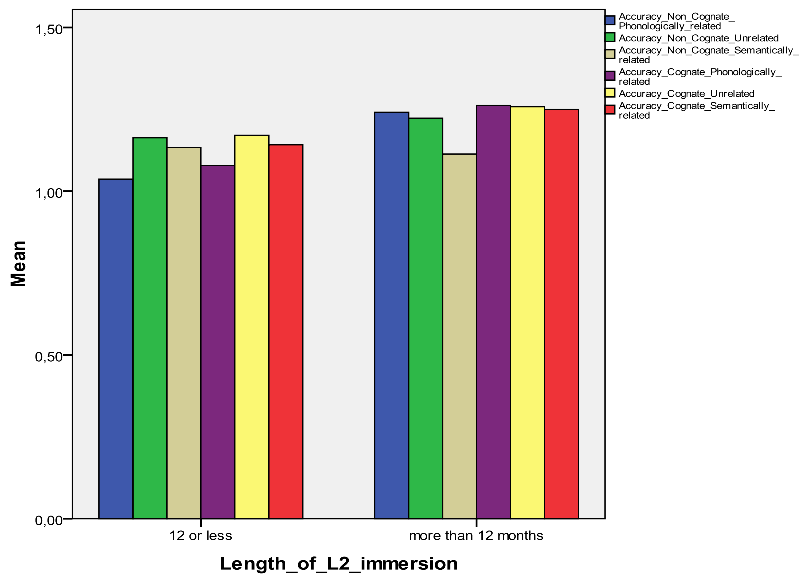
	Cognates		**Non-cognates**	
	Mean accuracy %	SD	Mean Accuracy %	SD
Phonologically related	77.78	25.69	69.08	24.38
Unrelated	77.78	23.69	77.3	23.33
Semantically related	75.85	24.31	74.4	22.83

Table 17: Accuracy percentages, more immersed group, Experiment 2

	Cognates		**Non-cognates**	
	Mean accuracy %	SD	Mean accuracy %	SD
Phonologically related	88.1	14.1	81.75	23.71
Unrelated	80.95	24.04	81.75	22.9
Semantically related	83.33	19.37	76.19	23.81

Analysis of variance was conducted with IS as within-participant and within-item factor and group assignment in terms of degree of L2 immersion as between-sujbects factor. The analysis is based on arcsine values of accuracy score percentages. The main effect of accuracy reached significance in the item analysis only ($F1$ (5, 31) = 1.36 p = .267, Z2 .180, $F2$ (1, 48) = 13.00, p

= .001, Z2 .213). The interaction effect was nearly significant in the subject analysis, and non-existent in the item analysis (*F*1 (5, 31) = 2.26, p = .073, Z2 .267, *F*2 (5, 48) = .93 p = .471, Z2 .088).



Planned comparisons revealed that the less immersed group had higher accuracy scores on the unrelated non-cognate condition compared to the phonological non-cognate condition (*t* (22) = -2.41 p =.025), as well as the semantic non-cognate condition compared to the phonological non-cognate condition (*t* (22) = -2.65 p =.015). The unrelated cognate condition also had higher accuracy relative the phonological non-cognate condition (*t* (22) = -2.91, p =.008) and so did the semantic cognate condition compared to the phonological non-cognate condition (*t* (22) = -2.68, p =.014). Even though only close to significant, it might be worth mentioning that the phonological cognate condition had lower accuracy than the semantic cognate condition (*t* (22) = -2.17 p =.041), the unrelated cognate condition (*t* (22) = -2.28, p =.032) and the unrelated non-cognate condition (*t* (22) = 2.10, p =.047).

Table 18: Planned comparisons on accuracy scores for the less immersed group

Picture IS-relation	Df	T	Sig. 2-tailed
NC phon. - C unrelated	22	-2.91	.008
NC phon. – C semantic	22	-2.68	.014
NC phon. – NC semantic	22	-2.65	.015
NC phon. – NC unrelated	22	-2.41	.025
NC phon. – C unrelated	22	-2.28	.032
C phon. – C semantic	22	-2.17	.041

C phon. – NC unrelated	22	2.10	.047

NC = non-cognate
C = cognate
Phon. = phonologically related

The more input-group had higher degree of accuracy in the phonological cognate condition compared to the semantic non-cognate condition (*t* (13) = -2.47, p =.028). Close to reach significance is the higher degree of accuracy in the unrelated cognate condition compared to the semantic non-cognate condition (*t* (22) = -2.21 p =.046) and the semantic cognate condition compared to the semantic non-cognate condition (*t* (22) = -2.20, p =.046).

Table 19: Planned comparisons, accuracy scores, less immersed group, Exp 2

Target word IS-relation	Df	T	Sig. (2-tailed)
NC semantic – C phon	13	-2.47	.028
NC semantic – C unrelated	13	2.21	.046
NC semantic – C semantic	13	2.20	.046

NC = non-cognate
C = Cognate
Phon = phonologically related

Control group

Data from the monolingual control group was given the same treatment as the data for the bilingual groups in terms of elimination of null responses and outliers. A total of 7.41% of the data are eliminated, out of which ?% are outliers, ?% are technical errors and ?% are true errors. The remaining part is treated as accuracy scores, 92.59%, of all naming responses. See table 20 for accuracy score percentages for the monolingual control group.

Table 20: Mean accuracy percentages, monolingual group, Experiment 2

Picture IS-relation	**Mean accuracy %**
NC Phonological	87.04
NC Semantic	95.06
NC Unrelated	89.51
C Phonological	94.44
C Semantic	91.98
C Unrelated	97.53

NC = non-cognate
C = cognate

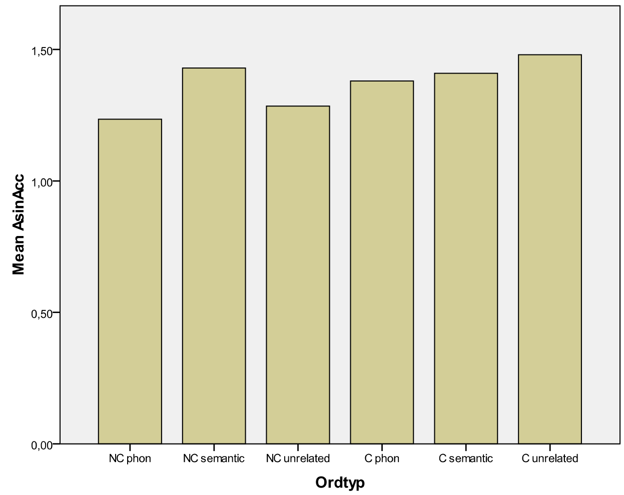
Analysis of variance was conducted with IS as within-subjects variable. The analysis is based on Arcsine values of accuracy score percentages in order to obtain data with a normal distribution, following Howell (2002). The following formula was used in Excel: =ASIN(SQRT(cell/100)). A significant effect of accuracy was present in both the participant and the items analyses, ($F1$ (5, 13) = 2.98, p = .052, Z .534, $F2$ (5, 48) = 2.43, p = .048).

Planned comparisons with a Bonferroni correction were conducted to further investigate how the accuracy effect differed among experimental conditions. Through these analyses, it is revealed that non-cognate phonologically related ISs induces a higher degree of accuracy compared to non-cognate semantically related (t (17) = -2.25, p = .022) as well as compared to the cognate unrelated condition (t (17) = -3.64, p = .002), suggesting that the non-cognate phonological condition is easier to process. It is also revealed that the cognate unrelated condition has a higher accuracy score compared to the non-cognate unrelated condition (t (17) = -3.48, p = .003), suggesting that the cognate unrelated condition is easier to process.

Although not significant, there is a nearly significant difference in that the cognate phonological condition induces higher accuracy compared to the non-cognate phonological condition (t (17) = -2.16, p = .045) as well as compared to the non-cognate unrelated condition (t (17) = -2.09, p = .052). There is also a nearly significant difference in that the cognate unrelated condition induces higher accuracy scores compared to the cognate phonological condition (t (17) = -2.03, p = .058) as well as compared to the cognate semantic condition (t (17) = 2.07, p = .054). And finally, non-cognate semantic condition induces slightly higher accuracy compared to the non-cognate unrelated condition (t (17) = -1.91, p = .073). Table 21 displays significant accuracy effects in the control group.

Table 21: planned comparisons, accuracy, control group

Experimental condition	T	Sig. (2-tailed)
NC phon – NC semantic	-2.25	.022
NC phon – C unrelated	-3.64	.002
C unrelated – NC unrelated	-3.48	.003
C phon – NC phon	-2.16	.045
C phon – NC unrelated	-2.09	.052
C unrelated – C phon	-2.03	.058
C unrelated – C semantic	2.07	.054
NC semantic – NC unrelated	-1.91	.073



Discussion

The control group differs significantly in accuracy scores among the experimental conditions and the difference follows a pattern. Except for the non-cognate semantic condition, the cognate conditions have higher accuracy scores. Out of the 9 target words which are Spanish/Swedish cognate words in this experiment, all of them are also cognate words in English (see appendix G for a description of the target words in Experiment 2). This means that the experimental condition which tests cognate status in the bilingual group also tests cognate status in the control group, but in English.

The higher accuracy scores produced by the control group in the cognate conditions suggest that these are easier to process. The non-cognate semantic condition also induces very high accuracy scores and there is no obvious explanation to that, but this suggests that this condition is easy to process, and hence we should expect a facilitation effect in this condition in the naming latency analysis.

Naming latencies

Bilingual groups

Naming latency analyses are based exclusively on accurate naming responses. Table 22 and 23shows the distribution of mean naming latencies as a function of target word and IS-pairing in the two bilingual groups. Analysis of variance was conducted with participants and items as random factors and type of IS as within-subjects variable and amount of L2 immersion as between-subjects factor. A clear main effect of distracter type was observed ($F1$ (5, 31) = 11.92, p = .000, Z2 .658, $F2$ (1, 48) = 25.76, p =

.000, Z2 .349). The interaction effect between type of distracter and bilingual group was clearly significant in the participant analysis and nearly significant in the item analysis (*F*1 (5, 31) = 3.35, p = .016, Z2 .350, *F*2 (5, 48) = 2.07, p = .085, Z2 .178).

Table 22: Naming latencies, less immersed group, experiment 2

	Cognates		**Non-cognates**	
	Mean	SD	Mean	SD
Phon.	1031.35	127.43	1037.19	133.93
Semantic	1090.09	155.60	991.71	100.46
Unrelated	1090.78	137.47	994.72	120.81

Table 23: Naming latencies, more immersed group, experiment 2

	Cognates		**Non-cognates**	
	Mean	SD	Mean	SD
Phon.	1002.00	162.16	1002.07	176.60
Semantic	969.34	116.04	883.52	112.02
Unrelated	999.75	121.76	987.37	112.82

To further investigate the two-way interaction, planned comparisons were performed with a Bonferroni correction. For the group with less L2 immersion, the naming latencies for the cognate semantic condition was significantly longer compared to the non-cognate semantic condition (*t* (22) = 3.84, p = .001), as well as compared to the non-cognate unrelated condition (*t* (22) = 4.40, p = .000). The cognate unrelated condition was significantly longer compared to the cognate phonological condition (*t* (22) = 2.44, p = .023), as well as compared to the non-cognate semantic condition (*t* (22) = 5.02, p = .000), and compared to the non-cognate unrelated condition (*t* (22) = 4.26, p = .000), and compared to the non-cognate phonological condition (*t* (22) = 2.51, p = .020). See table 24 and 25 for significance in planned comparisons for the two bilingual groups.

For the group with more L2 immersion, one target word IS-pair differ significantly from all other target word IS-pairs; it is the non-cognate semantic condition which induces the shortest naming latencies in the experiment for the more immersed group. The non-cognate semantic condition was significantly shorter compared to the non-cognate semantic condition (*t* (13) = 2.99, p =.010), the cognate unrelated condition (*t* (13) = 5.45, p =.000), the cognate phonological condition (*t* (13) = 3.83, p =.002), the non-cognate unrelated condition (*t* (13) = 4.56, p =.001), the non-cognate phonological condition (*t* (13) = 4.41, p =.001).

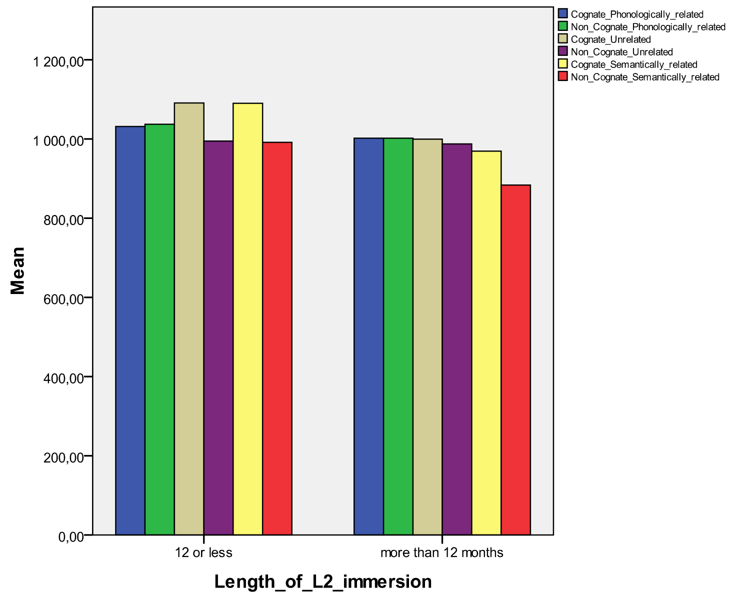


Table 24: Planned comparisons results, less immersed group, experiment 2

Experimental condition	T	Df	Sig. (2-tailed)
C semantic - NC unrelated	4.40	22	.000
C semantic - NC semantic	3.84	22	.001
C unrelated - NC semantic	5.02	22	.000
C unrelated - NC unrelated	4.26	22	.000
C unrelated – NC phonological	2.51	22	.020
C unrelated – C phonological	2.44	22	.023

C = Cognate, NC = Non-cognate

Table 25: Planned comparisons, more immersed group, Experiment 2

Experimental condition	T	Df	Sig. (2-tailed)
NC semantic - C unrelated	5.45	13	.000
NC semantic - NC unrelated	-4.56	13	.001
NC semantic - NC phonological	-4.41	13	.001
NC semantic - C phonological	3.83	13	.002

NC semantic - C phonological	-3.60	13	.003
NC semantic - C semantic	2.99	13	.010

C = Cognate, NC = Non-cognate

Word familiarity and word frequency is known to have effects on lexical processing. In this thesis, subjective familiarity rates are used. In the familiarity rating task, participants rated their familiarity with each picture word on a scale from 1 to 7, 1 being the lowest degree of familiarity and 7 the highest. An anova was performed with mean familiarity ratings for participant group with less L2 immersion and the group with more L2 immersion as within subject variable and cognate status as between-subjects factor.

Table 26: Mean familiarity ratings, less immersed group, Experiment 2

Word status	Bilingual group	Mean f-rates	SD
Cognate words	Less immersed	4.98	.933
	More immersed	5.85	.681
Non-cognate words	Less immersed	5.70	.987
	More immersed	6.30	.655

A main effect was obtained reflecting that cognates are rated for lower familiarity than non-cognates ($F1$ (1, 35) = 40.97, p = .000, $F2$ (1, 52) = 57.53, p = .000). An interaction effect, however, was not observed in either analysis ($F1$ (1, 35) = 1.53, p = .225, $F2$ (1, 52) = 2.03, p = .160), indicating that amount of L2 immersion in this study has no effect on familiarity rating and cognate status. Words were grouped according to familiarity rating to form two groups, words rated below 6 and words rated 6 or above. Analysis of variance was performed for each group with naming latencies as dependent variable and familiarity group as within subjects factor. Naming latencies was not affected by familiarity neither for the less immersed group (F (1, 52) = .256, p = .615) or for the more immersed group (F (1, 52) = .179, p = .674).

Amount of word neighbors in each language of a bilingual is known to have an effect on lexical processing. This was tested in an anova with naming latencies for each bilingual group as dependent variable and number of neighbors as between subjects factor. The Swedish target words were divided into two groups, x had less than one neighbor and x had one neighbor or more. The interaction between naming latencies and number of Swedish word neighbors was not significant $F2$ (1, 52) = .788, p = .379). This suggests that lexical processing in their L2, no participant group is not sensitive to L1 word neighbors of target words. The interaction between naming latencies and number of Spanish word neighbors was not significant either (F*2* (

Word length is a characteristic which is known to exert influence on lexical processing. This was tested with an anova with naming latencies for the two bilingual groups as dependent variable and number of syllables as between subjects factor. Eleven of the target words consist of three syllables and seven consist of three syllables. There was no significant difference in naming latencies depending on word length ($F2\ (1, 52) = .581$, $p = .449$) suggesting that no bilingual group is sensitive to this word characteristic in lexical processing in their L2.

Discussion

The bilingual groups differ significantly in how they process cognate words compared to non-cognate words. The less immersed group has larger differences in that more of the cognate words differ from the non-cognate words, while the more immersed group seems to process all experimental condition (but one) similarly. This is in line with existing research on lexical processing of cognate words which demonstrates that the cognate facilitation effect is present in low-proficient groups and is expected to disappear as proficiency level increases.

However, the cognate effect in this thesis is not a facilitating effect, but rather an interference effect. Cognates need longer time to process, when they are paired with an unrelated IS and a semantically related IS. These conditions require longer processing. There are two possible explanations for this. One possible explanation is that the longer processing latency in the cognate condition reflects what is generally referred to as the word frequency effect, according to which low frequency words take longer to process compared to words with higher frequency. The cognate words in this study are given lower familiarity ratings compared to the non-cognate words. It is possible that the participants are rating them higher than what actually reflects how well they know these words. It is repeatedly demonstrated in the research on bilingual lexical processing that bilingual participants generally rate cognate words as more familiar (or more frequent) than what should be expected. If the cognate effect is a reflection of the word frequency effect, we would expect the less immersed group to have larger effects. And this is indeed so, the bilingual group with less L2 immersion has a larger degree of the reversed cognate effect, i.e. more of the cognate conditions differ in naming latencies compared to the group with more immersion. The word frequency effect cannot, however, explain the shorter latencies for the non-cognate semantic condition in the more immersed group.

A second plausible explanation to the reversed cognate effect in the less immersed group is that they are form dependent in lexical processing. If we resort to the revised hierarchical model and assume that lexical links are more dominant in less immersed bilinguals, compared to conceptual links. When the bilingual accesses the L1 lexical representation for a cognate, a form representation is activated which is so close to the target form representation that hesitation occurs, perhaps even competition between these two representations. The transition from lexical to conceptual processing is a matter of degree and happens gradually in a word-by-word manner (reference?). It is fair to assume that degree of lexical processing follows degree of frequency, i.e. low frequency words are lexically processed to a higher extent than high frequency words.

According to this reinterpretation of the revised hierarchical model from a spreading activational perspective, we can explain why the cognate phonological condition does not follow the same pattern as the cognate unrelated and semantic conditions. When there is a phonologically related IS, the target form representation is activated to such an extent that facilitation occurs. Since the phonemes in this representation receive activation from target form, non-target form as well ass the related IS, this enhances production.

What then about the more immersed group? The cognate phonologically related condition does not have shorter naming latencies for these participants. Since cognates share form in the two languages, the similarity in form is characteristic for this experiment and therefore it prompts lexical processing. Participants in the more immersed group are mainly conceptually driven, i.e. their lexical processing is dominated by conceptual links, which means that the form similarity does not have the same effect on their lexical processing. The fact that the non-cognate semantic condition is the shortest for the more immersed group could be a manifestation of the dominance of conceptual processing in these participants. The lexically driven experiment prompts them to compensate with even stronger conceptual processing to such an extent that the condition which involves most conceptual processing (i.e. with the least focus on form) is facilitated. This facilitating effect is then interpreted as a clear task effect.

In line with this type of reasoning, the interpretation of the naming latency patterns in experiment 2 comes down to what processing demands the bilingual is exposed to and how (s)he responds to these demands. A bilingual with little L2 immersion has not yet developed enough conceptually driven processing links between conceptual and lexical representations in L2, this person processes his L2 mainly by means of lexical links. And especially in low frequency words and words which are similar in form. When such a person is exposed to a situation which prompts lexical processing, these processing links cannot be suppressed.

Concerning word type effects, such as word length, number of neighbors (I didn´t do this yet!) and word familiarity, there is no such effects in this experiment for either group.

A post hoc analysis

In a post hoc analysis it was revealed that whether participants know additional languages or not has an effect on the mean response latencies of the different distractor types. Participants were divided into groups

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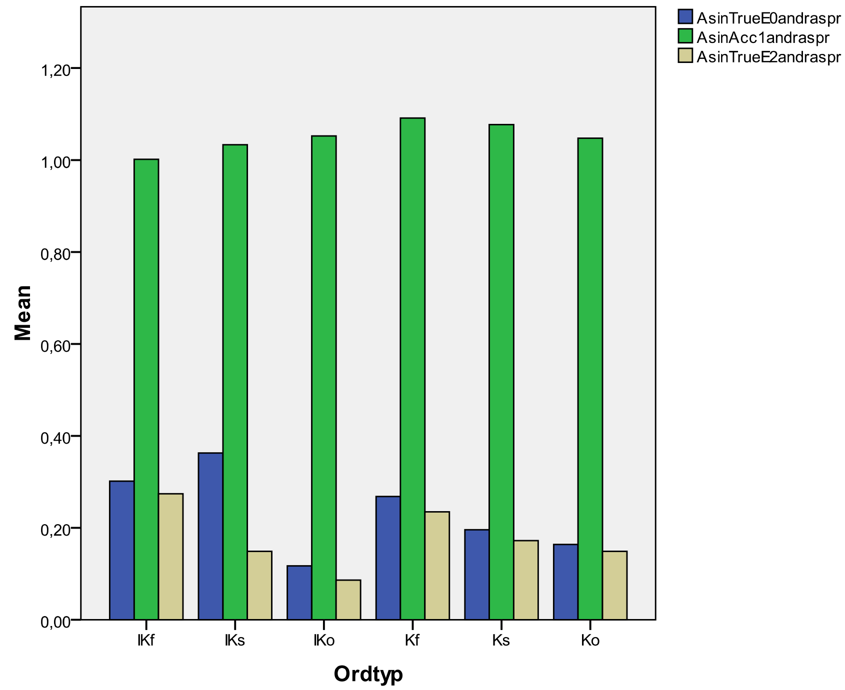


Discussion

The expected naming latency pattern when comparing cognates and non-cognates is that the former experimental condition should produce shorter response times than the latter. For the group with less natural L2 immersion, the results display the opposite pattern; cognates are longer than non-cognates. Hence, there is no CFE. How should we interpret these results? Is there an interference effect? In experiment 1, we have concluded that the less immersed group is prone to lexical processing. If this is the case, than we should interpret the results of experiment 2 as a consequence of lexical processing as well.

If we look at the less immersed group, cognates and non-cognates display a pattern very different from one another. The pattern of the non-cognate word type categories is very similar to the pattern in experiment 1. The phonologically related condition has produced longer response latencies than both the semantically related and the unrelated condition and this difference is significant. This is the mirror image of the pattern displayed by the cognate word types. Among the cognate word types, the phonologically related condition produces shorter latencies than both the semantically related and the unrelated condition, and this difference nearly reaches significance.

So, what we see is a significant phonological interference effect in the non-cognate conditions, and a nearly significant phonological facilitation effect in the cognate conditions. One interpretation of this is that the ISs which are phonologically related to the non-cognate words are not perceived as similar at all by the bilingual participants with less immersion. These phonological overlaps are not qualitatively different from those to non-cognate words (?).

The less immersed group does perceive cognates and non-cognates as qualitatively different processing wise. The cognate interference effect is quite large in the semantic and unrelated conditions. If we assume that the less immersed bilingual is prone to lexical processing, then these participants benefit from form similarity. Hence, when cognates are paired with semantically related and unrelated distracters, interference is produced. The large difference between the semantic and unrelated conditions on cognates and non-cognates must be considered a task effect.

General discussion

Appendix A

LANGUAGE BACKGROUND QUESTIONNAIRE

Name……………………………………

Telephone number……………………………………………..

When were you born? (year, month) ………………….

In what country were you born? If you were not born in Sweden, state what year you arrived to Sweden.

____

At what age did you start to learn Spanish? How? Where?

____

Did you speak Spanish with your parents while growing up?

____

At what level do you study Spanish at the University?

____

Have you studied Spanish at any other University or school (for example high school)?

____

Have you been to a Spanish speaking country? Which country? How long and when were you there?

____

Have you been to any other country for a longer period of time?
Which? When and for how long?

____
___

How well do you judge your Spanish proficiency to be, compared to other languages you know? The language you consider to be your strongest should be a 5 on the scale. The language you consider to be your mother tongue should be rated 5.

Swedish

1 2 3 4 5

Spanish

1 2 3 4 5

English

1 2 3 4 5

Other (write what language)

1 2 3 4 5

Other (write what language)

1 2 3 4 5

Do you speak Spanish outside the university class? With whom?

A lot____ A little____ Nothing____

____
__

Do you watch a lot of Spanish TV or Spanish movies? Do you listen to Spanish music?

____
__

Circle the best alternative. 1 is the lowest score and 5 is the highest.

Estimate you level of comprehension of spoken Spanish.

1 2 3 4 5

Estimate you level of speaking Spanish.

1 2 3 4 5

How well do you read in Spanish?

1 2 3 4 5

How well do you write in Spanish?

1 2 3 4 5

Further information

____

Circle the best alternative on a scale from A to F how many hours you read, write, speak and listen in Spanish. The amount of hours should comprise both university course time and the time outside of class.

Try to estimate an average for the autumn/spring semester. The values on the scale equal the following amount of hours:

A = 1-2 hours/week
B = 2-5 hours/week
C = 5-8 hours/week
D = 8-11 hours/week
E = 11-14 hours/week
F = 14 or more hours/week

Read	A	B	C	D	E	F
Write	A	B	C	D	E	F
Speak	A	B	C	D	E	F
Listen	A	B	C	D	E	F

Try to estimate your total usage of Swedish and Spanish in percentage. For example, if you think you don´t use Spanish to a great extent, you can write ”Swedish 90%” and “Spanish 10%”. If you use you Spanish a lot, for example both in class and together with you friends/family, maby you can write ”Swedish 45%” and ”Spanish 55%” or something like it. Try to state you average during the spring-/autumn semester.

Swedish ________________ Spanish__________________

ADMISSION

I consent to participate in the study on vocabulary development carried out by PhD student Ulrika Serrander at Uppsala University. I hereby give my approval to the results being used in research and education on language and language acquisition, with the right to anonymity. PhD student Ulrika Serrander, Department of linguistics and philology (ulrika.serrander@lingfil.uu.se) at Uppsala University, guarantees that the data is stored, handled and used in accordance with the ethical principles of research for social sciences and humanities stated by the Swedish research council (www.vr.se).

____

Date

____

Signature

____

Clarification of signature

Appendix B

LANGUAGE PROFICIENCY TEST

Part I: Spanish grammar and vocabulary

Fill in the gaps to complete the sentences. In some cases it requires one word to complete th sentence, sometimes several.

1. ¡ ___________________sed tengo!

2. Cuando eran más jóvenes siempre __________________a fútbol, ahora ya no juegan.

3. Hoy hemos ido a trabajar. Ayer no___________________________.

4._____________________, buscaste, buscó, buscamos, buscasteis, buscaron.

5. Ayer _____________________yo la mesa, hoy te toca ponerla a ti.

6. ¿A _______________________gente habían invitado?

7. Nació ____________________________1925.

8. Las sillas de mi abuela eran __________________________madera.

9. Pasaremos _______________________tu casa cuando salgamos de la oficina.

10. Marta y Pablo _______________________________de su luna de miel.

11. Lamentablemente ________________________podemos quedarnos cinco minutos.

12. Cuando llegué, ellos ___________________________en el sofá.

13. Tengo un piso muy pequeño. No sé si _____________________todos.

14. Cuando trabajaba en Londres, siempre ___________________a casa por Navidad.

Circle the correct choice of word to complete the sentence. You can only circle one word per sentence.

1. ¿Qué __________ Uds.?
A. hacéis
B. hago
C. hacen
D. haces

2. Rosa y Miguel van __________ cine.
A. al
B. de la
C. del
D. a la

3. Yo __________ el hermano de Pepe.
A. eres
B. soy
C. estoy
D. es

4. Hace un año que trabajo en __________ fábrica.
A. esto
B. esta
C. ese
D. este

5. Tomás dijo que __________ a correos pero no tiene tiempo.
A. va
B. iría
C. iba
D. ir

6. ¿Dónde vivían los aztecas a __________ venció Cortés?
A. quienes
B. que
C. los cuales
D. quien

7. Juan quiere que __________ temprano.
A. llegan
B. llegaron
C. llegar
D. lleguen

8. Las niñas __________ jugando en la calle.
A. son
B. somos
C. están
D. está

9. El otro día yo __________ Tomás.
A. veía
B. vi a
C. viste
D. vieron

10. Ayer __________ buen tiempo.
A. era
B. hacía
C. había
D. estaba

11. Era probable que él lo __________ .
A. tenga
B. tuvo
C. tenía
D. tuviera

12. Todas mis amigas __________ a la fiesta por Marcos.
A. han sido invitadas
B. han sido invitado
C. están invitado
D. son invitadas

13. Rosa me __________ ayer.
A. visitasteis
B. visité
C. visitaste
D. visitó

14. Pepe toca __________ guitarra.
A. los
B. la
C. lo
D. el

15. ¡ __________ Uds.!
A. Se levanten
B. Levántense
C. Levántanse
D. Levántese

Part II: Spanish grammar
Every sentence contains a couple of underlined words. Circle the word which is incorrect. You can only circle one word per sentence.

1. <u>Ayer</u> yo <u>ella</u> escribí <u>una</u> <u>carta</u>.
A. Ayer
B. ella
C. una
D. carta

2. <u>El</u> <u>campesino</u> <u>venden</u> <u>frutas</u>.
A. El
B. campesino
C. venden
D. frutas

3. Dirigimos uno negocio importante.
A. Dirigimos
B. uno
C. negocio
D. importante

4. Poco a poco los estudiantes van aprendendo.
A. a
B. los
C. van
D. aprendendo

5. Ellos fueron al teatro los sábados.
A. Ellos
B. fueron
C. los
D. sábados

6. El médico era un hombre dedicaba a la numismática.
A. era
B. dedicaba
C. a
D. la

7. ¿Saludan Uds. al profesor al entra en la clase?
A. Saludan
B. Uds.
C. al
D. entra

8. ¿Quien las va a arreglar?
A. Quien
B. las
C. va
D. a

9. Pagó diez dólares para el libro.
A. Pagó
B. dólares
C. para
D. el

10. Le lo dijo hace mucho tiempo.
A. Le
B. lo
C. dijo
D. hace

11. ¿De dónde viene todo esto ruido?
A. dónde
B. viene
C. todo
D. esto

12. Si tenía mucho dinero, me compraría un coche nuevo.
A. tenía
B. me
C. compraría
D. un

13. Mañana por la mañana he terminado con mi trabajo.
A. por
B. he
C. terminado
D. mi

14. Andrés no quiso discutir y le fue a Madrid.
A. quiso
B. discutir
C. le
D. a

15. La ciudad fue destruido por el huracán.
A. La
B. fue
C. destruido
D. por

Part III. Vocabulary
Choose the word which best fits in the sentence. Circle one word only.

1. Los___________ ayudan a los médicos.
A. enfermos
B. enfermeros
C. enero
D. entrenadores

2. Es una broma: yo te estoy tomando ___________.
A. el pelo
B. el codo
C. el chiste
D. la pierna

3. Yo voy a la playa porque____________ calor.
A. hago
B. estoy
C. soy
D. tengo

4. ¿A qué hora llega el avión __________ Miami?
A. a
B. en
C. para
D. con

5. Este abrigo es muy chico: no te __________ bien.
A. coloca
B. lleva
C. queda
D. cabe

6. Rafa tiene ___________ estudiar esta noche.
A. a
B. de
C. con
D. que

7. Hace mal tiempo hoy: está lloviendo a __________
A. gatos y perros
B. cántaros
C. mucho
D. relámpago

8. Ellos __________ la guitarra.
A. juegan
B. actúan
C. tocan
D. interpretan

9. Yo no entiendo ____________ tú dices eso: es mentira.
A. que
B. por qué
C. qué
D. porque

10. No entiendo la tarea así que le _________ una pregunta al profesor.
A. pregunto
B. pido
C. hago
D. contesto

Part IV. Reading comprehension
Read the Spanish texts and choose the best answer to the questions that follow.

Todos los pueblos tienen, sin duda, una serie de fórmulas prácticas para la vida, consecuencia de la raza, de la historia, del ambiente físico y moral.

Miguel de Unamuno, Del sentimiento trágico de la vida

1. Según el contexto de esta narración, ¿qué quiere decir la palabra "pueblo"?
A. gente
B. aldeas
C. tribus
D. países

2. ¿A qué clase de fórmula se refiere el fragmento?
A. a una fórmula química
B. a una fórmula urbana
C. a una fórmula social

D. a una fórmula matemática

¿Dónde estás, señora mía,
que no te duele mi mal?
O no lo sabes, señora,
o eres falsa y desleal.

Miguel de Cervantes, Don Quixote

3. ¿A quién le habla el narrador en esta estrofa?
A. a sí mismo
B. al lector
C. a una mujer
D. al autor

4. ¿Cómo describe el narrador a la "señora"?
A. contenta
B. leal
C. desleal
D. triste

Para Rodolfo Otto la presencia de lo Otro - y podríamos añadir, la sensación de "otredad"- se manifiesta "como un misterio tremendum, un misterio que hace temblar." Al analizar el contenido de lo tremendo, el pensador alemán encuentra tres elementos. En primer término el terror sagrado, esto es, "un terror especial," que sería vano comparar con el miedo que nos produce un peligro conocido. El terror sagrado es pavor indecible, precisamente por ser experiencia de lo indecible.

Octavio Paz, El arco y la lira

5. ¿A qué se refiere "otredad" en este fragmento?
A. al plagio
B. a una falta de comunicación
C. a una disparidad entre un punto de vista alemán y otro punto de vista español
D. a algo más allá del mundo que percibimos

6. ¿Qué quiere decir Paz cuando escribe "pavor indecible?"
A. Es un pavo que tiene miedo.
B. Es un miedo que no se puede explicar.
C. El terror es algo sagrado.
D. La experiencia es indecible.

7. Según Paz, ¿cuáles son las dos ideas que serían vanas comparar?
A. Rodolfo Otto y Octavio Paz
B. el contenido y los elementos del relato
C. el miedo y el terror
D. la experiencia y la ira

Habló del Yucatán, donde habían construido catedrales suntuosas para ocultar las pirámides paganas, sin darse cuenta de lo que los aborígenes acudían a misa porque debajo de los altares de plata seguían vivos sus santuarios. Habló del batiburrillo de sangre que habían hecho desde la conquista: sangre de español con sangre de indios, de aquéllos y éstos con negros de toda laya, hasta mandingas musulmanes, y se preguntó si semejante contubernio cabría en el reino de Dios.

Gabriel García Márquez, Del amor y otros demonios

8. ¿Cuál es el tema de este fragmento?
A. la Conquista del Yucatán
B. asombro por una existencia mutua de indígenas y españoles después de la conquista
C. las catedrales del Yucatán
D. la religión en tiempos precolombinos

9. ¿Quién será el protagonista de este fragmento?
A. un español
B. un conquistador radio
C. un arqueólogo
D. un locutor de dias indígenas

10. ¿Qué es una cosa de la cual el protagonista NO habla en este fragmento?
A. la mezcla de razas desde la Conquista

B. las fechas de la conquista del Yucatán
C. las catedrales del Yucatán
D. las pirámides del Yucatán

Appendix C

SUBJECTIVE RATINGS OF LANGUAGE PROFICIENCY

Participant ID:	English:	Spanish:	Other:	Other:
21	4	3	-	-
32	3	1	-	-
33	3	4	-	-
34	4	2	-	-
18	4	3	-	-
28	4	2.5	-	-
16	4	2	-	-
15	3	3	-	-
14	3	3	-	-
11	2	3	-	-
63	4	3	-	-
58	3	2	-	-
42	4	2	-	-
44	3	2	-	-
46	4	3	-	-
47	4	3	-	-
25	4	4	-	-
10	4	3	-	-
35	4	2	1 (German)	-
13	4	3	2 (German)	-
22	4	3	2 (German)	-
24	4	4	1 (German)	-
62	4	3	4 (German)	-
59	3	4	1 (German)	-
17	4	3	2 (German)	-
53	5	2	3 (German)	-
51	4	1	3 (French)	-
5	4	4	2 (French)	-
19	3	4	2 (French)	-
12	3	4	2 (Italian)	-
31	4	3	2.5 (German)	2.5 (Portuguese)
48	5	3	2 (German)	2 (French)
38	3	4	2 (French)	1 (Portuguese)

2	4	4	3 (French)	2 (?)
61	3	4	5 (French)	1 (German)
40	4	4	3 (Hebrew)	1 (French)
29	4	2	2(Norwegian)	1 (French)

Appendix D

WORD FAMILIARITY RATINGS

INSTRUCTIONS

This is a test to see how well you know certain spanish words. You will be presented a list of 33 spanish words. Mark each of the words according to how well you know it on a scale from 1 to 7 (a 1 indicates “never seen, heard, or used the word in my life”; a 7 indicates “often seen, heard or used the word”).

muñeca

1 2 3 4 5 6 7

banana

1 2 3 4 5 6 7

cesta

1 2 3 4 5 6 7

plato

1 2 3 4 5 6 7

flecha

1 2 3 4 5 6 7

Etc.

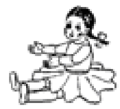
Appendix E

MEAN WORD FAMILIARITY RATINGS FOR EACH BILINGUAL GROUP

Target word:	Less immersed group:	More immersed group:
Non-cognates:		
Boca (mouth)	6.83	6.86
Pelota (ball)	5.26	6.14
Nube (cloud)	5.22	6.36
Pantalón (trousers)	6.65	6.86
Montaña (mountain)	6.61	6.71
Árbol (tree)	6.70	6.86
Corazón (heart)	6.70	6.93
Techo (roof)	4.78	6.0
Galleta (cookie)	4.61	6.07
Libro (book)	6.96	7.0
Reina (queen)	5.78	6.50
Muñeca (doll)	4.22	5,57
Plato (plate)	6.65	6,86
Llave (key)	6.48	6.64
Peine (comb)	5.17	5.07
Mochila (backpack)	4.22	6.29
Tenedor (fork)	5.70	6,57
Cama (bed)	6.87	6.93
Total:	**5.85**	**6.46**
Cognates:		
Balcón (balcony)	5.48	6.29
Banana (banana)	5.57	4.86
Bomba (bomb)	5.09	6.21
Tractor (tractor)	4.35	5.21
Camello (camel)	3.22	4.93
Lampara (lamp)	5.91	6.71
Pistola (gun)	5.43	6.0
Sofá (sofa)	5.83	6.5
Zebra (cebra)	3.78	5.71
Total:	**4.96**	**5.82**

Appendix F

PICTURE STIMULI FOR ADULT EXPERIMENT 1, NON COGNATES



Doll:
docka-muñeca

Trouser:
byxa-pantalón

Mountain:
berg-montaña

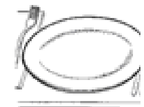
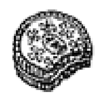


Plate
tallrik-plato

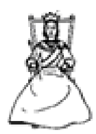
Tree:
träd-árbol

Comb:
kam-peine



Cookie:
kaka-galleta

Roof:
tak-techo

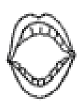


Queen:
drottning-reina

Heart:
hjärta-corazón

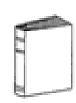
Key:
nyckel-llave

Fork:
gaffel-tened



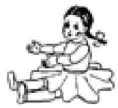
Mouth:
mun-boca

Ball:
boll-pelota



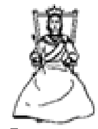
Book:
bok-libro

Cloud:
moln-nube



Doll:

docka-muñeca

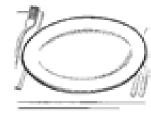


Queen:

drottning-reina

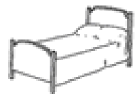
Key:

nyckel-llave



Plate

tallrik-plato



Bed:

säng-cama

Comb:

kam-peine

Appendix H

LIST OF STIMULI PAIRS, EXPERIMENT 1

Picture name (target word)	IS, semantically related to the target word	IS, phonologically related to the target word	IS, phon related t translati of the tar
Àrbol (träd, tree)	Blomma (flower)	Armband (bracelet)	Träsko (c
Montaña (berg, mountain)	Hav (see)	Morrhår (whisker)	Bädd (be
Llave (nyckel, key)	Dörr (door)	Jacka (jacket)	Nystan (b
Corazón (hjärta, heart)	Blod (blood)	Kompis (friend)	Hjälte (he
Ball: pelota (boll)	Mål (goal)	Persika (peach)	Borg (for
Galleta (kaka, cookie)	Bröd (bread)	Gardin (curtain)	Karta (ma
Libro (bok, book)	Tidning (news paper)	Linne (top)	Bostad (h
Nube (moln, cloud)	Himmel (sky)	Nos (snout)	Måltid (m
Techo/tejado (tak, roof)	Vägg (wall)	Täcke (cover)	Tal (num
Tenedor (gaffel, fork)	Kniv (knife)	Tändsticka (match)	Galge (ha
Muñeca (docka, doll)	Nalle (teddy bear)	Morot (carrot)	Dolk (da
Pantalón (byxa, trousers)	Skjorta (shirt)	Panna (pan)	Byggnad
Plato (tallrik, plate)	Glas (glas)	Planka (wooden board)	Tangent (key)
Boca (mun, mouth)	Tunga (tongue)	Bock (he-goat)	Mussla (c
Peine/peineta (kam, comb)	Borste (brush)	Peppar (pepper)	Kant (ma
Reina (drottning, queen)	Slott (castle)	Regn (rain)	Droppe (

Appendix I

LIST OF STIMULI PAIRS, EXPERIMENT 2

Picture name, target word	IS, semantically related to the target word	IS, phonologically the target word
Llave (nickel, key)	Dörr (door)	Jacka (jacket)
Libro (bok, book)	Tidning (news paper)	Linne (top)
Tenedor (gaffel, fork)	Kniv (knife)	Tändsticka (match)
Mochila (ryggsäck, backpack)	Väska (bag)	Morgon (morning)
Muñeca (docka, doll)	Nalle (teddy bear)	Morot (carrot)
Plato (tallrik, plate)	Glas (glas)	Planka (wooden bo
Peine/peineta (kam, comb)	Borste (brush)	Peppar (pepper)
Reina (drottning, queen)	Slott (castle)	Regn (rain)
Cama (sang, bed)	Kudde (pillow)	Kalv (calf)
Balcón (balkong, balcony)	Fönster (window)	Bassäng (pool)
Banana (banan, banana)	Åpple (apple)	Bagage (luggage)
Bomba (bomb, bomb)	Vapen (weapon)	Borr (drill)
Tractor (traktor, tractor)	Lastbil (truck)	Tratt (funnel)
Camello (kamel, camel)	Öken (desert)	Kappa (coat)
Lampara (lampa, lamp)	Ljus (candle)	Lamb: lamm
Pistola (pistol, pistol)	Gevär (rifle)	Pinne (stick)
Sofá (sofa, sofa)	Fåtölj (armchair)	Socka (sock)
Cebra (zebra, zebra)	Häst (horse)	Segel (sail)

References

Alltarriba, J. & Mathis, K. M. 1997. Conceptual and lexical development in second language acquisition. *Journal of Memory and Language*, 36, 550-568.

Beauvillian, C. & Grainger, J. 1987. Accessing Interlexical Homographs: Some Limitations of a Language-selective Access. *Journal of Memory and Language*, 26 (6), 658-672.

Brown, A. & Gulberg, M. 2008. Bidirectional crosslinguistic influence in L1-L2 encoding of manner in speech and gesture: A study of Japanese speakers of English. *Studies on Second Language Acquisition,* 30(2), pp 225-251.

Brysbaert, M., Van Dyck, G., Van de Poel, M. 1999. Visual word recognition in bilinguals: evidence from masked phonological priming. *Journal of Experimental Psychology: Human Perception and Performance*, 25 (1), 137-148.

Caramazza, A., Costa, A. 2001.

Carroll, S. E. 1992. On Cognates. *Second Language Research*, 8 (2), 93-119.

Costa, A. & Caramazza, A. 1999. ??

Costa, A., Miozzo, M., & Caramazza, A. 1999. Lexical selection in bilinguals: Do words in the bilingual's two lexicons compete for selection? *Journal of Memory and Language*, 41, 365-397.

Costa, A., Caramazza, A., Sebastian-Gallés, N. 2000. The Cognate Facilitation Effect: implications for models of lexical access. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 26(5), 1283-1296.

Costa, A., Mahon, B., Savova, V., Caramazza, A. 2003. Level of categorisation effect: A novel effect in the picture-word interference paradigm. *Language and cognitive processes,* 18(2), 205-234.

Damian, M. F. & Martin, R. C. 1999. Semantic and phonological codes interact in single word production. *Journal of Experimental Psychology: Learning, Memory and Cognition,* 25 (2), 345-361.

De Bot, K. 1992. A bilingual production model: Levelt's "Speaking" model adapted. *Applied linguistics*, 13 (1), 1-24.

De Bot, K. & Schreuder, R. 1993. Word production and the bilingual lexicon. In: Schreuder, R. & Weltens, B. (eds.). 1993. *The Bilingual Lexicon*. Amsterdam: John Benjamins.

De Groot, A. 1992. Determinants of word translation. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 18, 1001-1018.

De Groot, A. 1993. Word-type effects in bilingual processing tasks: Support for a mixed-representational system. In: Schreuder, R. & Weltens, B. (eds.) *The Bilingual Lexicon* (27-51). Amsterdam: John Benjamins.

De Groot, A., Dannenburg, L., & Van Hell, J. 1994. Forward and backward word translation by bilinguals. *Journal of memory and language,* 33, 600-629.

De Groot, A., & Poot, R. 1997. Word translation at three levels of proficiency in a second language: The ubiquitous involvement of conceptual memory". *Language Learning* 47, 215-264.

De Groot, A. M. B., Delmaar, P. & Lupker, S. J. 2000. The processing of linterlexical homographs in translation recognition and lexical decision: Support

for non-selective access to bilingual memory. *Quarterly Journal of Experimental Psychology*, 53, 397-428.
De Groot, A. M. B. 2002. Lexical representation and lexical processing in the L2. In: Cook, V. (ed.), *Portraits of the L2 user.* Clevedon: Multilingual Matters LTD, 32-63.
Dell, G. S. 1986. A spreading-activation model of retrieval in sentence production. *Psychological review*, 93, 283-321.
Dell, S. G., Schwartz, M. F., Martin, N., Saffran, E. M. & Gagnon, D. A. 1997. Lexical access in aphasic and non aphasic speakers. *Psychological Review*, 104, 801-838.
Dijkstra, A., Van Jaarsveld, H. & Ten Brinke, S. 1998. Interlingual homograph recognition: Effects of task demands and language intermixing. *Bilingualism: Language and Cognition*, 1, 51-66.
Dijkstra, T., Grainger, J. & Van Heuven, W. J. B. 1999. Recognition of Cognates and Interlingual Homographs: The Neglected Role of Phonology. *Journal of Memory and Language* 41, 496-518.
Dijkstra, T., Timmermans, M., & Schriefers, H. 2000. On being blinded by your other language: Effects of task demands and language intermixing. *Journal of Memory and Language*, 42, 445-464.
Doctor, E. A. & Klein, D. 1992. Phonological processing in bilingual word recognition. In: Harris, R. J. (ed.). *Cognitive processing in bilinguals*. Amsterdam: Elsevier, 237-252.
Durgunoglu, A. Y. & Roediger, H. L. 1987. Test differences in accessing bilingual memory. *Journal of Memory and Language* 26, 377-391.
Gaulin, C. & Campbell, T. 1994. Procedure for assessing verbal working memory in normal school-age children: Some preliminary data. *Perceptual and Motor Skills*, 79, 55-64.
Gerard, L. D. & Scarborough, D. L. 1989. Language-specific lexical access of homographs in bilinguals. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 15, 305-313.
Glaser & Glaser 1989
Gollan, T, H, Forster, K. I. & Frost, R. 1997. Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew-English bilinguals. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23, 1122-1139.
Grainger, J. 1993. Visual word recognition in bilinguals. In: Schreuder, R. & Weltens, B. (eds.). *The Bilingual Lexicon*. Amsterdam: John Benjamins. Sidor??
Grainger, J & Beauvillian, C. 1987. Language blocking and lexical access in bilinguals. *Quarterly journal of experimental psychology*, 39a, 295-319.
Grainger, J. & Dijkstra, T. 1992. On the representation and use of language information in bilinguals. In: Harris, R. J. (ed.), *Cognitive processing in bilinguals*, 207-222. Amsterdam: North Holland.
Green, D. 1986. Control, activation and resource: A framework and a model for the control of speech in bilinguals. *Brain and Language*, 27, 210-223.
Green, D. W. 1993. Towards a model of L2 comprehension and production. In: Schreuder, R. & Weltens, B. (eds.). *The Bilingual Lexicon*. Amsterdam: John Benjamins, 249-277.
Green, D. W. 1998. Mental Control of the Bilingual lexico-semantic system. *Bilingualism: Language and Cognition* 1. 67-81.
Grosjean, F. 1985. The bilingual as a competent but specific speaker-hearer. *Journal of Multilingual and Multicultural Development*, 6, 467-477.

Grosjean, F. 1989. Neurolinguists, beware! The bilingual is not two monolinguals in one person *Brain and language,* 36, 3-15.
Grosjean, F. 1997. Processing mixed language: Issues, findings, and models In: De Groot, A., & Kroll, J. (eds.). *Tutorials in Bilingualism: Psycholinguistic Perspectives*. Mahwah, NJ: Lawrence Erlbaum Associates, 225-254.
Haigh, C. A., Jared, D. 2007. The activation of phonological representationsby bilinguals while reading silently: evidence from interlingual homophones. Journal of Experimental Psychology: Learning, Memory and Cognition, 33, 623-644.
Harris, M. 1992. Language experience and early language development: from input to uptake. Hove: Erlbaum.
Harris, R. J. 1992. (ed.). Cognitive processing in bilinguals. Amsterdam: Elsevier.
Hermans, D. 2000. Word production in a foreign language. Unpublished doctoral dissertation. University of Nijemegen. Nijmegen: The Netherlands.
Hermans, D., Bongaerts, Th, De Bot, K., & Schreuder, R. 1998. Producing words in a foreign language: Can speakers prevent interference from their first language? Bilingualism: Language and Cognition, 1 (3), 213-229.
Howell, D. C. 2002. Statistical Methods for Psychology (5th ed.). Pacific Grove, CA: Duxbury.
Humphreys, G. W., Riddoch , M. J., & Quinlan, P. T. 1988. Cascade processes in picture identification. Cognitive neuropsychology, 5, 67-103.
Linck, A. J., Kroll, J. F. & Sunderman, G. 2009. Losing Access to the Native Language While Immersed in a Second Language: Evidence for the Role of Inhibition in Second-Language learning. Psychological Science, 20, pp 1507-1515.
Jescheniak, J. D. & Schriefers, H. 1998. Discrete serial versus cascaded processing in speech production: Further evidence from the co-activation of near-synonyms. Journal of Experimental Psychology: Learning, Memory and Cognition, 24, 1256-1274.
Kellerman, E. (1983). Now you see it, now you don't. In Gass, S. & Selinker, L. (Eds.), *Language transfer in language learning.* (pp. 112-134). Rowly, MA: Newbury House.
Kolers, P. A. 1963. Interlingual Word associations. *Journal of Verbal Learning and Verbal Behavior* 2. 291-300.
Kroll, J. & Sholl, A. 1992. Lexical and conceptual memory in fluent and non-fluent bilinguals. In: Harris, R. J. (ed.). *Cognitive Processing in Bilinguals*. Amsterdam: Elsevier Science Publishers, 191-204.
Kroll, J. & Stewart, E. 1994. Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language,* 33, 149-174.
Lam, A. S. L., Perfetti, C. A. & Bell, L. 1991. Automatic phonetic transfer in bidialectal reading. *Applied Psycholinguistics*, 12, 299-311.
La Heij, W., Hooglander, A., Kerling, R., & Van der Velden, E. 1996. Non-verbal context effects in forward and backward word translation: Evidence for concept mediation. *Journal of memory and language,* 35, 648-665.
Levelt, W. J. M. 1989. *Speaking. From intention to articulation.* Cambridge, Mass.: The MIT Press.
Levelt, W. J. M., Schriefers, H., Vorberg, D., Meyer, A. S., Pechmann, T. & Havinga, J. 1991. The time course of lexical access in speech production: A study of picture naming. *Psychological review,* 98, 615-618.
Levelt, W. J. M., Roelofs, A., & Meyer, A. S. 1999. A theory of lexical access in speech production. *Brain and behavioral sciences,* 22:1, 1-38.

MacNamara, J. 1967. The linguistic independence of bilinguals. *Journal of Verbal Learning and Verbal Behavior,* 2, 250-262.
MacNamara, J. & Kushnir, S. 1971. Linguistic independence of bilinguals: The input switch. *Journal of Verbal Learning and Verbal Behavior,* 10, 480-487.
Mahon, B. Z., Costa, A., Peterson, R., Vargas, K. A., Caramazza, A. 2007. Lexical selection is not by competition: a reinterpretation of semantic interference and facilitation effects in the picture-word interference paradigm. *Journal of Experimental Psychology, Learning, Memory and Cognition,* 33,
Marian, V. & Spivey, M. 2003. Bilingual and monolingual processing of competing lexical items. *Applied Psycholinguistics,* 24, 173-193.
Rumelhart, D.E., & McLelland, J., (eds.). 1986. *Parallel Distributed Processing: Explorations In The Microstructure of Cognition, Vol. 1*. Cambridge, MA: MIT Press.
Meuter, R. F. I. & Allport, A. 1999. Bilingual language switching in naming: Asymmetrical costs in language selection. *Journal of Memory and Language,* 40, 25-40.
Nas, G. 1983. Visual word recognition in bilinguals: Evidence for a cooperation between visual and sound based codes during access to a common lexical store. *Journal of Verbal Learning and Verbal Behavior*, 22, 526-534.
Penfield, W. & Roberts, L. 1959. *Speech and Brain Mechanisms*. Princeton: Princeton University Press.
Peterson, R. R. & Savoy, P. 1998. Lexical selection and phonological encoding during language production: Evidence for cascaded processing. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 24, 539-557.
Paradis, M. 1987. *The Assessment of Bilingual Aphasia.* Hillsdale: Erlbaum.
Paradis, M. 2004. *A Neurolinguistic Theory of Bilingualism.* Amsterdam/Philadelphia: John Benjamins Publishing Company.
Pérez, M-A. & Navalon, C. 2003. Normas españolas de 290 nuevos dibujos: Acuerdo en la denominación, concordancia de la imagen, familiaridad, complejidad visual y variabilidad de la imagen. *Psicológica,* 24, 215-241.
Potter, M. C., So, K. F., von Eckhardt, B., & Feldman, L. B. 1984. Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior,* 23, 23-38.
Poulisse, N. & Bongearts, Th. 1994. First language use in second language production. *Applied linguistics*, 15, 36-57.
Poulisse, N. 1997. Language production in bilinguals. In: A. De Groot & J. Kroll (eds.). *Tutorials in bilingualism: Psycholinguistic perspectives.* Mahwah, N.J.: Lawrence Erlbaum Associates.
Poulisse, N. 1999. *Slips of the tongue: Speech errors in first and second language production.* Amsterdam/Philadelphia: John Benjamins Publishing Company.
Rahman, R. A., Melinger, A. 2007. When bees hamper the production of Honey: Lexical interference from associates in speech production. *Journal of experimental psycholocy; learning, memory and cognition*, 33(3), 604-614.
REAL ACADEMIA ESPAÑOLA: Banco de datos (CREA) [en línea]. *Corpus de referencia del español actual.* <http://www.rae.es> [2006-02/3]
Roelofs, A. 1992. A spreading-activation theory of lemma retrieval in speaking. *Cognition*, 42, 107-142.
Roelofs, A., Meyer, A. S., & Levelt, W. J. M. 1996. Interaction between semantic and orthographic factors in conceptually driven naming: Comment on Starreveld & La Heij. 1995. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 22, 246-251.

Sánchez-Casas, R. M., Davies, C. W. & García-Albea, J.E. 1992. Bilingual lexical processing: Exploring the cognate/non-cognate distinction. *European Journal of Cognitive Psychology,* 4, 293-310.

Scarborough, D. L., Gerard, L., & Cortese, C. 1984. Independence of lexical access in bilingual word recognition. *Journal of Verbal Learning and Verbal Behavior,* 23, 84-99.

Sherkina, M. 2003. The Cognate Facilitation Effect in Bilingual Speech Processing. *Toronto Working Papers in Linguistics,* 21, 135-151.

Sherkina, M. 2004. The Cognate Facilitation Effect in Bilingual Speech Processing: The Case of Russian-English Bilingualism. *Cahiers Linguistiques d'Ottawa,* 32, 108-121-

Schriefers, H., & Meyer, A. S. 1990. Experimental note: Cross-modal, visual-auditory picture-word interference. *Bulletin of the Psychonomic Society,* 28, 418-420.

Schriefers, H., Meyer, A. S., & Levelt, W. J. M. 1990. Exploring the time course of lexical access in language production: Picture-word interference studies. *Journal of Memory and Language*, 29, 86-102.

Snodgrass, J. G. & Vanderwart, M. 1980. A Standardized Set of 260 Pictures: Norms for Name Agreement, Image Agreement, Familiarity, and Visual Complexity. *Journal of Experimental Psychology: Human Learning and Memory,* 6 (2), 174-215.

Spivey, M. & V. Marian. 1999. Cross talk between native and second languages: Partial activation of an irrelevant lexicon. *Pcychological Science*, 10, 281-284.

Starreveld, P. A. 2000. On the Interpretation of Onsets of Auditory Context Effects in Word Production. *Journal of Memory and Language* 42, 497-525.

Starreveld, P. A. & La Heij, W. 1999. Word-substitution errors in a speeded picture-word task. *American Journal of Psychology,* 112, 521-553.

Strijkers, K., Costa, A., Thierry, G. 2010. Tracking lexical access in speech production: Electrophysiological correlates of word frequency and cognate effects. *Cerebral Cortex,* 20 (4), 912-928.

Sunderman, G. & Schwartz, A. I. 2008. Using cognates to investigate cross-language competition in second language processing. *TESOL Quarterly,* 42, pp 19-33.

Tzelgov, J., Henik, A., Sneg, R. & Baruch, O. 1996. Unintentional word reading in via the phonological route: The stroop effect with cross-script homophones. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* 22, 336-349.

Van Hell, J. G. 1998. *Cross-language processing and bilingual memory organization.* Unpublished doctoral dissertation. University of Amsterdam. (?) Amsterdam: Universiteit van Amsterdam.

Vitkovitch & Tyrrell, 1999)

Von Studniz, R. E. & Green, D. W. (1997) "Lexical decision and language switching". *International Journal of Bilingualism: Cross-Disciplinary, Cross-Linguistic Studies of Language Behavior*, 1, 3-24.

Weinreich, U. 1953. *Languages in Contact: Findings and Problems.* New York: Linguistic Circle of New York (Reprinted in 1979 by Mouton, The Hague).

Wilson, H. 1999. The overlapping distributed model for the bilingual lexicon: some evidence from Spanish-English form priming. PhD dissertation, University of New Mexico.

Yudes, C., Macizo, P., Bajo, T. 2010. Cognate effects in bilingual language comprehension tasks. *NeuroReport*, 21, 507-512.