

**LEXICAL REPRESENTATION OF COGNATES AND  
NONCOGNATES IN SECOND LANGUAGE LEARNERS: AN  
INVESTIGATION USING THE TRANSLATION  
RECOGNITION TASK**

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## Abstract

This study tests the prediction made by the Parasitic Model of vocabulary acquisition (Hall, 2002), that upon initial exposure to a second language (L2), learners benefit from the existence of formal and conceptual overlap that is shared between pairs of cognates. The accuracy and response time performance of two groups of native English-speaking learners of French, one with less French exposure and one with more French exposure, was compared in a translation recognition task. In the task, participants had to decide whether two words were correct translation pairs when the first word presented was French and the second word presented was English. In the trials where participants were required to answer “no”, the English words were incorrect but were similar to the French word in form. Half of the incorrect pairs included a French word that is a true French-English cognate (e.g. *gris*–*grim*) and half of the incorrect pairs included a French word that is a true French-English noncognate (e.g. *lapin* – *latin*). In the trials where participants were required to answer “yes”, half the pairs were correct cognates (e.g. *gris* – *grey*) and the remaining pairs were correct noncognates (e.g. *lapin* – *latin*). In the “no” trials there was no effect of cognate status of the French prime, but an overall effect of orthographic relatedness of the distracter item, which was present in both less and more L2 exposure groups. This result is taken as support of the theory of language non-selective access (Dijkstra & Van Heuven, 1998). In the “yes” trials there was an effect of cognate status, which provides support for the Parasitic Model. Moreover, the accuracy results show that the rate of the lexicon’s integration of orthographic knowledge is greater for novel noncognate words compared to novel cognate words. This result is taken as support for the hypothesis that the excitatory connections that exist between cognate representations remain permanent throughout second language acquisition.

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## 1. INTRODUCTION

There is no denying the crucial role of the lexicon in second language acquisition (SLA). As Singleton (1999) points out, the great task of learning either a first language (L1) or second language (L2) lies in the “nitty-gritty” of the lexicon, as opposed to “broad syntactic principles” (1999: 4). In monolingual psycholinguistic models of production and comprehension, the mental lexicon is placed in the centre of operations (Aitchison, 1994; Levelt, 1989). For example, in Levelt’s Lexical Hypothesis, speech is ultimately “lexically driven”, in that the lexicon functions as a mediator between intended meaning and its grammatical and phonological formulation (1989: 181). A lexicon-centric view of language is also particularly relevant to a theory of second language acquisition, because, according to Laufer, “the most striking differences between foreign learners and native speakers is in the quantity of words each group possesses” (1998: 255).

Much of the research on SLA questions the extent of the influence of the existing L1 lexicon on the acquisition of L2 lexis. As shall be covered in the upcoming literature review, with regard to the lexicon specifically, much work in psycholinguistics over the last 30 years has highlighted the high degree of connectivity between the L1 and L2 lexicon. In other areas, scholars have looked at second language lexical competence (Nation, 2001; Singleton, 1999). Nation (2005), for example, argues that the focus of research on L2 competence should be at the level of the lexical unit, rather than on the level of syntax. This view does not seem so controversial given the extensive body of research on ‘cross-linguistic influence’ (CLI), which has consistently favoured the view that L2 learners exploit any available surface-feature similarities between two languages (Kellerman, 1977, 1983; Ringbom, 1987). Within the domain of CLI research there are numerous studies on ‘borrowing’ or ‘lexical transfer’, out of which spawned the first investigations into the role of ‘cognates’ in second language acquisition (cf. Odlin, 1989). Cognates are groups of translation equivalent words that share a high degree of both orthographical/phonological form and meaning. For example, the English word *milk*, the German word *milche* and the Croatian word *mlijeko* are all cognates. According to Ringbom (1983), learning cognates are an important step in expanding the L2 lexicon because formal similarity across potential translation equivalents is the first stage of integrating new words into the lexicon. Laufer (1988; 1990a; 1990b) has considered this issue even further, suggesting that formal similarity between two words (‘synforms’) can also lead to a false hypothesis that the words share meaning, such as in the

case of false cognates. Meara (1984) too, has also presented extensive data, which suggest that L2 learners assume meaning overlap between a novel L2 item and its perceived L1 equivalent, purely based on formal resemblance.

Even though research into language pedagogy and linguistic transfer has established that cognates provide learners a “foothold” into the L2 lexicon (Midgley, Holcomb & Grainger, 2011: 1634), the fact still remains that in the task of second language vocabulary acquisition “cognates are the exception, not the rule” (La Heij, Hooglander, Kerling and Van Der Velden, 1996: 653). Despite this, psycholinguists continue to exploit the unique status of cognates in order to illuminate theories of monolingual and bilingual theories of lexical representation and process. As will be surveyed in the current study, their particular status has aided psycholinguistic research on lexical storage and access in the task of tapping into the underlying organisation of L1 and L2 words in the mental lexicon. One theory of L2 lexical representation is Hall’s (2002) Parasitic Model, which forms much of the theoretical framework of the current study. The Parasitic Model proposes a mechanism of integration of L2 word forms using available links with formal features existing within the L1 lexical network. Central to the study, the Parasitic Model makes different predictions for patterns of cognate and noncognate processing in L2. The model however, does not make specific predictions about how these patterns change over time.

This study compares cognate versus noncognate lexical access across less and more exposed native English-speaking learners of French using a translation recognition task. The task was chosen with the aim of capturing existing inter-linguistic connections between L1 and L2 words using a chronometric analysis methodology. The translation recognition experiment was designed to generate an interference effect by deliberately pairing an incorrect but orthographically similar L1 English word with an L2 French word. A potential interference effect caused by the L1 distracter is reflective of cross-linguistic competition. Response times and accuracy data were recorded in order to measure whether French primes that are cognates generated more interference and confusion than primes that were noncognates when presented before English words that were form-related but did not share meaning. If more interference was generated by French cognate primes, then this may be an indication of the exceptional links that are hypothesized to exist between pairs of cognate words in the bilingual lexicon.

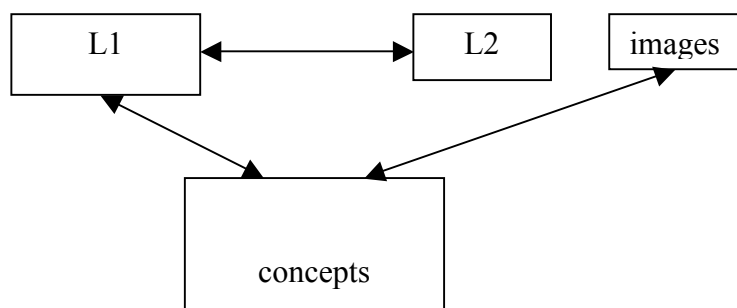
This dissertation begins with a review of the literature pertinent to the understanding of

the organisation of the L1 and L2 lexicon. Before arriving at the Parasitic Model's representation of the relationship between L1 and L2 lexical units, it is necessary to firstly review two other prominent research approaches, which concern the understanding of the macro-level architecture of the bilingual lexicon. The first approach aims to characterise the bilingual lexicon from the perspective of lexical and conceptual organisation. This approach is relevant to this study because it has given insight into the development of the configuration of the lexical and semantic levels of bilingual lexicon representation. The second approach is rooted in the connectionist framework of language processing. Connectionism, which was pioneered by McClelland and Rumelhart (1981), aims to explain the mechanics of online language performance by using artificial networks to simulate real-life cognitive processes involved in human pattern association. The bilingual adaptation of McClelland and Rumelhart's (1981) connectionist model is essential to the discussion as it describes the processes behind visual word recognition when there are two languages operating within the same lexical network. In the section that follows, I will present an outline of the specific aims of the present study, which will include a discussion of the adopted methodological approach. Following the data analysis and results, I will interpret and discuss the implications of my findings. The final section includes a concluding summary of the main findings of the study.

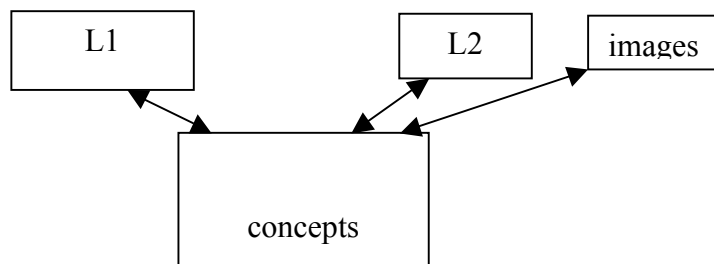
## 2. LITERATURE REVIEW

### 2.1. *The development of bilingual lexical and conceptual memory*

Models of bilingual processing have traditionally aimed to address the way in which the second language (L2) learner acquires and connects new L2 lexical representations with an already existing store of native-language words and their meanings. In an early account of the organisation of the bilingual lexicon, Potter, So, Von Eckhardt and Feldman (1984) compared two formative models of the bilingual lexicon that were originally developed by Weinreich (1974). The Word Association Model (Figure 1) describes a subordinate system in which the conceptual access of an L2 word is mediated by the L1 translation equivalent. In contrast, the Concept Mediation Model (Figure 2) describes a compound system in which there is no connection between L2 words and L1 words. In this model, the meaning of the L2 word is accessed directly. Potter et al. (1984) rejected the Word Association Model in favour of the Concept Mediation hypothesis based on similar reaction time (RT) data for forward (L1 to L2) translation and picture naming in less and more fluent bilinguals. They reasoned that concept mediation involves the same number of stages for both task types; in forward translation and picture naming, once the word or picture has been conceptualized, then access of the L2 item is direct. In contrast, under the Word Association Model, picture naming and forward translation would have produced varying RT results. Picture naming under the Word Association Model demands one extra stage: once conceptual access has occurred, the L1 lexical entry must be accessed before translation into L2. Forward translation under the Word Association Model requires one less stage because conceptual mediation is not implicated; instead, the L1 word connects directly with the L2 equivalent.



**Figure 1.** The Word Association Model (adapted from Potter et al., 1984)

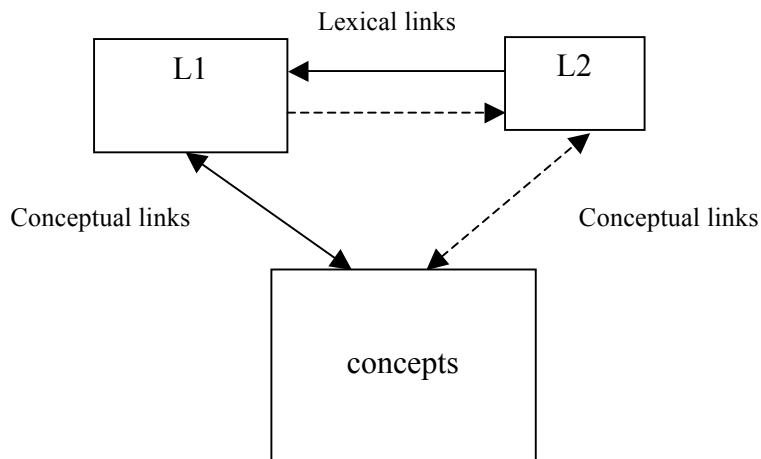


**Figure 2.** Concept Mediation Model (adapted from Potter et al., 1984)

In spite of Potter et al.'s (1984) evidence in support of a theory of concept mediation in bilingual lexical access, subsequent research has suggested that as bilinguals become more fluent there is a developmental progression from word association to concept mediation. Chen and Leung (1989) and Kroll and Curley (1988) both found evidence in contradiction of the claims of Potter et al.'s study. Chen and Leung (1989) found support for the Word Association Model in less fluent bilinguals, in that RTs for forward translation were faster than RTs for picture naming. Kroll and Curley (1988) also failed to replicate the findings of Potter et al.'s study. For more fluent bilinguals, they reported interference effects in picture naming, forward translation and word naming tasks that required participants to semantically categorise items. The same effect was not found for less fluent bilinguals, which suggests that L2 lexical access does not directly activate meaning in less skilled bilinguals.

To account for the emerging picture of the development of the bilingual lexicon, Kroll and Stewart (1994) proposed the Revised Hierarchical Model (henceforth RHM). The RHM (Figure 3) unifies the Word Association Model and the Concept Mediation Model in order to represent the implications of the findings that the strength of the connections between words and the conceptual store changes as L2 fluency progresses. The RHM proposes that in order to access the meaning of new L2 words, learners access the L1 equivalent first. According to the model, the strength of the lexical level connection is stronger from L2 to L1 than from L1 to L2 because the retrieval of L2 meaning requires the regular access of information from the L1 (the RHM represents the asymmetry of connection strength with weaker links represented as dashed lines). Regarding the connections between words and concepts, the RHM proposes

that the strength of the link from words to concepts is greater for L1 words than L2 words, but eventually, as L2 proficiency increases, conceptual access becomes stronger for L2 words.



**Figure 3.** The Revised Hierarchical Model (adapted from Kroll & Stewart, 1994)

Kroll and Stewart (1994) found evidence in support of the RHM in an experiment that involved highly proficient Dutch-English bilinguals translating either semantically categorised or semantically randomised lists. Kroll and Stewart found that translation from L1 to L2 engages conceptual access because semantic categorisation of words made translation times slower. On the other hand, L2 to L1 translation was not affected by the manipulation of semantic categorisation because translation times were the same for semantically categorised and randomized word lists. Therefore, this finding confirmed the RHM's proposed asymmetry between the connection strength of L1 words and concepts and L2 words and concepts.

Further support of the RHM comes from a study carried out by Talamas, Kroll and Dufour (1999) that compared translation recognition performance in less and more fluent Spanish-English bilinguals. In the task, participants were required to decide whether a series of pairs of English-Spanish translation equivalents were correct or not. Talamas et al. (1999) found that less fluent participants took longer than more fluent bilinguals to decide on incorrect translation pairs when an L1 word was orthographically related to the real L1

translation. For example, a pair such as *garlic* - *ojo* complicated the decision process because *ojo* meaning ‘eye’ shares formal resemblance with *ajo*, which is the correct translation equivalent. On other hand, semantically competing incorrect translation pairs were more difficult for more fluent bilinguals to decide on. For example, when an incorrect pair such as *snow* - *lluvia* was presented, RTs were slow relative to control pairs, because *lluvia* meaning ‘rain’ is semantically related to the correct equivalent of *snow*, which is *nieve*. This finding supports the general claim of the RHM, that in early bilinguals there is strong activation of the L1 equivalent, but this disappears with L2 experience.

What makes these findings so relevant for this particular study is that they shed light onto the way in which L2 forms are mapped onto their meanings in coordination with the pre-existing L1. The evidence reviewed here is in favour of a broad picture of bilingual development in which less proficient learners are dependent on the L1 to access stored word meanings, whereas more proficient learners are able to access L2 word meanings directly. It is clear that the most robust model to account for this is the RHM. However, at the lexical level, the aim of the RHM is only to characterise the dependence of less fluent bilinguals on the translation equivalent, and in doing so the L1 and L2 lexicon are represented as two distinctly separate entities. There is another domain of psycholinguistic research onto bilingual processing that suggests that the L1 and L2 lexicons are not detached, but are instead part of one integrated lexical network.

## ***2.2. Language non-selectivity in bilingual visual word recognition***

The studies reviewed so far have drawn attention to the nature of L1 influence in the development of the L2. However, another line of research has focused on the degree of interconnectivity of the L1 and L2 in online language comprehension. Out of this area of investigation, there is now substantial evidence that in visual word recognition, bilinguals activate both languages in parallel. This evidence is key to the present study because it makes specific predictions about the distinction between cognate and noncognate lexical access.

Many of the studies that have explored the nature of bilingual word recognition are based on the findings of seminal psycholinguistic research on the online processes of monolingual lexical access. The most prominent of such studies was carried out by Coltheart, Davelaar, Jonasson, and Besner (1977), who revealed that when a target shares orthographic features with a set of other words in the same language, these competing form relatives decelerate the

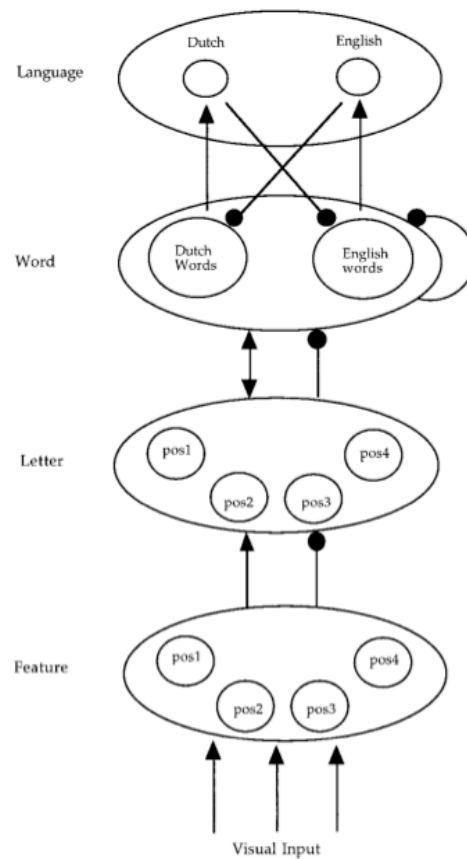
retrieval of the target item. Using a lexical decision task, Coltheart et al. (1977) found that nonwords with a high number of close orthographic neighbours took longer for participants to decide on than nonwords with a low number of orthographic neighbours. For example, accessing a real English word such as *cold* would receive more lexical competition than the word *sign*. *Cold* has many orthographic neighbours, including *cord*, *sold*, *fold* and *colt*, yet the word *sign* only has *sigh* as an orthographic neighbour.

McClelland and Rumelhart (1981) interpreted the effect of lexical neighbourhood density on word retrieval as a process of spreading parallel activation of competing lexical representations. In this view, the metaphor of neural connectivity is used to describe the mechanism of competition and selection involved in lexical access. According to McClelland and Rumelhart's (1981) connectionist Interactive Activation model, orthographic representations are arranged into three levels of representation. At the bottom level are sub-lexical feature nodes and above these are letter and word level nodes. As a string of letters is presented to the model, information is activated at each node level that is present in the visual input. Crucially, each representational node is connected within and across levels and it is the strength of these connections that drives the lexical selection process. If the competing nodes are related, the connections are excitatory and if the competing nodes are unrelated, the connections are inhibitory. The target lexical representation is ultimately selected through a process of lateral inhibition. In other words, the lexical representation that first surpasses an activation threshold is selected as the target item and the potential candidates that do not exceed this threshold become suppressed.

There is now compelling evidence that the theory of monolingual interactive parallel activation can be extended to accommodate a theory of bilingual word recognition (Dijkstra & Van Heuven, 1998; Grainger & Dijkstra, 1992; Van Heuven, Dijkstra & Grainger, 1998). For example, Van Heuven, Dijkstra & Grainger (1998) found that in proficient Dutch-English bilinguals, word selection inhibition is not only determined by the neighbourhood density of the target language, but also of the neighbourhood density of both languages combined. Van Heuven et al. (1998) showed that when a lexical identification task was performed in English (L2), minimal orthographic pairs across both languages were activated. For example, the Dutch word *oord* has *word* and *bord* as within-language orthographic neighbours but also *lord* and *ford* in English. Moreover, when the density of the orthographic neighbourhood was unequal across languages, an effect on lexical decision times was observed. When the average neighbourhood density of the set of English target items was

large in Dutch, but small in English, lexical decision RTs were slower. In contrast, when the average neighbourhood density value was increased in the English language, this slowed down response times to Dutch items and facilitated English lexical decision. These findings were among the first to suggest that bilingual lexical access is nonselective, in that words belonging to both languages are considered for selection when access to only one language is required.

Ultimately, Van Heuven et al.'s findings suggest that when L2 lexical items are incorporated into the lexical network, the word activation mechanism remains indifferent to which language the target item belongs. The Bilingual Interactive Activation (henceforth BIA, Figure 4) model (Dijkstra & Van Heuven, 1998) accounts for the hypothesis of language nonselective access in bilingual word recognition and is an adapted version of its monolingual counterpart. The added features of the BIA model include an integrated lexicon and the language node feature. According to Van Heuven et al. (1998), at the word level, all words from both languages inhibit each other, and these word nodes send activation to the corresponding language node. To select the right language, the language node sends top-down inhibitory feedback to words that do not exist in the language. Eventually, the unintended language should be sufficiently suppressed and the word in the correct language is selected.



**Figure 4.** The Bilingual Interactive Activation Model (adapted from Dijkstra & Van Heuven, 1998)

In further support of the BIA model, Dijkstra, Van Jaarsveld and Ten Brinke (1998) found evidence to suggest that more fluent bilinguals are less sensitive to the orthographic characteristics of the stimulus and are able to make use of the presence of higher-level word meaning information. In the study, a lexical decision experiment was used in order to assess the level of L1 influence on L2 word retrieval. In the experiment, proficient Dutch-English bilinguals were required to perform lexical decision in their L2. Dijkstra et al. (1998) found that the presence of Dutch-English interlingual homographs, words that are identical in form but do not share meaning, did not affect RT performance. However, also included within the critical materials were Dutch-English cognates, words that share form and meaning, and this did facilitate RT performance. Therefore these findings are also compatible with the predictions made by the RHM, in that more fluent bilinguals were sensitive to the manipulation of semantic features.

In a more recent study, Sunderman and Kroll (2006) explicitly tested both the RHM and the BIA model in the same experiment. Their findings are relevant to the current study

because they provide clear evidence for the distinction between the kind of lexical processing predicted by the RHM versus the kind of lexical processing predicted by the BIA model. In their experiment, Sunderman and Kroll (2006) assessed whether language proficiency effects the level cross-language lexical activation in English-Spanish bilinguals in a translation recognition task. In the translation recognition task, an L2 prime followed by an L1 word are presented and participants have to decide whether the two words are correct translations. In one condition of the experiment, incorrect English (L1) translations were orthographic neighbours of the target Spanish (L2) word, for example, *cama* - *comma* was presented instead of the true translation pair, *cama* - *bed*. In another condition, incorrect English translation neighbours were, this time, orthographic neighbours of the true English equivalent, for example *cara* - *face* was presented instead of *cara* - *fact*. Sunderman and Kroll (2006) reported that, regardless of proficiency, L1 lexical neighbours of the L2 words affected response times and accuracy of judgements relative to control words. They also reported an effect of proficiency on response times and accuracy on translation judgement. In other words, more proficient L2 learners were more accurate and faster at responding to form-related lexical items compared to less proficient L2 learners. On the other hand, L1 words that were neighbours of the L1 equivalent were only troublesome for less fluent bilinguals and only produced minimal interference for more fluent bilinguals.

Overall, the findings of Sunderman and Kroll's (2006) study provide further support for both the BIA model and the RHM, but do so within the same task context. Importantly, these findings converge upon previous BIA-centred research reviewed in this section. They suggest that activation and competition between potential word candidates is language non-selective. According to Sunderman and Kroll this is because L1 activation is an "unavoidable" and "general" characteristic of bilingual word recognition (2006: 418). Yet, the results also suggest that activation of the L1 translation neighbour diminishes as proficiency increases, which provides evidence for the RHM. This experiment has provided much influence on the current project, which aims to use the same methodology in order to investigate the way in which cognates in contrast to noncognates are represented in the bilingual lexicon.

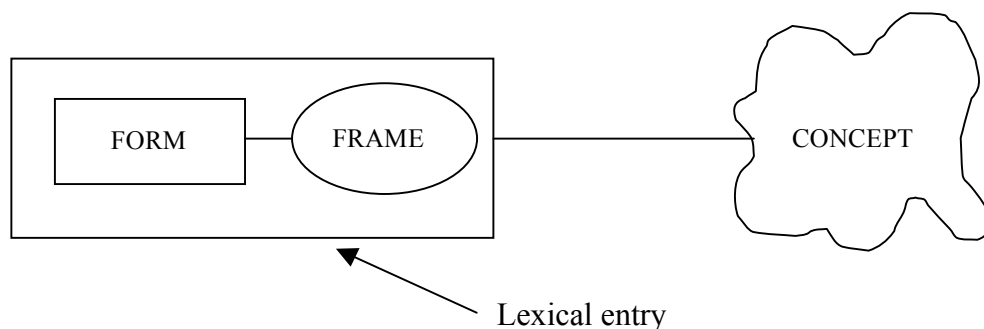
### ***2.3. Cognates within the bilingual lexical network: The Parasitic Model***

To further understand the mechanisms of cross-language interference it is necessary to refine the scope of the representation of the bilingual lexicon. The BIA is useful in that it

represents a psychologically real process of word access, but the model does not fully address the way in which L2 lexical form is mapped onto meaning. The RHM, on the other hand, does include a representation of bilingual lexical and conceptual organization and is a useful characterisation of the macro-level architecture of the bilingual lexicon. Yet, in order to gain a clearer understanding of the difference between how particular L2 lexical items are processed in the initial stages of L2 input, the lens onto which the lexicon is viewed must be magnified.

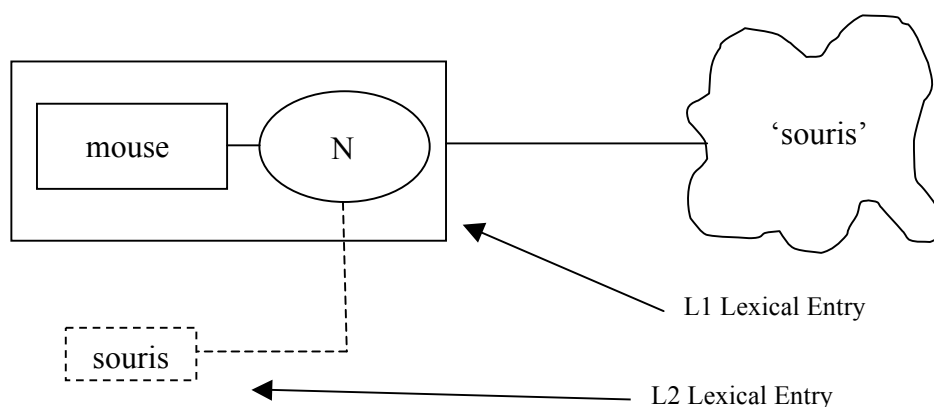
The Parasitic Model, developed by Hall (1992, 2002), fulfills this demand by depicting the nature of cross-linguistic lexical activation at the micro-level of the lexical unit. The model details the representation and process of particular cross-linguistic instantiations within the lexical network. The Parasitic Hypothesis (Hall, 2002) describes the process of integration of novel lexical input into a system of prior lexical knowledge. The main claim of the model is that connections are made, where possible, between new lexical representations (parasites) and existing representations (hosts) where there is an available point of contact to be made. This, according to Hall and Ecke (2003), is the automatic and default process in second language, and even third language vocabulary acquisition.

The Parasitic Model is represented using Hall's (1992) Triad Model as the framework of a lexical entry (Figure 5). According to the Triad Model, lexical entries within the mental lexicon are made up of two representational substructures, the first is a pairing of phonological/orthographic surfaces features and syntactic frame nodes which constitute the linguistic element of the entry, and the second is the nonlinguistic conceptual representation (this configuration is not unlike Levelt's (1989) conception of the lexeme/lemma/concept triad).



**Figure 5.** The Triad Model (adapted from Hall, 1992)

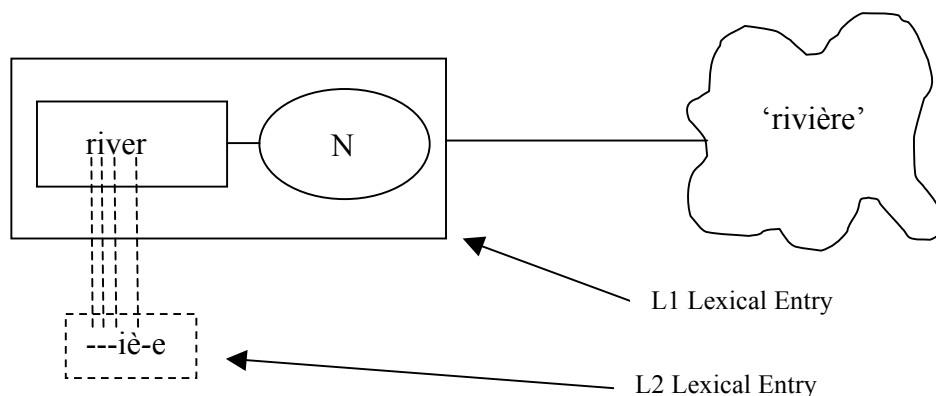
According to the model, the language faculty deals with the novel surface form by assigning it a meaning based on available explicit confirmation (e.g. a classroom translation task) or any implicitly deducible cue (e.g. contextual or information). The parasitic strategy claims that upon hearing a novel lexical item a process occurs whereby the speaker makes use of the available information in the linguistic environment to “construct a memory trace of the pronunciation and/or spelling, and then to make the right connections with existing lexical and conceptual knowledge” (Hall, 2002: 72). In the model, the syntactic information of the L1 word is specified, but the L2 representation shares this information. Jiang (2000) adopted a similar kind of L2 word representation in his model of lexical fossilization, where L1 lemma/grammatical information is contained within the L1 entry. The default noncognate connection of the Parasitic Model is represented below (Figure 6) using two English-French translation equivalents.



**Figure 6.** The Parasitic Model with noncognate translation equivalent (adapted from Hall, 2002)

Central to the current study are the theoretical claims made by the Parasitic Model about the representation of inter-lexical connectivity based on overlapping formal characteristics of the L1 and L2 words. In exceptional circumstances translation equivalents share not only meaning, but also form. These kind of cross-language pairings are called ‘true cognates’ or just ‘cognates’. For example, a French-English pairing like *rivière* and *river* are true cognates as they share a significant amount of orthographic/phonological overlap and also meaning. In some cases though, two words across languages may just share form and not meaning, for example the word French word *attendre* meaning ‘to wait’ is not the translation equivalent of the English word *attend*. Pairs such as these are called “false cognates” or “faux amis” as they do not share the same underlying concept and have been found to mislead foreign language learners (Holmes & Ramos, 1995) and cause inhibitory effects on L2 reading times compared to cognates (Nakayama & Archibald, 2005). Hall (2002) tested the parasitic strategy on native Spanish-speaking learners of English in an experiment that tested whether participants would report familiarity and assume true translation equivalence status of English nonwords that orthographically overlap with real Spanish words (pseudocognates). Hall (2002) found that participants reported greater familiarity and provided more consistent real Spanish translations with pseudocognates compared to control English nonwords that shared no formal resemblance with words in Spanish.

In contrast to the default noncognate parasitic representation, where the L2 item is connected to the syntactic frame element of the host, the inter-lexical connection of a cognate pair is represented with dashed lines between orthographic features, which represent the redundant connections between the L2 and L1 orthographic representations. In this way, the Parasitic Model is very much consistent with the governing principle of the BIA model, in that spreading activation of orthographic/phonological features across whole L1 and L2 word representations is the most economic and efficient means of lexical processing. This feature of Parasitic Model is also in line with Lemhöfer and Dijkstra’s (2004) interpretation of the facilitatory effects of near and identical cognates on reading time as support for the theory of cognate recognition as a process of co-activation of separate language-tagged orthographic cognate representations, which then feed forward to a single shared semantic node. The Parasitic Model assumes this feature in its figurative representation whereby the L2 item is attached subordinately to the L1 item, and meaning is only accessed through the activation of the L1 equivalent.



**Figure 7.** The Parasitic Model with cognate translation equivalent (adapted from Hall, 2002)

### ***2.3.1. The development of parasitism***

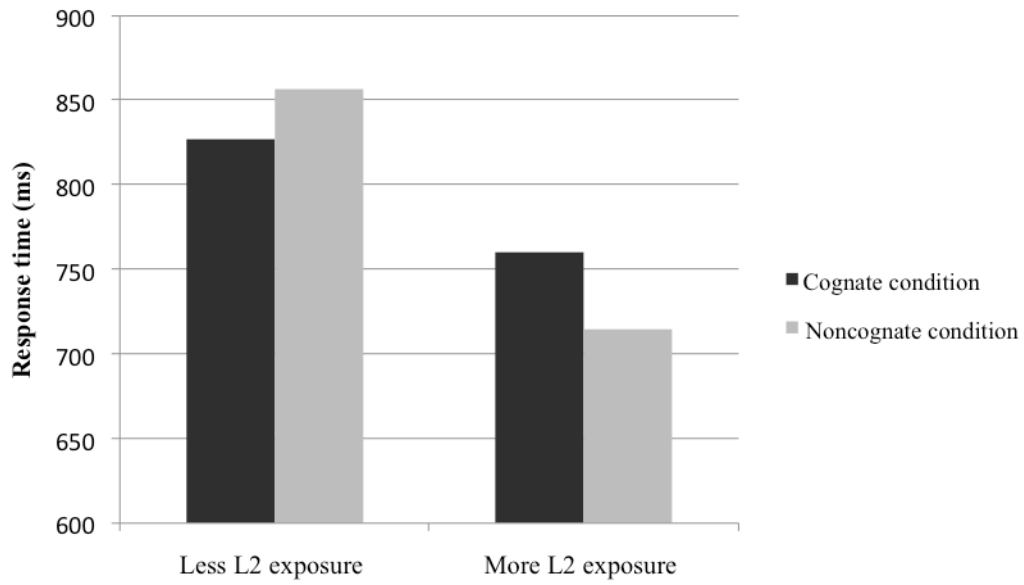
At the macro level, Kroll and De Groot (1997) suggest that lexical mediation eventually gives way to direct conceptual access, which leads to greater control and inhibition of both languages. But at the fine-scale lexical and sub-lexical level, it cannot be certain that all lexical entries transition to greater autonomy at the same rate. The current study aims to provide an ontogenetic account of cross-linguistic influence beyond the first stages of initial L2 exposure, after the initial parasitic links connections have been established. As a first step towards reaching this goal, it is useful to think of the lexicon as a vast and interconnected store of word representations.

In his seminal book on speech production, Levelt (1989) argues that lexical level connections are either intrinsic, which are the links *within* the four blocks of lexical entry information (semantics, syntax, phonology/orthography and morphology), or associative, which are the links *between* lexical entries at each point of contact. It is clear in the Parasitic Model, that the lexical links are associative; they occur when L2 lexical entries associate themselves with an L1 entry without a fully composed intrinsic structure. Crucially, Levelt (1989) also argues that the mental lexicon is dynamic, once the intrinsic lexical information has been established in the L2 entry (the *form* and *frame* in the Parasitic Model) the subordinate association across the L1 and L2 entry information may no longer be required. At this stage, the L2 lexical entry would become independent of the L1 entry. The process of achieving greater L2 autonomy is characterised by Hall and Reyes as “an ongoing reconfiguration and expansion of networks of lexical “triads” of form frame and concept”

(2009: 28). Therefore, the transition towards “emancipation” of the L2 parasite from its L1 host must be due to the lexical network receiving greater input and activation in the L2 (Alonso, 2010). Once this occurs, inhibition of the L1 network becomes stronger and the new L2 system can become more qualitatively distinct from the L1 system.

Hall (2002) makes the distinction between a cognate versus a noncognate associative connection in a static representation of the L2 lexical entry. What must follow is an account of how these two types of L2 lexical representations develop longitudinally from the stage of early input. In a study aiming to confirm the presence of parasitic links, Schmidtke (2010), using a chronometric analysis methodology, traced the development of cognate versus noncognate word recognition. The experiment tested the changes of parasitic links pseudolongitudinally, by comparing two groups of native English-speaking school children learning French who had accumulated differing amounts of L2 exposure in the classroom. The experiment task required participants to answer whether they were familiar with a series of cognate and noncognate French words to which they had been previously exposed to in class. The results of the experiment showed that with little L2 exposure, cognate lexical access was faster than noncognate lexical access. However, with more L2 exposure, noncognate lexical access RTs ended up being faster than cognate lexical access RTs (Figure 8). The implication of this finding is that the highly excitatory and exceptional parasitic attachments between formal feature nodes in cognates make it difficult for the L1 host to shake-off the L2 parasite. In other words, the results of Schmidtke (2010) suggest that the *resilient* parasitic links between the L2 and L1 cognate translation equivalents, over time, are less susceptible to change. In contrast, the results suggest that noncognates are not connected to the L1 entry with the same high level of resilience; therefore the intrinsic lexical connections can be reconfigured with more ease.

### Schmidtke (2010) Results



**Figure 8.** Mean RTs of French cognate and noncognate recognition with less and more French (L2) exposure (from Schmidtke, 2010)

### 3. THE PRESENT STUDY

The present study aims to follow the same route of Schmidtke's (2010) enquiry into the existence and development of parasitic links using a chronometric analysis methodology. However, in the experiment reported by Schmidtke (2010) L2 learners were only required to answer whether they were familiar with an L2 word, and although the task provided a realistic reflection of the lexical processing of cognate versus noncognate words, it cannot be certain that the familiarity judgment task captured to what extent the learners really 'knew' the words they were being presented, if at all. In the experiment the critical stimuli were rejected or accepted on the basis of whether participants 'recognised' the word. So, even if a participant did press 'yes' to one of the words, surface feature recognition does not demand semantic access. Therefore, we cannot be sure whether this methodology revealed the availability of the corresponding semantic knowledge for the word forms. The current study aims to compliment the results of less advanced L2 learners' 'shallow' lexical knowledge with a measure of their deep lexical knowledge. In order to achieve this, it is necessary to use a different type of methodology, the translation recognition task, to see whether the same kinds of results hold.

In a translation recognition task, the participant sees a pair of words, one in the L1 and one in the L2. In the task, the two words can or cannot be correct translations of one another, and the participant has to decide whether the second word is a correct translation of the first word. In contrast to the word familiarity task, the translation recognition task does not exploit shallow and weakly rooted knowledge. The participant is required to verify whether the two words share the same meaning, therefore the translation recognition task forces the participant to activate conceptual retrieval (De Groot & Comijs, 1995). Because conceptual retrieval is implicated in this type of task, we can be sure that this methodology is able to penetrate lexical knowledge further than only the recognition of the surface form.

The rationale behind the current experiment design is to detect the presence of already existing parasitic links and trace their development over time. As the Parasitic Model claims, the difference between the parasitic connection in cognates and noncognates is that cognates are linked at the form level whereas in a noncognate parasitic connection, the target L2 entry is connected to the L1 frame. Therefore, in order to potentially exploit the difference between the two kinds of parasitic connections that exist between translation equivalents, this design manipulates the orthographic relatedness of the incorrect translations. In the current design,

the incorrect translations are manipulated so that the English (L1) word resembles the form of the French (L2) word. Sunderman and Kroll (2006) call these pairs ‘translation neighbours’. In general, when an incorrect, but form-related English word appears after the French prime, this should forcibly induce a cognate-like state. Eventually participants should be able to judge whether the form-related English word is a correct translation equivalent, but the overlap of form between the pair of words should cause interference and therefore longer RTs and decreased accuracy. In order to be sure of an effect of form interference, relative to each prime, correct judgments RTs of orthographically related words will be compared against RTs of unrelated control words. However, critical to this particular design however, is that the French prime words are divided into two sub-types so that half of the French prime words are true French-English cognates and the other half are true French-English noncognates.

The primary hypothesis here is that an incorrect but form-related English word presented after a French word that is a true French-English cognate (e.g. *construire* - *constrict* is presented instead of *construire* - *construct*) will create a greater effect of interference when compared to an incorrect but form-related English word presented after a French word that is a true French-English noncognate (e.g. *chanter* - *chunter* is presented instead of *chanter* - *sing*). The reasoning here is that there should be a greater amount of residual orthographic activation between a cognate French word and its incorrect form-related pair compared to a noncognate French word and its incorrect form-related pair. When presented with an incorrect English word which is form-related to a French word that is a cognate, highly activated orthographic links connecting the target item and the false item already exist between the L2 target item and the true translation equivalent. In contrast, when judging an incorrect form-related English word following a French word that is a noncognate with the true English word, the same level of activation across the various letter level nodes should not create an interference effect if the same level. This would therefore confirm the presence of parasitic links.

Moreover, if there is an effect of the cognate status of the French L2 prime, then I predict that, in RT and accuracy, the difference between the interference values for the less exposed and the more exposed French learners will be greater for incorrect form related noncognate translation pairs than incorrect cognate form-related translation pairs. This would be complement the data reported by Schmidtke (2010), that the rate of progression of word recognition speed from low to high L2 exposure is greater for noncognates than for cognates.

## 4. METHOD

### 4.1. *Participants*

Thirty-two secondary school children participated in the experiment. The participants were all native English speakers with normal or corrected-to-normal vision and were recruited from French language classes at a secondary school in England. All participants were monolingual and the only foreign language class they were enrolled on was the French course at the school. Prior to learning French in secondary school, all participants had not had any other formal teaching of French. French language ability was chosen on the basis of school year level. In this secondary school, the school children progress through the French curriculum in 5 stages, beginning at the school year age group of 11-12 years old (1<sup>st</sup> year of secondary school) and finishing at 15-16 years old (5<sup>th</sup> and final year of secondary school). The less proficient French learners ( $n = 16$ ) were selected from a subset of the highest ability group of 11-12 year olds<sup>1</sup>. The more proficient French learners ( $n = 16$ ) were selected from a subset of the highest ability group of 15-16 year olds. Proficiency level was therefore determined by a measure of exposure to classroom taught French. Operationalising L2 experience on the basis of classroom experience is not without limitation, but given the considerable gap between classroom exposure time for the less and more proficient French learners, L2 learning experience time is sufficient enough to validate the proficiency distinction. At time of experiment participation less exposed participants had amassed approximately 70 hours of French teaching at time of experiment participation, and the more proficient French learners had received 700 hours of French teaching.

### 4.2 *Materials*

To ensure that all participants were familiar with the words used in the task, all French stimuli were selected from the Expo 1 textbook which was used as a teaching material in 1<sup>st</sup> year French classes (Meier and Ramage, 2003). There were a total of 64 translation sets created. Half of these were correct French-English translation pairs and the remaining half was made up of false French-English translation pairs. Incorrect translation pairs were manipulated by replacing the true English equivalent with an English word that was orthographically related to the French translation counterpart (i.e. form related to the first

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<sup>1</sup> Ability level grouping is determined by Key Stage 2 SATs results in English, Mathematics and Science.

item of the pair). In the first condition, half of the manipulated incorrect translation equivalents were originally true French-English cognates and in the second condition the remaining half were originally true French-English noncognates. For example, in the correct French-English cognate word pair, *parc* - *park*, the English item is changed to *parc* - *part* and the correct French-English noncognate word pair, *chanter* - *sing*, is changed to *chanter* - *chatter*. The pairs in the first condition are called cognate lexical neighbours and the pairs in the second condition are called noncognate lexical neighbours, with *cognate/noncognate* referring to the cognate status of the French item and *neighbours* indicating that the two items are orthographically similar. For each incorrect item, in both conditions an orthographically unrelated control word was generated. An example of the materials used in the experiment is given in Table 1 and the full list of stimuli for the “yes” and “no” trials can be found in the Appendix.

**Table 1.** Illustration of materials used in each condition

<b>STIMULI EXAMPLES</b>		
	<b>L2 target item (French)</b>	<b>L1 translation (English)</b>
<b>Correct translations:</b>		
Cognate	<i>parc</i>	<i>park</i>
Noncognate	<i>chanter</i>	<i>sing</i>
<b>Incorrect translations:</b>		
Cognate lexical neighbour	<i>parc</i>	<i>part</i>
Unrelated control	<i>parc</i>	<i>deal</i>
Noncognate lexical neighbour	<i>chanter</i>	<i>chatter</i>
Unrelated control	<i>chanter</i>	<i>despise</i>

**Note.** In the experiment there are no multiple configurations of the same distracter in each condition as it appears in this table. The purpose of table is to illustrate how the words are manipulated and distributed across each condition. In other words, the cognate and noncognate French-English pairings in the correct translation condition do not appear in the incorrect translation condition. Moreover, the same cognate and noncognates with related distracters do not appear with unrelated distracters.

#### **4.2.1. Prime controls**

##### ***Cognate status***

A point scoring system was used to operationally define cognate status of the French primes and their true equivalents used in both the “no” and “yes” trials. In this system, orthographic likeness was required to be above 70% to be included in the cognate item list. With all inflections removed, 1 point was given to each identical letter in the same position, conventionally differing vowel equivalents in the same position are counted as 0.5, and conventionally differing cross-language consonant equivalents were also counted as 0.5. Below are three examples of how the cognate strength point scoring system was implemented on the French/English cognates (adapted from Schmidtke, 2010):

i.     r e p e   t e r

       r e p e a t

ii.    m o     n t a g n e

       m o u n t a i n

iii.   c o u l e u r

       c o    l o u r

As can be seen in example i., 10 of 13 letters overlap in the same positions, which therefore counts as an orthographic similarity of 77%. The letter *a* in ‘repeat’ is not counted as an overlapping letter as it is conventionally tied to the phoneme representation *ea*. In example ii., 12 out of 16 letters overlap which grades this cognate as having 75% formal overlap. Lastly, in example iii., 10 out of 13 letters directly match up in the same word positions. However, the *e* in the French vowel combination *eu* is the conventional equivalent of *o* in the English vowel combination *ou*. These two letters are therefore counted as 0.5 each, which contributes to an overall overlap total of 11 out of 13 (85%).

The average cognate likeness percentage values of the cognate primes used in the “yes” trials was compared to those used in the “no” trials in an independent T-test to ensure an

equal balance of cognate strength throughout the experiment. The non-significant result ( $t(30) = .641, p = .526$ ) revealed that the average cognate likeness of the French primes of the “no” trials ( $M = 75.06\%, SE = 2.11$ ) was similar to the average cognate likeness of the “yes” trials ( $M = 76.75\%, SE = 1.58$ ).

### ***Frequency and word length***

Frequency values (per million words) for the French prime words were taken from the French film subtitle corpus database, Lexique 2 (New, Pallier, Brysbaert, and Ferrand, 2004). This measure was used instead of a written French corpus based on evidence that film subtitle frequency as an estimation of real-life word-frequency is just as accurate at predicting differences in lexical decision times as a corpus of written language use (New, Brysbaert, Bronis and Pallier, 2007). New et al. (2007) calculated the correlation coefficient of word frequency and lexical decision time using several frequency measures as predictors of lexical decision RTs. It can be interpreted in the regression values in their analyses, that the film subtitle frequency is just as valid as a written corpus at predicting differences in lexical decision times.

The cognate French prime words and the noncognate French prime words were matched for frequency and number of letters. It was also important to balance frequency and word length of cognates and noncognates across “yes” and “no” trials. Two separate independent factorial ANOVAs were therefore performed for frequency and word length values of French prime words.

There was a non-significant main effect of trial-type on the frequency of the French prime,  $F(1, 60) = .659, p = .420$ . The result indicates that regardless of the French-English cognate status of the French prime, primes across “yes” and “no” trials were, on average, equally frequent. There was also a non-significant main effect of cognate status on the frequency of French primes,  $F(1, 60) = .466, p = .497$ . This result indicates that regardless of whether the prime is part of the “yes” trial or “no” trial stimuli set, on average, cognates and noncognate French primes were as equally frequent. There was also a non-significant interaction effect between trial type and cognate status of the prime,  $F(1, 60) = .020, p = .888$ . As suggested by the results in Table 2, this confirms that the difference in average frequency values of cognate and noncognate French primes was similar for primes in “yes” and “no” trials.

The results of the ANOVA for word length also revealed non-significant results. There was a non-significant main effect of trial type,  $F(1, 60) = .935, p = .337$ , indicating that irrespective of the French-English cognate status of the French prime, primes across “yes” and “no” trials were, on average, as equally long. There was also a non-significant main effect of cognate status on the word length of French primes,  $F(1, 60) = .037, p = .847$ . This result confirms that cognate and noncognate French primes, regardless of whether they were “yes” or “no” prime stimuli were, on average, of equal length. Crucially, as is suggested by the results in Table 2, there was a non-significant interaction effect between trial type and cognate status of the prime,  $F(1, 60) = .337, p = .564$ . This result verifies that the difference in average word length values of cognate and noncognate French primes was similar in “yes” and “no” trials. These averages can be seen in Table 2.

**Table 2.** Mean characteristics of French prime words used in “yes” and “no” trials

	Cognates		Noncognates	
	Frequency	Length	Frequency	Length
“Yes” trials	59	5.9	74.7	5.8
“No” trials	78.5	5.4	102.3	5.6

*Note.* Mean word length (number of letters) and mean word frequency per million in English were taken from Lexique 2 (New et al., 2004).

#### **4.2.2. Distracter controls**

##### ***Orthographic likeness***

Form related distracters were generated using the same method used to operationally define the cognate status of the prime words: all form related distracters shared at least 70% of their letters with those of the prime. The incorrect French-English items were also matched for grammatical class, so that the French item and both the orthographically related and unrelated control distracters were of the same lexical category. Also, every effort was made to ensure that all distracter types did not relate semantically to the French prime word or to the true English equivalent.

### ***Frequency and word length***

In both cognate and noncognate lexical neighbour conditions, orthographically unrelated control distracters were matched as closely as possible for word length and frequency to their respective related pairs. All word length and frequency values are given in Table 3. Matching related and unrelated distracters ensures that any difference in translation recognition performance is not influenced by variation of word length or frequency, but because of the variation of their orthographic characteristics. For example, if it takes longer for a participant to decide that *chanter-chatter* compared to *chanter-despise* then it can be deduced that response time interference stems from the overlap in lexical form and not the near-identical word length and frequency of *chatter* and *despise*.

A film subtitle frequency (per million words) measure was taken from the English Lexicon Project for each distracter (Balota, Yap, Cortese, Hutchison, Kessler, Loftis, Neely, Nelson, Simpson and Treiman, 2007). As well as comparing frequency and word length of the related and unrelated distracters, it was also necessary to ensure that frequency and word length of the distracters were matched across those paired with cognate and noncognate primes. It is crucial that any difference in the between cognate lexical neighbours and noncognate lexical neighbours in the accuracy and response time data are not attributable to a difference in the frequency and length characteristics between the distracters used in each condition. Therefore separate independent factorial ANOVAs were calculated for frequency and word length values.

The results of the frequency ANOVA were all non-significant. There was a non-significant main effect of orthographic relatedness of the distracter, such that regardless of the cognate status of the French prime to which a distracter is related, there was no difference between the average frequency values of the orthographically related and orthographically unrelated distracters,  $F(1, 60) = .000, p = .986$ . There was also a non-significant main effect of cognate status, such that regardless of the orthographic relatedness of the distracter types, there was no difference between the overall average frequency values of a distracter related to a cognate French prime compared to a distracter related to a noncognate related to a French prime,  $F(1, 60) = .038, p = .847$ . Crucially, there was no main interaction between orthographic relatedness and cognate status,  $F(1, 60) = .002, p = .969$ . This result confirms that the difference between the average frequency values of the orthographically related and unrelated distracters was the same for distracters related to cognate prime words and

noncognate prime words.

The results of the word length ANOVA were all non-significant too. The main effect of orthographic relatedness of the distracter was non-significant,  $F(1, 60) = .000, p = 1.000$ , which indicates that irrespective of the cognate status of the prime to which the distracter is related, there was no difference between the average word length of the orthographically related distracter compared to the average word length of the orthographically unrelated distracter. The main effect of cognate status was non-significant,  $F(1, 60) = 2.996, p = .089$ , such that regardless of orthographic relatedness of the distracter, the average word length of all distracters paired with cognates is not significantly less than the average word length of distracters paired with noncognates. Lastly, there was no significant interaction effect between orthographic relatedness of the distracter to the prime and the cognate status of the prime to which the distracter is related,  $F(1, 60) = .000, p = 1.000$ . This result expresses that the difference between the average word lengths of the orthographically related and unrelated distracters was the same for distracters related to cognate prime words and noncognate prime words.

**Table 3.** Characteristics of distracter and control words in all conditions of the experiment

	Distracter		Control	
	Length	Frequency	Length	Frequency
Cognate condition	5.1	28.8	5.1	29.1
Noncognate condition	5.6	26.8	5.6	26

**Note.** Mean word length (number of letters) and mean word frequency per million in English were taken from the English Lexicon Project (Balota et al., 2007).

### **4.3. Design**

Participants each saw 32 “yes” trials and 32 “no” trials in total. In the 32 “no trials”, 64 (32 related and 32 unrelated) English distracters were selected. Each French word was therefore paired with both a related and unrelated distracter. Half of the related and unrelated English distracters were incorrect equivalents of cognate French items and the other half were incorrect equivalents of noncognate of French items. Two versions of the experiment were therefore created so that the critical materials were counterbalanced. One version, presented

to half the participants within each group, had half the critical French stimuli paired with 16 related distracters and the other half of the critical French stimuli paired with 16 unrelated distracters (distributed evenly between cognate and noncognate French items). Another version switched the relatedness factor so that the same items that were paired with related distracters in the previous version were paired with unrelated distracters in this version and *vice-versa*. This aspect of the design ensures that each participant sees the French item paired with a distracter (either related or unrelated) only once. In the 32 “yes” trials, there was also an even distribution of cognate and noncognate translation pairs, these remained the same in both versions of the experiment.

#### ***4.4. Apparatus and procedure***

Each participant was tested individually and was verbally instructed by the experimenter and was also asked to read additional instructions that appeared on the computer screen before the experiment. The translations were presented so that a French word was presented on a screen for 400 ms replacing a fixation point. A blank screen followed the French word for 100 ms, and then an English word appeared in the same position. The English word remained on the screen until the participant pressed either the “yes” or the “no” button. The participants were instructed to decide whether the second word was a correct translation of the first word. Participants were instructed to respond as quickly and accurately as possible. RT was recorded to the nearest millisecond from the onset of the presentation of the second word. The materials were presented electronically using the experimental software program E-Prime 2.0 (Psychology Software Tools, Pittsburgh, PA). The materials were presented in 4 randomised block orders and the presentation order of the stimuli within each block was randomised. Ten practice trials were presented prior the start of the experiment.

A pilot run of the experiment was carried out on 3 participants of each proficiency group to ensure that the 400 ms duration of the prime was appropriate for the participants between 11 and 16 years of age. Unlike the present experiment, previous translation recognition tasks, such as Talamas et al. (1999) and Sunderman and Kroll (2006), have used post-pubescent individuals as subjects. The results of the pilot were such that across “yes” and “no” trials, the accuracy average accuracy score for participants belonging to both exposure level groups exceeded 70%. Therefore, the experiment with 400 ms prime duration was deemed suitable to run.

## 5. RESULTS

### 5.1. Data Analysis

Only the correct responses were included in the RT analysis. Accuracy is coded by E-Prime as either correct or error. Any RTs faster than 3000 ms were treated as outliers and removed from the analyses. Each participant mean for the “yes” and critical “no” trials were calculated and analysed separately. Any RTs that were 2.5 standard deviations above or below the participant’s mean were also treated as outliers and were excluded from the analyses. Less than 1% of the data were excluded.

### 5.2. Correct translation pairs

The correct (“yes”) trials were those in which the English translation equivalents of the French words were correct (these results can be seen in Table 4). Even though the hypothesis is dependent on the results of the “no” trials, comparing the two proficiency groups in the “yes” trials is useful as it further supports the distinction between the ability of the less exposed and more exposed L2 learner groups. Also, recall that half of the translation pairs in the “yes” trials were cognates and the other half were noncognates. An analysis of cognate status on translation recognition of correct pairs could also complement results of the incorrect trials. Therefore, a 2 x 2 mixed ANOVA was performed on the “yes” trials data, with exposure level entered as a between-subjects variable and cognate status as a related variable.

**Table 4.** Mean RTs (ms) and Percent Accuracy for Translation Recognition in “yes” trials

	Less L2 exposure				More L2 exposure			
	Cognate		Noncognate		Cognate		Noncognate	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
RTs	1094	286	1210	250	663	146	777	211
Accuracy	73%	14%	37%	13%	88%	9%	59%	10%

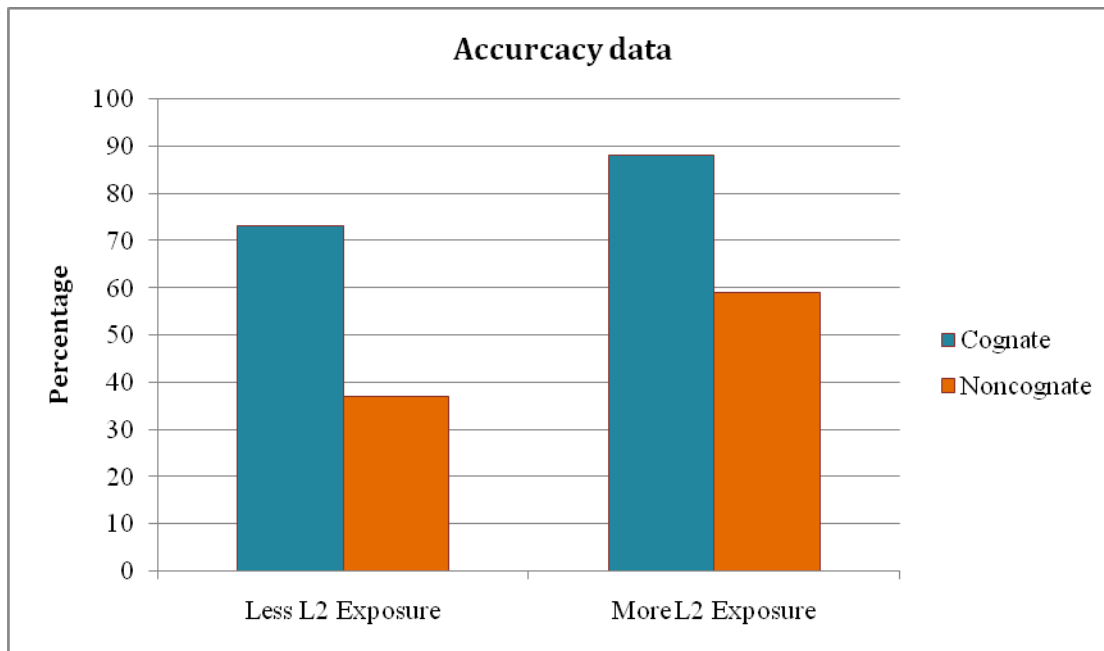
*Note.* *M* = Mean; *SD* = Standard Deviation.

For both accuracy and response time data, there were significant main effects of exposure level. Overall, the less exposed L2 learner group were significantly slower to judge correct translations,  $F(1, 30) = 34.634$ ,  $p = < .001$ , and made less accurate judgments,  $F(1, 30) = 51.003$ ,  $p = < .001$ , than the more exposed L2 learners. On average, the less exposed L2 learners responded in 1152 ms, which was significantly slower, compared with more exposed L2 learners who on average responded in 720 ms. The average accuracy for less exposed L2 learners was 55%, which was significantly lower than the average for the more exposed L2 learners, which was 81%.

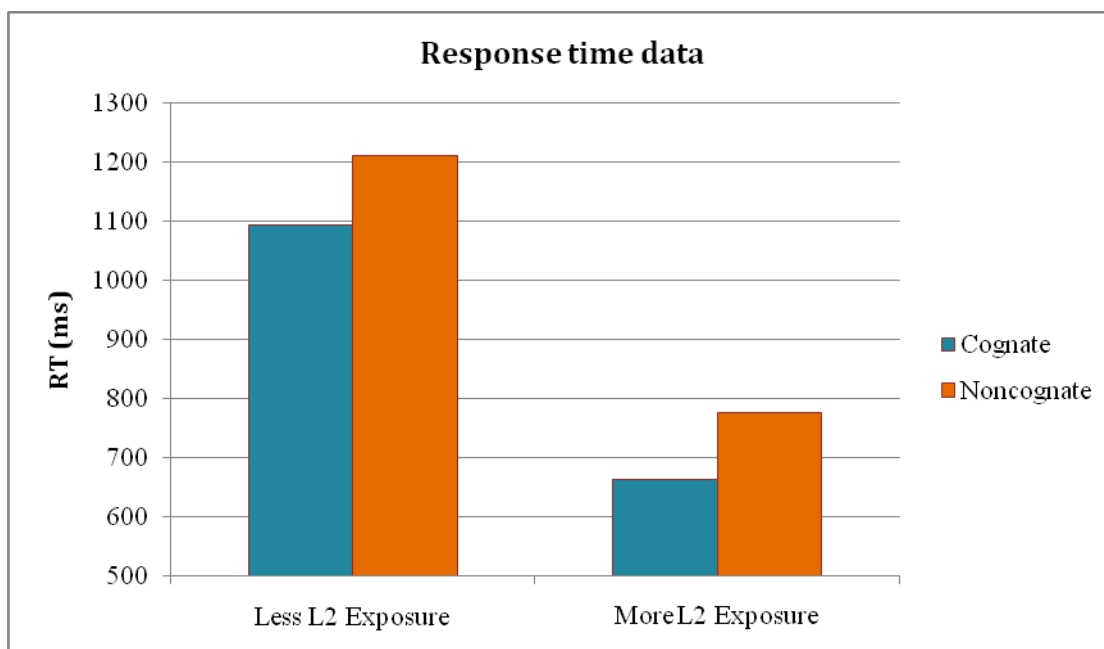
Furthermore, in the “yes” trials conditions, there was a main effect of cognate status. Overall, cognate translation pairs were judged faster, than noncognate translation pairs,  $F(1, 30) = 11.630$ ,  $p = < .05$ , and more accurately,  $F(1, 30) = 151.306$ ,  $p = < .001$ . On average, participants responded correctly to cognate translation pairs in 879 ms, which was significantly faster than the average response time to noncognate translation pairs, which was 994 ms. On average, the average accuracy for cognate translation pairs was 80%, which was significantly higher than the average accuracy score for noncognate translation pairs, which was 55%.

Moreover, in the accuracy data, there was a significant interaction between cognate status and exposure level,  $F(1, 30) = 27.47$   $p = < .001$ . The significant simple contrast effect,  $p = < .001$  indicates that the difference between the judgment accuracy of cognate and noncognate scores was notably greater for less exposed participants (diff. = 36%) than for more exposed participants (diff. = 29%). From less to high exposure, the difference between participants accuracy of cognates was 15% which is less than the 22% increase in accuracy of noncognate translation pairs from less to high exposure. This indicates that the rate of improvement for accuracy was more rapid for noncognate translation recognition than cognate translation recognition.

Even though the main effect of cognate status on response time judgment and accuracy of correct French/English translation pairs and the interaction effect of L2 exposure and cognate status on accuracy are intriguing results, at the moment, the most important and relevant finding in the “yes” trials data is the main effect of level of L2 exposure. Ultimately, this result provides additional validity for the distinction between the exposure level groups.



**Figure 9.** Mean accuracy for translation recognition judgement of cognate and noncognate L2 words in the correct trials



**Figure 10.** Mean RTs for translation recognition judgement of cognate and noncognate L2 words in the correct trials

### 5.3. Incorrect translation pairs

The complete RT results for the critical trials are shown in Table 5 and the complete accuracy results for the critical trials are shown in Table 6; RTs and accuracy values are given for each type of word pair. The “no” trials tested whether L1 words that were orthographically related to L2 words created more response time interference and lower judgment accuracy than L1 words that were not orthographically related to the L2 word. Furthermore, half of the L2 words were cognates and the remaining half were noncognates.

The magnitude of interference was calculated for each type of distracter as the difference between the related and unrelated trials. The interference scores express the degree of sensitivity in each of the manipulated conditions. Separate factorial mixed (2 x 2 x 2) ANOVAs were performed on the mean correct and percent accuracy for each participant. Amount of L2 exposure (less and more) was entered into each analysis as a between-subjects variable, and orthographic relatedness (related and unrelated) and cognate status (cognate or noncognate) were entered as repeated within-group (related) variables.

**Table 5.** Mean RTs (ms) for Translation Recognition in “no” trials

	Less L2 exposure				More L2 exposure			
	Cognate		Noncognate		Cognate		Noncognate	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Related	1215	195	1255	357	740	187	801	197
Unrelated	1086	214	1123	290	632	135	635	148
Interference	129	-19	132	67	108	52	166	49

**Note.** *M* = Mean; *SD* = Standard Deviation.

**Interference is computed as the difference between related and unrelated conditions**

**Table 6.** Mean accuracy (%) for Translation Recognition in “no” trials

	Less L2 exposure				More L2 exposure			
	Cognate		Noncognate		Cognate		Noncognate	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Related	60%	24%	49%	23%	81%	18%	78%	16%
Unrelated	84%	14%	83%	19%	95%	9%	97%	7%
Interference	24%	10%	34%	4%	14%	9%	19%	9%

**Note.** *M* = Mean; *SD* = Standard Deviation.

**Interference is computed as the difference between related and unrelated conditions**

### ***Response Latencies***

Two results were significant in this analysis. There was a main effect of relatedness, such that regardless of the level of L2 exposure and cognate status of the L2 word, all participants were slower to reject incorrect form-related pairs compared to unrelated pairs,  $F(1, 30) = 33.416, p = < .001$ . This finding supports the claim of the BIA model that orthographic neighbours are active in both languages during word recognition for more experienced bilinguals, and also complements Sunderman and Kroll’s (2006) results that this claim of the BIA model extends to less experienced bilinguals.

There was also a main effect of exposure level. Regardless of relatedness and cognate status of the prime, participants who had more L2 exposure responded faster than participants who had less L2 exposure,  $F(1, 30) = 52.326, p = < .001$ . This suggests that as L2 exposure increases, so does the speed of L2 word recognition.

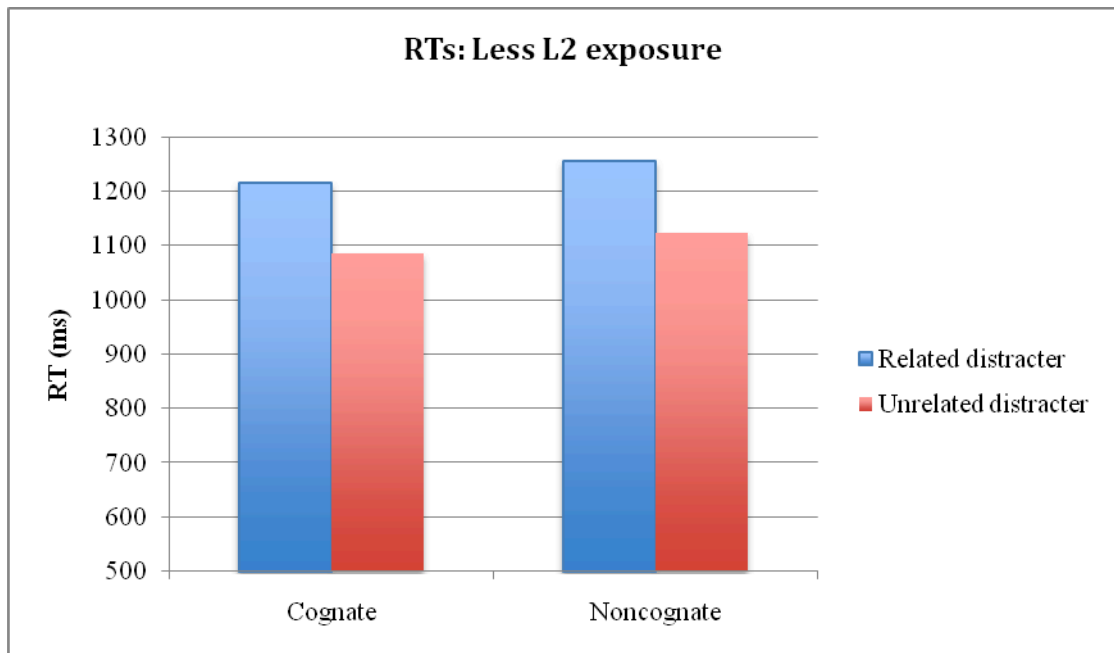
However, there was no significant interaction between relatedness and exposure level,  $F(1, 30) = .002, p = .883$ . This result confirms that, on average, there was no difference in the interference (computed as the mean unrelated distracter RT subtracted from related distracter RT) caused by orthographically related distracters between participants with less and more L2 exposure.

Also, there was no main effect of cognate status,  $F(1, 30) = 1.724, p = .199$ . This means that regardless of exposure level and orthographic relatedness of the distracter, there was no effect of the cognate status of the prime on response times. The interaction between

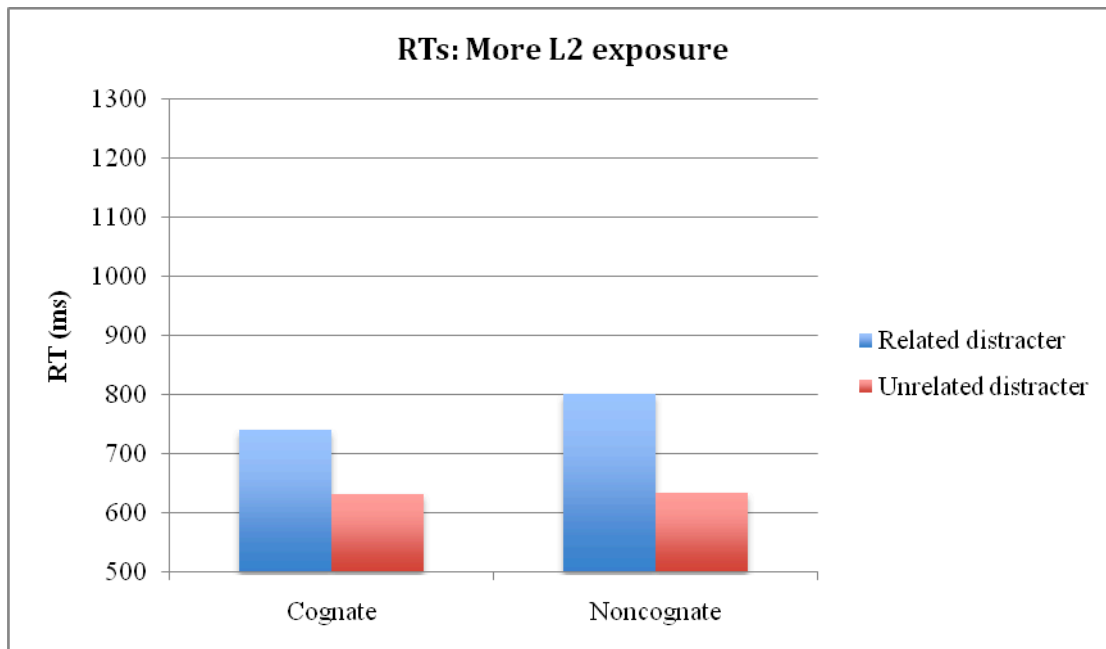
relatedness and cognate status also did not reach statistical significance,  $F(1, 30) = .245, p = .624$ . This shows that, on average, there was no difference between the interference values (computed as the mean unrelated distracter RT subtracted from related distracter RT) caused by a distracter related to a cognate prime compared to interference generated by a distracter related to a noncognate prime.

The interference values suggest that the difference between cognate and noncognate RT interference in more exposed participants is greater than the difference between cognate and noncognate RT interference in less exposed L2 learners. However, the three way interaction between cognate status, relatedness and L2 exposure level is also non-significant,  $F(1, 30) = .193, p = .664$ . Overall, these results show that the cognate status of the L2 target item does not effect the degree of interference caused by the form-related distracter, and also that the difference in interference between cognates and noncognates does not differ significantly across exposure level groups.

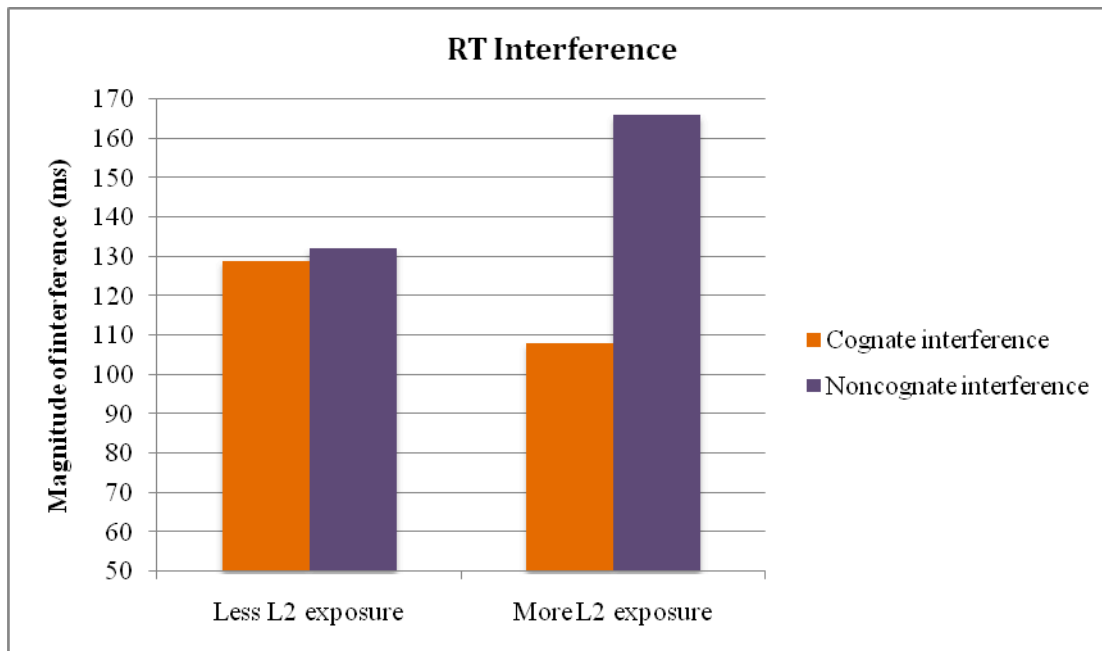
Lastly, an important part of the study was to measure the difference of the rate of progression between cognate and noncognate lexical access as L2 exposure increases. In order to test this, the difference between the interference values of the less exposed and more exposed cognate conditions were compared with the difference between the interference values of the less exposed and more exposed noncognate conditions in a simple dependent t-test. The t-test revealed that there was no statistical difference between the rate of response time development of cognates versus noncognates,  $t(15) = .437, p = .668$ . This suggests that from less exposure to high exposure, there was no difference between the improvement of speed of judgement between noncognates and cognates.



**Figure 11.** Mean RTs for translation recognition judgment of cognate and noncognate L2 words when confronted with orthographically related and unrelated L1 distracters with less L2 exposure



**Figure 12.** Mean RTs for translation recognition judgment of cognate and noncognate L2 words when confronted with orthographically related and unrelated L1 distracters with more L2 exposure



**Figure 13.** The magnitude of RT interference for the two conditions (cognate and noncognate) for less and more exposed L2 learners. Interference is measured as the difference between the RT values of the related and unrelated distracter conditions

### *Accuracy*

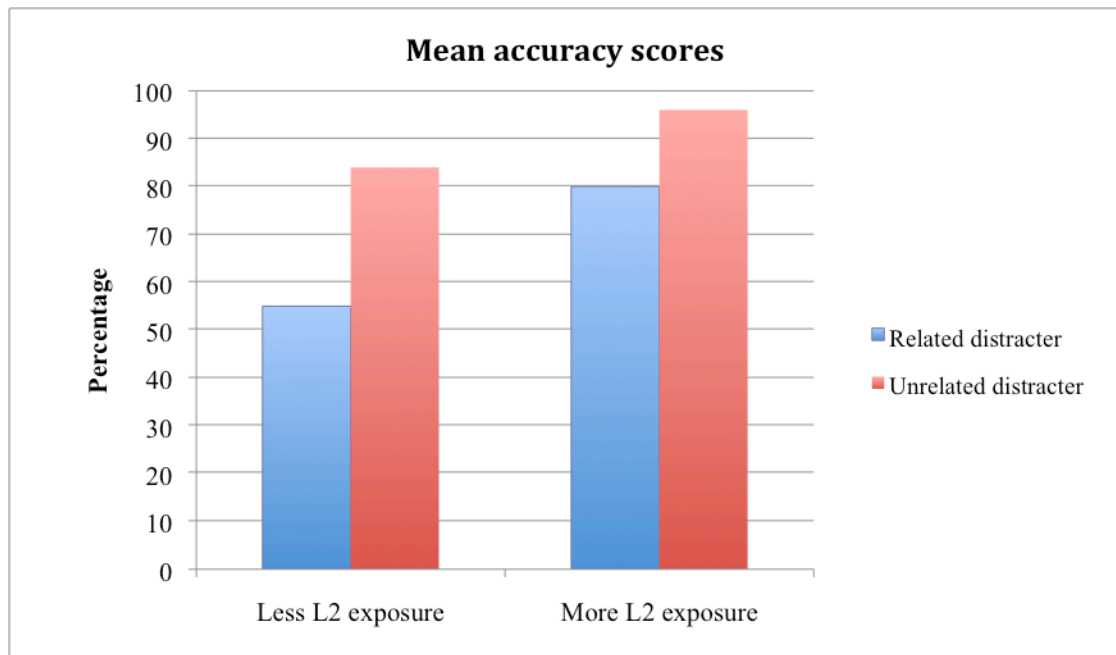
As reported for the RT data, there were two significant results for the accuracy data. Firstly, there was a main effect of relatedness, such that all participants, regardless of the level of L2 exposure and cognate status of the L2 word, participants were less accurate at judging related rather than unrelated incorrect translation pairs,  $F(1, 30) = 45.165, p < .001$ . Secondly, there was a main effect of exposure level, such that regardless of relatedness of the English word and cognate status of the L2 word, participants who had more L2 exposure were more accurate than participants who had less L2 exposure,  $F(1, 30) = 22.181, p < .001$ . Both of these effects are compatible with the RT data. They indicate that there is increased competition among form-related cross-language relatives in less and more experienced L2 learners, and that L2 learners less successfully reject potential lexical candidates.

There was non-significant, but borderline interaction between relatedness and level of L2 exposure on the accuracy of participants' judgments,  $F(1, 30) = 3.316, p = .079$ . This means that, on average, the difference between the interference scores (computed as the difference

between related and unrelated values) of participants who had less French exposure (29%) and the interference scores of participants who had more French exposure (16%) was approaching significance (see Figure 14 for a graph of this result).

Concordant with the RT data, there was no effect of the cognate status of the French prime on the ability to accurately decide on an incorrect translation pair,  $F(1, 30) = 2.226, p = .146$ . Moreover, as in the RT data, the interaction between relatedness and cognate status did not reveal a statistically significant result,  $F(1, 30) = 22.181, p = .152$ . There was also no significant three way interaction between cognates status, relatedness and exposure,  $F(1, 30) = .282, p = .599$ . These statistical results confirm the pattern emerging in Table 6, that there is no difference between the interference values in cognate and noncognate conditions. Moreover, the difference between cognate and noncognate accuracy interference is not significantly dissimilar between exposure level groups.

Finally, a dependent t-test was performed to test the difference in accuracy between the less and more L2 exposure results of the cognate condition and the less and more L2 exposure in the noncognate condition. The t-test revealed that there was no difference between the rate of development of accuracy in judging incorrect pairs with cognate versus noncognate French primes,  $t(15) = .540, p = .597$ .



**Figure 14.** Overall mean translation recognition accuracy scores of related and unrelated distracters compared across less and more L2 exposure groups

#### ***5.4. Summary of results***

Overall in both the “yes” and “no” trials participants who had more L2 exposure were faster at correctly judging translation equivalents compared to participants who had L2 exposure. Moreover, in both “yes” and “no” trials, participants with more L2 exposure also answered with greater accuracy.

In the “yes” trials, where French words were followed by their correct English equivalents, all participants were faster at correctly judging cognate translation equivalents than noncognate translation equivalents. Also, in the “yes” trials, participants were more accurate at verifying cognate word pairs than noncognate word pairs. Moreover, participants with less L2 exposure show a greater difference between cognate and noncognate judgment accuracy compared with participants with more L2 exposure.

In the “no” trials, when a French word was followed by an incorrect English word, both the less and more L2 exposure groups took longer to make correct judgments when the English word was orthographically related to the French word, compared to when the English word shared no formal resemblance to the French word. The accuracy data is compatible with this aspect of the RT data; participants made more accurate judgments when deciding on

incorrect English translations when the English word was orthographically unrelated to the French prime compared to when the English word was orthographically related to the French prime.

The main effect of exposure level and the main effect of orthographic relatedness suggested that although more experienced L2 learners were quicker to respond and make more accurate decisions than less experienced L2 learners, both groups are prone to interference caused by form-related interference. The lack of an interaction effect between exposure level and orthographic relatedness for RTs and accuracy confirmed that the magnitude of interference caused by form-related distracters relative to unrelated distracters was the same for participants who had less L2 exposure compared to participants who had more L2 exposure.

Lastly, unlike in the “yes” trials, there was no significant effect of cognate status on the accuracy and speed of correctly judging in the “no” trials. In other words, whether or not the French prime was a French-English cognate, it did not appear to have an effect on the degree of interference for both accuracy and speed of judgment. Moreover, the magnitude of interference for both accuracy and response times was the same for cognates and noncognates across exposure level groups.

## 6. DISCUSSION

### 6.1. The “no” trials

#### 6.1.1. Interpreting the translation recognition task

The aim of this experiment was to capture the presence of inter-linguistic links using a translation recognition task on native English-speaking learners of French. In the critical incorrect (“no”) trials, participants saw cognate and noncognate French words followed by an incorrect but orthographically similar English word. The hypothesis was that an incorrect French-English pair such as *parc-part* would take longer than for the participant to decide on than *chanter-chatter*. This is because the word *parc* would also co-activate letter features in its true equivalent, *park*, as well as the incorrect word *part*. In contrast, *chanter* would not co-activate letter features of its true equivalent *sing*, but only the letters in *chatter*. The results for these trials show that there was no difference in RT or accuracy interference between the condition where the French prime was a cognate or when the French prime was a noncognate. Therefore, this pattern of results does not support the main research hypothesis.

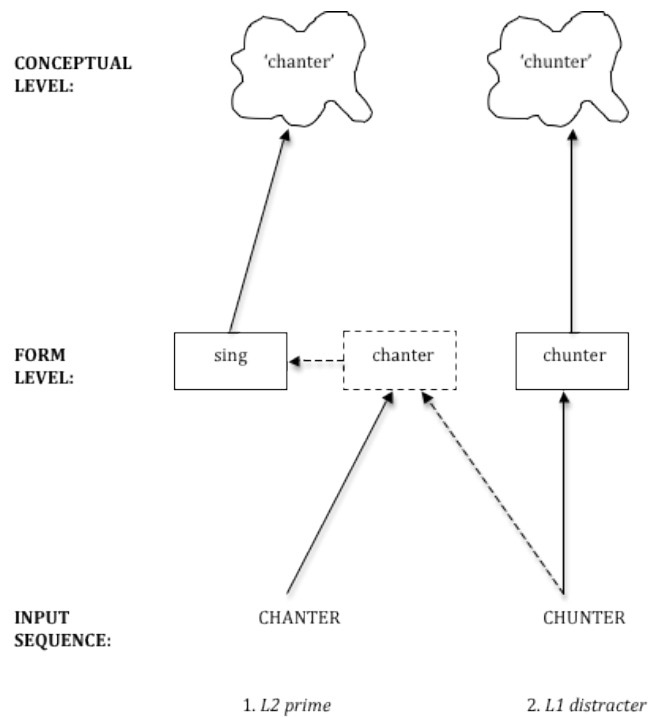
On the other hand, the “yes” trials generated a set of interesting results. In the “yes” trials, participants saw pairs of true cognate and noncognate equivalents where the French word was followed by an English word. In these trials, the judgements of cognates pairs were significantly faster and more accurate than those for noncognate pairs. These results support the Parasitic Model, in that the RT and accuracy results suggest that when participants were confronted with pairs of cognates, they were able to take advantage of the shared co-activation of the orthographic features across the L2 prime and the L1 target word. The absence of an effect of cognate status in the “no” trials when it is present in the “yes” trials does not disprove Hall’s Parasitic Model, instead these results point to a feature of the design of the critical “no” trials that caused the contrasting results. Therefore, the results of this study indicate that what is necessary is an interpretation of the difference between the lexical processing involved in the “yes” and the “no” trials.

In a correct trial, the participant was confronted with an L2 French prime, which was then followed by its correct L1 English equivalent. In these trials a difference between cognate and noncognate translation recognition was found. The pairs in these trials, regardless of cognate status, share the same meaning. Therefore the interpretation is that an effect of cognate status was found when contrasting conceptual interference was absent. Indeed, in an

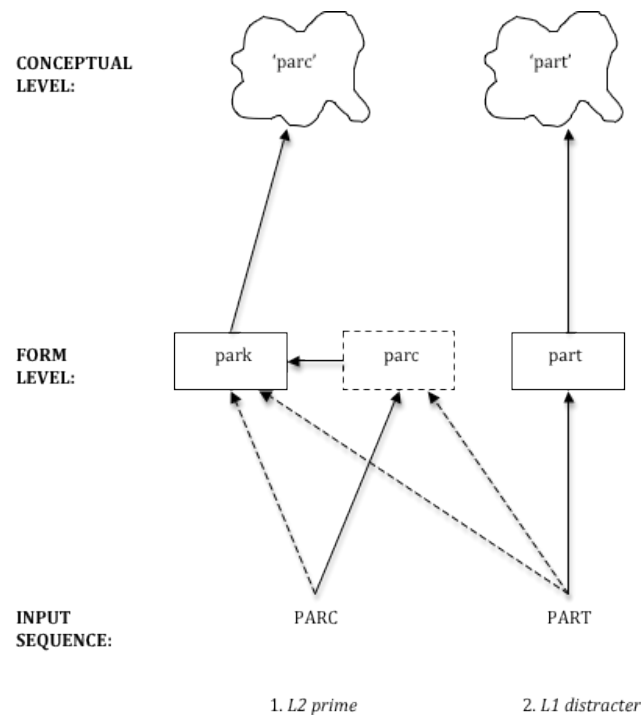
incorrect trial, the participant was confronted with an L2 French prime, which was followed by an incorrect L1 English word. Importantly, irrespective of whether the incorrect English item shared orthographic form with the French prime, the English word did not share the same meaning. Therefore, in the case of the pair *parc-part*, the decision process was constrained by the activation of the meaning of *parc*, conflicting with the succeeding activation of the meaning of *part*. In other words, the judgement process of an incorrect English translation activates conceptual information that is not shared by the L2 word and its true L1 equivalent.

Crucially, the fact that meaning across two lexical items was not shared could explain the reason for the balanced RT and accuracy values of the word pairs with a cognate prime and word pairs with a noncognate prime. At the first stage of the trial, when the French prime was presented that has a cognate L1 equivalent, the initial pathway to its concept was fast compared to when a French prime that has a noncognate L1 equivalent was presented. When the English distracter was presented at the second stage, the prime that was a true cognate is likely to have caused additional interference in the decision process because of a triad of co-activation of the form features of the incorrect L1 word, the L2 prime *and* the activation of the correct L1 equivalent. In contrast, when an orthographically related word was presented after a French prime that has a noncognate equivalent, conceptual access upon presentation of the prime is initially slow. However, in the second stage, upon presentation of the distracter, there is less overall interference because spreading of activation of orthographic features only exists between the prime and the incorrect English word and *not* with the correct L1 equivalent.

In other words, it could be that the initial quick access of a cognate French word followed by the presentation of a form related English distracter increased the overall level of lexical activation and interference. These RTs were counterbalanced by the initial slow access of the noncognate word and the subsequent comparatively low level of activation caused by a form related English distracter. Therefore, the RT results could be reflecting a trade-off between the difference in the speed of conceptual access of the prime, which is dependent upon its cognate status, and the overall level of accrued orthographic activation after the related distracter has been presented. This is represented schematically in Figure 15 and Figure 16 below.



**Figure 15.** A figure representing the process of the translation recognition task with a noncognate French prime. In stage one, the L2 prime activates the word form representation, which is then translated into the L1, which in turn activates the semantic representation. In stage two, the L1 distracter activates the L1 word form representation, reactivates the word representation of the L2 prime and then activates the separate semantic representation (dashed lines represent weaker activation and solid lines represent stronger activation).



**Figure 16.** A figure representing the process of the translation recognition task with a cognate French prime. In stage one there is parallel activation of the L2 prime with greater stimulation of the matching L2 word form representation. The link between the L1 and L2 word form representation and the direct link from the L2 word form to the semantic representation reflects the added connectivity, which contribute to the cognate effect. In stage two, the L1 distracter activates the L1 word form representation, reactivates the word representation of the L2 prime, and L1 equivalent of the prime, and then activates the separate semantic representation (dashed lines represent weaker activation and solid lines represent stronger activation).

### 6.1.2. Implications for The Parasitic Model of vocabulary acquisition

It is clear that the RT data for the “no” trials did not reveal any difference between cognate and noncognate lexical access. Hence, it is difficult to reconcile the results of the “no” trials with the results of Schmidtke’s (2010) developmental account of the Parasitic Model. As Figure 15 and Figure 16 aim to illustrate, the form-related L1 distracter did not uncover the subordinate connections that potentially exist with between L2 and L1 translation equivalents. This fault in the design of the experiment could be remedied in a future experiment where L1 distracters that share the orthographic code of the true L1 translation equivalent are used instead of L1 distracters that share form resemblance with the L2 prime. Recall that Sunderman and Kroll (2006) and Talamas et al. (1999) used this kind of distracter to test the predictions of the RHM. They found a drastic difference in the level of interference caused by distracters related to the L1 equivalent between less and more fluent L2 learners. They reasoned that the interference caused by the distracter that was formally related to L1

equivalent was an indication of reliance on the L1 translation equivalent during lexical access. Their finding can also be interpreted within the Parasitic Model, which posits that subordinate links exist between the new L2 word and the L1 translation equivalent. It would be interesting to replicate the design of Sunderman and Kroll (2006) and Talamas et al. (1999) study, but vary the cognate status of the prime, like in the present study. This may be a more suitable way of detecting shared activation of orthographic features in cognate lexical access, because an L1 (English) form relation of the translation would increase the shared orthographic activation that already exists between the L2 (French) word and its true L1 equivalent, e.g. *payer-pat* would be the incorrect version of *payer-pay*. In contrast, one would predict that there would be no co-activation of the noncognate French prime when followed by an English translation neighbour, but only the orthographic activation of the L1 equivalent, e.g. *cheval-house* instead of *cheval-horse*.

The design that is proposed above would be more likely to tap into the difference between the inter-linguistic subordinate links of cognates and noncognates. This is because making the distracter overlap with the L1 translation neighbour is likely to interrupt the translation pathway from the L2 item to the L1 item. As is demonstrated in the present results, the distracters used in the current design only detect the general mechanism of spreading activation across the whole lexicon.

The pattern of results in the accuracy data, however, provides an important finding that is more clearly in line with the predictions made by the Parasitic Model. Hall (2002) found that shared meaning is assumed when there is formal similarity between two potential translation equivalents. The present results show that there were more incorrect responses when an English distracter was orthographically related to the French prime, compared to when the English distracter was unrelated. Hall's (2002) study showed that English nonwords were assumed to be translation equivalents in Spanish based purely on orthographic overlap. For example, the English nonword *mirl* was consistently translated into Spanish as *mirlo* meaning 'blackbird'. The result reported in this experiment takes the support for the Parasitic Model in Hall's (2002) study even further by showing that real words, and not only nonwords that share a criterial amount of orthographic overlap can lead to the false assumption of shared meaning. The statistical analysis of the accuracy data also suggested that as L2 learners receive more L2 exposure, they are less likely to make mistakes based on form errors. This finding may reflect the participant's more robust L2 lexical knowledge. This finding is important because even though the RT data indicates that form related words slow down

processing, it suggests that L2 lexical representations become more stabilized and deeply routed with more L2 exposure.

### ***6.1.3. Implications for the BIA model***

The RT results of the “no” trials are in line with a connectionist view of the bilingual lexicon. The patterns of RT results obtained from this experiment reject a language-selective hypothesis and support the language non-selective access hypothesis, which is described by the BIA model. The BIA model addresses the phenomenon of interactive mutual activation of cross-language orthographic form relatives (Van Heuven et al., 1998). The results show that bilingual processing is interactive in that it took longer for participants to decide on incorrect translation pairs with form-related rather than unrelated words. Furthermore, the results of this study are also consistent with Sunderman and Kroll’s (2006) findings, which suggested that parallel activation of both languages does not diminish as L2 proficiency increases. The present data suggest that form-related distracters inhibited the decisions of all participants, regardless of proficiency. This kind of cross-language lexical activation is distinct from that predicted by the RHM or the Parasitic Model. The concern of the BIA model is not to explain how meaning is accessed via connections with the L1, but how all L1 and L2 word forms are active within a unified language non-selective lexical network.

## ***6.2. The “yes” trials***

### ***6.2.1. Implications for theories of lexical access***

In the “yes” trials, the presence of an effect of cognate status provides implications for monolingual theories of lexical access as well as for models of specifically bilingual lexical representation and process. Two conflicting theories of lexical access, cascaded activation and discrete serial activation, make different predictions about the effect of cognate status of the two words in the translation recognition task. Both types of models assume that lexical access involves two main stages (Garrett 1975, 1976). In the first stage, a lexical node is selected from a subset of competing lexical nodes and then in the second stage, the selected node is phonologically encoded before the word is articulated. A discrete serial model of lexical access (e.g. Levelt, 1989; Levelt, Roelofs & Meyer, 1999) posits that after the lexical node has been selected, phonological activation is restricted to this node. By contrast, a

cascaded model of lexical access (e.g. Caramazza, 1997; Dell, 1986; Dell & O'Seaghdha, 1992) posits that all potential lexical nodes that are activated via the semantic system spread to the phonological level. Costa, Caramazza and Sebastian-Galles (2000) found that bilingual lexical access of cognates support a cascaded model of lexical access.

Costa et al. (2000) investigated the picture naming times of cognate versus noncognate in Catalan-Spanish bilinguals. They reasoned that under a discrete serial processing account of lexical access, picture naming of cognate and noncognate words would generate similar RTs. In the case of noncognate translation pairs, once the lexical node for a Catalan word such as *taula*, meaning 'table', is activated, only this phonological code receives activation in the second stage of lexical access. Therefore the phonological segments /t/ /a/ /u/ /l/ /a/ are activated and not those corresponding to the lexical node of the Spanish equivalent, which is *mesa*. Under the discrete serial processing account, for cognate translation pairs, the process would be the same, after the selection of the lexical node of the Catalan word *gat* meaning 'cat', only the phonological segments /g/ /a/ /t/ would be activated in the second stage, and not any potential phonological activation of the competing Spanish lexical node for 'cat' which is /g/ /a/ /t/ /o/. Hence, a discrete serial model of lexical access would be immune to an effect of lexical access of a word that is a cognate, because, after the selection of the lexical node, phonological information between the two words are not permitted to interact. Indeed, in support of the cascaded activation theory of lexical access, Costa et al. found that picture-naming times for cognate words were shorter than for noncognates. This means that irrespective of whether a lexical node is selected, activation feeds forward to the phonological level.

Even though the models tested by Costa et al. (2000) deal with monolingual language production and phonological encoding, it can be assumed that the same kind of cascaded architecture exists in bilingual orthographic language comprehension. The results reported in the current experiment can be interpreted within a theory of cascaded activation in lexical access, such as the BIA model (Van Heuven et al., 1998). Participants were quicker to decide on a pair of French-English cognates, such as *fleur-flower*, than a pair of French-English noncognates, such as *chaud-hot*. It is clear that participants took advantage of the presence of orthographic overlap when deciding that two cognate words were correct equivalents.

These findings are also consistent with a large body of evidence from priming and repetition priming studies that also suggest that cognates are more rapidly recognised than

noncognates (Cristoffanini, Kirsner & Milech; 1986; De Groot & Nas, 1991; Lemhöfer & Dijkstra, 2004; Gollan, Forster & Frost, 1997; Sánchez-Casas, Davis & García-Albea, 1992; Schwanenflugel & Rey, 1986). In the bilingual priming paradigm, a lexical decision task is used to exploit the inter-linguistic connections between translation pairs. In this kind of task, the first word of the pair acts as a prime and the second word, the translation equivalent, acts as the target. Participants have to decide whether the target is a word or not. The evidence from both masked (e.g. De Groot & Nas, 1991) and unmasked (e.g. Forster & Davis, 1984) priming studies, seems to overwhelmingly confirm that cognates are recognised faster than noncognates, which suggests that cognates share representational form features.

However, there is a limit to how far the results of the present experiment can be held in accordance with results from priming studies. In cross-language priming studies such as De Groot & Nas (1991), the prime is usually presented with a short stimulus onset asynchrony (SOA) of less than 250 ms. In fact, Sánchez-Casas and García-Albea (2005) cite a study by Sánchez-Casas and Almagro (1999) where cognate priming effects were found for SOA of 30 ms and 60 ms. The purpose of such short SOAs is to reduce the effects of episodic memory retrieval (Sánchez-Casas & García-Albea, 2005). If the SOA is too long, it is likely that the priming effect will be diluted by an episodic memory record of the priming stimulus and therefore will not reflect real lexical processing. In the present experiment, the SOA was 400 ms, which suggests that the implications of the cognate facilitation effect for lexical access are not entirely compatible with the cognate facilitation effect found in priming studies.

Even-so, in the translation recognition task, the participant is not required to decide on the status of a single word, but on the status of a pair of potential translation equivalents. The translation recognition task requires the participant to confirm whether meaning is shared across the pair of translation neighbours. Therefore, the task demands a very different kind of lexical access whereby the participant is required to access underlying conceptual representations via the surface form. Where the translation recognition task may not tap into purely unconscious lexical processing, the possibility of data contamination from episodic memory and strategic guessing effects are offset by the likelihood that the task necessitates conceptual processing.

In summary, it may be that data from priming studies reflect more natural lexical processing than translation recognition, yet the translation recognition task imposes deeper semantic activation. Furthermore, despite the evaluation that longer SOAs are susceptible to

more strategic and careful answering, the point must be raised that the SOA of 400 ms still generated reliable interference effects from orthographically related words in the “no” trials. This suggests that simply knowing the correct answer did not play the only factor in correct translation judgment and that the orthographic characteristics of the stimuli were affecting the speed of lexical processing. It is for this reason that results of the “no” trials further strengthen the current thesis that cognate access is faster in the “yes” trials because of automatic processes of cascaded lexical access and not just conscious strategic guessing.

### ***6.2.2. Implications for cognate representation in the bilingual lexicon***

In sum, the findings for the “yes” trials of this study provide evidence for support of the claim that cognates are accessed faster than noncognates in bilinguals. What is more, this effect is found in L2 learners with less and more L2 exposure. The problem that remains is how best to represent cognates in models of bilingual memory. Although semantic activation is implicated within the BIA model (Dijkstra & Van Heuven, 1998) it can be argued that the most prominent feature of the model is the explicit and fine detailed description of the interactive processes of the integrated lexical level features of the network. This model suggests that cognates share one formal representation, in contrast to noncognates, which are represented autonomously. The model fails to explicitly address the representation of ‘false friends’, which were the kind of stimuli used in the “no” trials of the current study that shared surface form, but do not share meaning. This distinction is clear in the Parasitic Model, in which true cognates share the same conceptual node in contrast to whilst false friends are connected to two discrete units. A comparison of the results of the “yes” and “no” trials seems to confirm the importance of shared conceptual representation as a factor of rapid cognate lexical access.

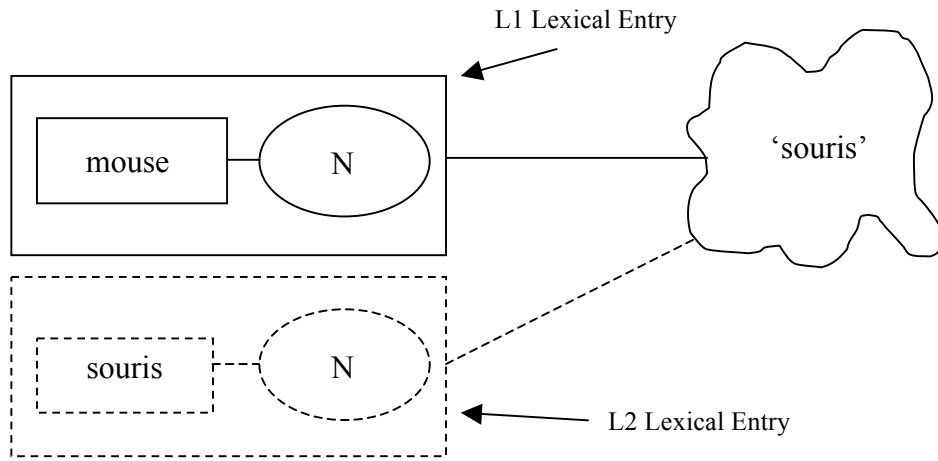
In the “no” trials, participants were less accurate at deciding on a pair of orthographically related cross-language pairs compared to orthographically unrelated cross-language pairs. In contrast, in the “yes” trials, shared form combined with shared meaning facilitated correct decisions of translation recognition. It is therefore likely that the rapid cognate effect on lexical processing is the consequence of the cognate word benefitting from the similar pre-established form to meaning associations in the L1. On the other hand, noncognates do not benefit from such pre-existing connections, which is demonstrated in the “yes” trials data of this study. Noncognate translation pairs were recognised less quickly and participants were

less sure accurate in deciding on their meaning relationship. In short, the combination of high levels of bottom-up (shared orthographic form) and top-down (shared meaning) activation seems to be the reason for the cognate advantage.

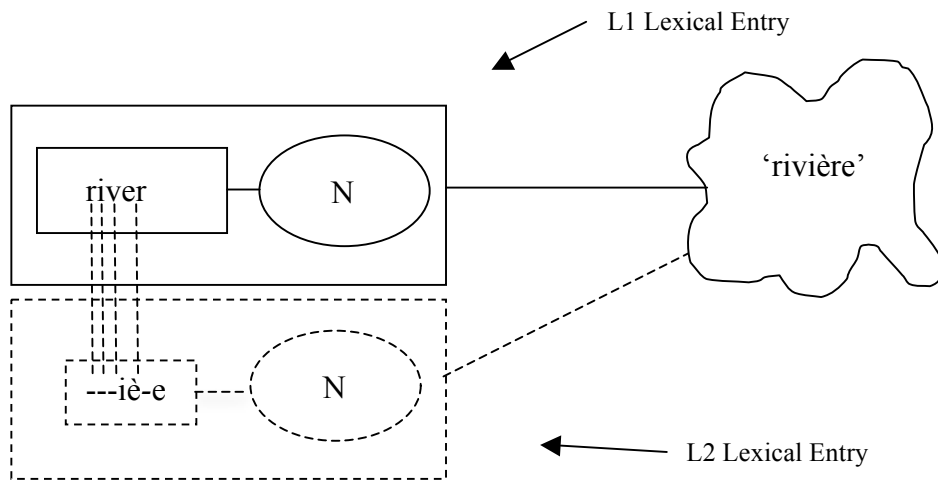
Finally, if rapid cognate lexical retrieval reflects an associative connection of meaning and form across two languages, then it seems unlikely that this configuration changes over time. This developmental account is supported by the imbalance in the difference between the rate of improvement of judgement accuracy of cognates and noncognates. The difference in the rate of improvement of translation recognition accuracy of noncognates is greater than that of cognates, which suggests that from low to high exposure, learners improved their knowledge of noncognates more than cognates. This probably reflects the lexical representation of noncognates developing from initially weak representation to a more robust representation. The smaller rate of improvement in accuracy scores for cognates probably reflects the reduced necessity for cognate representations to be constructed from ‘scratch’. The long-term effect is likely to be that L2 cognates continue to share the high level of orthographic code of the L1 and therefore maintain the inter-linguistic parasitic connection.

In consideration of the results of the “yes” trials, it is appropriate to adopt the Parasitic Model of vocabulary acquisition as an explanation for the cognate facilitation effect in early vocabulary acquisition. But how can the model account for the difference in the changing representations of cognate noncognate lexical access over time? Indeed, the purpose of the model is to characterize the dominance of the L1 on the L2 in the early stage of L2 vocabulary learning. This is represented by the model’s subordinate design, in which translation relies on word association. To account for the change in the representation of noncognates, Hall and Reyes (2009) suggest that as L2 lexical knowledge at the frame level becomes greater, noncognate word forms become separate autonomous entries. Therefore, the configuration of the connection between words and meanings resembles the layout of a compound model of bilingual lexical memory (illustrated in Figure 17). However, while it may be the case that initial L1 dependence may give way to direct conceptual access for noncognates, cognate representations may always remain shared at the lexical level. The comparisons of less and more exposed L2 learners in the “yes” trials of the present experiment support this likelihood. As L2 exposure increases, it may not be necessary for cognate translation to be mediated by the L1 in a subordinate fashion as L2 exposure increases. If access to each representation is aided by the mutual activation of the shared orthographic code, it is likely that this mode of access will remain unchanged as proficiency

increases. This is shown below in Figure 18, where the dashed lines represent the weaker connection between the L2 word form and the shared conceptual representation.



**Figure 17.** Autonomous L2 noncognate lexical representation (adapted from Hall & Reyes (2009))



**Figure 18.** Advanced stage cognate representation under the framework of the Parasitic Model

## 7. CONCLUSION

This study set out with the aim of investigating the nature of cognate lexical representation in the initial stages of second language vocabulary acquisition. The experiment was designed to exploit the existence and development of parasitic links as proposed by Hall (2002). According to the Parasitic Model, upon initial exposure to a new language, new L2 word representations first establish a connection with their L1 counterparts and then gradually begin to function autonomously. However, in the case of cognates, this study has shown that it is likely that there is no requirement to construct fully novel L2 representations, because much of the formal representation is already established as an L1 entry.

The translation recognition task was used to detect the excitatory links between the orthographic features of words in the L1 and L2. In the incorrect trials, the distracter stimuli were designed with the intention of capturing the unique inter-linguistic links of cognates. Whether the L2 prime was a cognate or a noncognate, the same level of interference caused by a form-related L1 distracter remained the same. Instead of providing evidence for parasitic links, these trials provided evidence for the general mechanism of bilingual spreading activation and language non-selectivity in bilingual word recognition (Van Heuven et al., 1998). The stimuli were not form-related to the translation equivalent (cf. Sunderman & Kroll, 2006), and therefore did not exploit the subordinate links that are hypothesized to exist between L2 and L1 translation equivalents. The correct trials showed that when both form *and* meaning are the same across L2 prime and the L1 equivalent, participants made more accurate judgments. Ultimately, the “yes” trials suggested that cognates are recognised more rapidly than noncognates. Therefore, the comparison between the “yes” and the “no” trials therefore highlighted the locus of the cognate advantage, which appears to be the parallel activation of form and meaning.

Finally, the results confirm that Parasitic Model can account for the results of both the “yes” and “no” trials. In the “no” trials, participants were more likely to treat an L1 distracter as a true equivalent, even if it did not share meaning. This is compatible with studies that indicate that false friends pose problems for language learners (e.g. Laufer, 1988; Meara, 1984). In the “yes” trials, participants benefited from overlap of both form and meaning, but were slower and less accurate in deciding on noncognates. Lastly, the fact that from less L2 exposure to more L2 exposure, the number of correct responses to cognates did not improve as greatly as noncognates suggests that the parasitic connection is retained for cognate lexical

representations.

In summary, the translation recognition task, which was employed in this study, has provided evidence for Hall's (2002) Parasitic Model by showing that cognates have privileged access to meaning through the L1 equivalent. What is more, for cognates, this kind of inter-linguistic configuration is unlikely to change as proficiency increases.

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## APPENDIX

### 1. Sample of items used in translation recognition task

#### 1.1. "No" Trials (correct translations in brackets)

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NONCOGNATE CONDITION		
French prime	Related distracter	Unrelated distracter
armoire ( <i>wardrobe</i> )	armour	rubble
chambre ( <i>bedroom</i> )	charmer	saviour
chien ( <i>dog</i> )	chief	judge
chemise ( <i>shirt</i> )	chemist	wrinkle
lapin ( <i>rabbit</i> )	latin	sheet
plage ( <i>beach</i> )	plane	stick
souris ( <i>mouse</i> )	source	button
stylo ( <i>pen</i> )	style	demon

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COGNATE CONDITION		
French prime	Related distracter	Unrelated distracter
chat ( <i>cat</i> )	chap	pond
construire ( <i>construct</i> )	constrict	sidetrack
gris ( <i>grey</i> )	grim	ripe
nom ( <i>name</i> )	nod	elf
parc ( <i>park</i> )	part	deal
préférer ( <i>prefer</i> )	pretend	deserve
prix ( <i>price</i> )	pride	joint
rapide ( <i>rapid</i> )	rabid	plump

## 1.2. "Yes" trials

COGNATES		NONCOGNATES	
French prime	Correct translation	French prime	Correct translation
actif	active	boisson	drink
bleu	blue	chaud	hot
boeuf	beef	cheval	horse
finir	finish	jouer	play
heure	hour	livre	book
jardin	garden	nager	swim
montagne	mountain	noir	black
tourner	turn	oeuf	egg