Multilingualism and the Mental Lexicon. Insights from language processing, diachrony, and language contact

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Abstract: The way in which the bilingual's two languages can co-exist and interact with each other is crucial for the study of language coactivation. This question has been tackled from the perspective of experimental psycholinguistics and that of language contact which can be brought together in the light of different, yet concomitant evidence related to multiple interactions between words from the two languages. Most of these interactions can be accounted for in terms of common and/or parallel morphological representations between the two languages. The two masked priming experiments using cross-script materials reported in this chapter corroborate and extend this hypothesis by showing that different 'levels' of morphological and/or etymological relatedness underlie different priming effects. The morphological priming pattern reflects an organisation of the lexicon based on 'cross-language derivational families', whereby morphologically complex L1 words automatically activate their base word in L2. Evidence that the opposite is not true suggests the existence of a looser link between L2 words and representations at the semantic-conceptual level, while still being compatible with evidence that translation primes induce significant effects in both L2-to-L1 and L1-to-L2 directions. Evidence from language contact supports the idea that the two languages do not behave in a strictly symmetric way. The more tenuous link between L2 vocabulary and a morphological/conceptual level is mirrored by the morphological integration of loan words into a matrix language, as a significant, preliminary step in the direction of a full conceptual integration. Further data from morphological integration in accordance with the cross-language priming data point to a view of the bilingual lexicon as a unified lexico-semantic architecture.

Keywords: bilingualism, lexical access, cognate effect, word family effect, comorphologies, language contact

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1 Introduction

The ability of bilinguals to master multiple languages is remarkable. An important question related to bilingual performance, with various implications for online processing, concerns the ways two language systems can in fact co-exist in a synergistic relationship and co-activate each other, while preventing, at the same time, their interaction from seriously disrupting daily verbal communication. As we know, language switches can be quite frequent in appropriate circumstances; however, it is a fact that bilinguals (or multilinguals) are good at preventing interferences between two (or more) languages (see Esposito et al. 2013; Marian et al. 2017) and can effectively function on either of them. The main focus of the present chapter will be on understanding how this is possible, and what the multifarious outcomes are of the dualistic dynamic of co-activation/competition between co-existing language systems. As we shall see in more detail in the following pages, speakers are very sensitive to word family effects, and these effects may effortlessly involve words of different languages in a highly integrated word knowledge system. The consequences of these effects on language performance can nonetheless be diverging and somewhat apparently contradictory, depending on as diverse factors as the nature of the specific language task speakers are engaged in, its illocutionary force, or its intended perlocutionary effects.

In order to describe the structure of the lexicon as well as the mechanisms responsible for processing words coming from two languages, we have to define the extent to which words from the languages of the bilingual are linked. There are four theoretical options to describe bilingual lexical representation, by combining four variables: separate lexica vs. unified lexicon and selective vs. non-selective access. In the present chapter, we explore the connections between related, albeit not necessarily converging research fields, such as experimental psycholinguistics and historical linguistics, by focusing on the role of morphological factors in influencing both human processing and mental representation of cognates.

The chapter is structured as follows. Section 1.1 discusses research on selective to non-selective access in the bilingual lexicon; Section 1.2 focuses on the definition of the cognate relation and on morphological transfer; Section 1.3 is concerned with cognate and non-cognate effects in cross-language processing; and Section 1.4 with indirect ways to study the issue of unified lexicon vs. separate lexica and the role of morphology. Section 2 presents two masked priming experiments with cross-script cognates. The psycholinguistic results are discussed in Section 3. Section 4 presents data on morphological integration (4.1) and co-morphologies (4.2) and shows how these support claims based on the psycholinguistic evidence. Section 5 closes up the chapter.

1.1 From selective to non-selective access in the bilingual lexicon

A well-known fact about bilingualism is that both languages of the bilingual are simultaneously activated, even when one of the two languages seems to be out of play (i.e., the non-target language). Many recent studies refer to language co-activation (e.g., van Hell and Dijkstra 2002; van Hell and Tanner 2012), which relates to the fact that access to the bilingual lexicon is profoundly non-selective with respect to languages (see below). Given this non-selective access, part of the research focuses on the examination of effects related to cross-language interaction. This interaction can be positive (as with the cross-language effect of the Morphological Family Size, e.g., Mulder et al. 2014) or negative, i.e. it creates interferences. Although language switches can be quite frequent in appropriate circumstances, bilinguals easily manage to prevent interferences, which may never surface in the performance of the speaker. In addition, the positive interactions *across* languages are not directly observable in natural speech, which is why psycholinguistics provide protocols, mainly behavioral, and, more recently, neuropsychological (e.g., Schwartz and Kroll 2006; van Heuven et al. 2008) aiming to unravel the organization and architecture of the bilingual lexicon. This interaction is not restricted to languages presenting formal and systematic similarities, but can be observed in bilinguals for whom the two languages belong to different systems (e.g., Hoshino and Kroll 2008, for Japanese-English bilinguals). The resulting cross-language activation and competition can be seen in brain activity in fMRI studies of proficient bilinguals (e.g., van Heuven et al. 2008).

The specification of the bilingual lexicon is based on two components: a structural aspect, relative to the organization of the two languages, and a processing one. As far as the structural component is concerned, a distinction obtains between lexical storage independent of the language and lexical storage depending on the language. A lexical storage independent of the language implies that the bilingual possesses a unified lexicon encompassing the two languages (integrated lexica hypothesis). Language-dependent storage implies the existence of two different lexica, one for each language (e.g., as in Kroll and Stewart's (1994) Revised Hierarchical Model, see Section 1.4.1). With regard to online processing, a distinction is made between selective vs. non-selective access. Given that all contemporary models of visual word recognition assume multiple matching between an input representation and a lexical representation in memory, the question of selective vs. non-selective access involves determining whether words from the two languages are simultaneously contacted/accessed during visual word recognition or if only the target language is activated. As van Heuven, Dijkstra and Grainger (1998) observe, four theoretical options can be found in the literature:

a) The first option involves selective access, combined with two independent lexica on the structural level. In this type of model, a research mechanism would have to first search the representations of the first lexicon and those of the second lexicon afterwards, in order to find the representation matching the input.
b) The second option postulates a selective access with a unified (integrated) lexicon, in which there is one node[1] for the first language (L1) and another for the second language (L2). Given that words from the non-target language are never activated (van Heuven et al. 1998), this theoretical option would be functionally equivalent to the first one: words from one language cannot have any influence, i.e. they cannot activate or inhibit processing of words in the other language.
c) The third option postulates a non-selective access with independent lexica: words from the two languages are activated in parallel (not in a serial manner), in such a way that all words that are partially compatible with the stimulus will be activated. Given that this option is based on independent lexica, the activation takes place via a mechanism that will search among the words of each language, separately from the other language. In an interactive activation model like the one presented by McClelland and Rumelhart (1981), the separate lexica hypothesis implies the existence of inhibitory connections within each lexicon.
d) The fourth option combines a non-selective access with an integrated (unified) lexicon, which is independent of language. Words from both languages will be activated in parallel and all words partially compatible with the stimulus will be activated at the same time, depending on criteria such as their frequency in the language. In an interactive activation perspective (McClelland and Rumelhart 1981) the unified lexicon hypothesis postulates the existence of inhibitory connections between the words of the *different* languages. As we shall see in Section 1.3, the distinction between parallel non-selective access with separate lexica vs. integrated lexicon is quite difficult to demonstrate empirically. All we can have is indirect evidence, mainly related to the various interactions between the two lexica, i.e. cross-language effects in which variables characterizing one language influence processing of the other (e.g., van Heuven, Dijkstra, and Grainger 1998, with orthographic neighbors, or cross-language Morphological Family Size effects, e.g., Mulder et al. 2014; Mulder, Dijkstra, and Baayen 2015).

1 See the architecture of the Interactive Activation Model (McClelland and Rumelhart 1981, 1988).

As far as selective vs. non-selective access is concerned, a first group of studies on bilingual[2] lexical access (Gerard and Scarborough 1989; Scarborough, Gerard, and Cortese 1984) put forward data in favor of selective access. Gerard and Scarborough (1989) used interlexical homographs (or false cognates), i.e., words that are written the same in the two languages, in the specific case, English and Spanish, but do not mean the same thing, e.g., *red* 'color' in English and 'clean' in Spanish. These interlexical homographs do not have the same frequency in the two languages (the English word is more frequent, in our example). The task was a monolingual lexical decision task and the results showed that only the target language frequency was relevant to predict the reaction times for the identification of the stimuli. In other words, even though *red* is very frequent in English, bilinguals were not quicker than Spanish monolinguals in recognizing the word, when the target language was Spanish. This was taken as evidence in favor of a selective access, in which the language processing system chooses to follow the path of one of the two languages, as if the other one did not exist.

While the very beginning of bilingual research is characterized by a consensus on selective access, which led the authors of the first model of bilingual production (Kroll and Stewart's 1994 Revised Hierarchical Model as well as its early version, the Word Association Model) to assume a selective access with separate lexica, during the 1990s, this position has been revised. One of the first studies to mark this revision is Altenberg and Cairns (1984). In an English lexical decision experiment with English-German bilinguals, the authors used non-words containing letter sequences that did not conform to the phonotactic properties of English, but conformed to those of German (e.g., PFLOK). Results demonstrated that bilingual subjects needed more time than monolinguals to reject these words, which is interpreted as evidence that the bilingual is unable to supress one of his two languages, even if the context of the task is strictly monolingual. Many subsequent studies explored experimental situations where the words of the different languages were intermixed or where the L2 was the target language. Results show that bilinguals activate words from their two languages when they make lexical decisions in the non-dominant language (L2), as well as when words from their L1 are present in the experiment. These L1 words can either be distractors (De Groot,

2 As Kroll and Stewart (1994: 151 fn1) stress, the term bilingual in the literature related to bilingual perception and production, refers to "individuals who acquired L2 in late childhood or early adulthood in a context where L1 was already clearly established, and for the most part, after any biologically sensitive or critical period in development had occurred. One difference between adult and child bilinguals is that for adults most new L2 words correspond to concepts that have already been acquired".

Delmaar, and Lupker 2000, exp. 3; Dijkstra, Van Jaarsveld, and Ten Brinke 1998, exp. 2), target words (van Heuven, Dijkstra, and Grainger 1998), or primes in masked priming experiments (Gollan, Forster, and Frost 1997), as we shall see in more detail in Section 2. Evidence for non-selective access comes from a multitude of tasks and languages: from simple naming (e.g., Jared and Kroll 2001, with English-French and French-English participants) and association tasks (e.g., Van Hell and De Groot 1998, Dutch-English bilinguals), to progressive demasking (e.g., van Heuven, Dijkstra, and Grainger 1998; Dijkstra, Grainger, and van Heuven 1999, both with Dutch-English bilinguals) and masked priming with cognate and non-cognate words (e.g., De Groot and Nas 1991, with English-Dutch bilinguals; Gollan, Forster, and Frost 1997, with Hebrew-English bilinguals; Voga and Grainger 2007, with Greek-French bilinguals). All these data support the non-selective hypothesis.

Among these studies published in the last 25 years dealing with the separate vs. integrated lexica issue, many use cognate materials such as *palace* – *palacio* in English-Spanish, *pyramid* – *pyramida* in English-Hebrew, or *πόρτα* /'porta/ – *porte* 'door' in Greek-French. The cognate effect, which in processing terms is the fact that a cognate word (e.g., *palacio*) will significantly facilitate the recognition of its translation in the other language (e.g., *palace* in English) is one of the best-studied and most robust bilingual effects. This cognate effect is found not only when both prime and target words are written in the same alphabet, but also when they are written in different scripts (cross-script priming task):[3] e.g., *κέντρο* /'kendro/ – *centre* in Greek-French (Voga and Grainger 2007; see also Gollan, Forster, and Frost 1997, Hebrew-English). This effect also provides the basis for several applications in second language learning, especially related to vocabulary in a second language. For example, Sheng et al. (2016) with children from 4 to 7 (English-Spanish and Mandarin-English) demonstrated that cross-linguistic similarities at the phonological level allow bootstrapping of vocabulary learning.

The next section focuses on the definition of the cognate relation, which may differ according to the type of protocol used, e.g., lexical access (word recognition) vs. word production protocols, or according to the languages being studied, i.e., more or less diachronically related and morphologically or formally overlapping. As we will see in Section 1.2, the way in which *cognateness*

3 The fact that psycholinguistic research on bilingualism tends to create categories on the basis of formal factors, (e.g., same-script, cross-script) may seem inappropriate and difficult to understand from a linguistic point of view. However, from a psycholinguistic point of view, formal factors can completely change the nature of the processes the experiment taps into. This is especially true for visual protocols, such as the one we use here (Section 2).

is defined depends on the discipline considered. One of the aims of this chapter is to explore the connections between related, albeit not necessarily converging research fields, such as historical linguistics and psycholinguistics, by focusing on the role of morphological factors in influencing both human processing and mental representation of cognates.

1.2 Cognate definition and morphological transfer

The term 'cognate' is used in different ways in psycholinguistics and historical linguistics. In historical linguistics, cognates are words that are etymologically linked. The etymological link can be either directly inherited from a common ancestor or borrowed via language contact. By way of example, the numerals English *ten*, Dutch *tien*, and German *zehn* are cognates via inheritance, as they stem directly from reconstructed Germanic **tehun*, which itself is related to Tocharian A *śäk*, Ancient Greek *déka*, Latin *decem*, Old Church Slavonic *desętĭ* and so forth; and all of them descend from reconstructed Indo-European **dekḿn̥*. According to an etymological approach, Spanish *diez* and English *ten* are cognates. Also English *curtain* and German *Gardine* are cognates; however, not via inheritance but via language contact because they were both borrowed from French *courtine*. In psycholinguistics, the notion of cognate is based on the criterion of perceptual recognizability, which requires formal similarity under the exact conditions of a given experiment, as we shall illustrate in the next section through a brief data review. In a visual masked priming experiment, for instance, it is crucial that the orthographic overlap is measured in an objective way, and kept stable throughout the experiment. A consequence of the psycholinguistic logic and experimental constraints is that two words which match each other formally are considered as cognates, irrespective of any etymological relation of inheritance or borrowing between them. Formal match is conceived in terms of acoustic (i.e., phonetic) or visual (i.e., orthographic) overlap, which is why 'cognateness' can be a matter of degree in psycholinguistics. Consequently, while Spanish *diez* and English *ten* are considered cognates by historical linguists, they are hardly viewed as such by psycholinguists; on the other hand, lexical borrowings such as English *curtain* and German *Gardine* are cognates according to both approaches: they are etymologically related words, and they bear both acoustic and visual similarities.

Admittedly, historical linguists and psycholinguists have different aims by vocation. The former want to understand how language change comes along and why languages develop the way they do. The latter study language

processing through standardized protocols in order to specify the way in which words are represented in the mental lexicon, and, when it comes to morphology, how constructed words are represented and processed by the language processing system. In historical linguistics, the study of the transfer of single morphological formatives has proved a fruitful heuristic tool in investigations of the genealogical relatedness of languages or language groups, such as in the studies by Whaley (2012), Mithun (2013), Law (2014) and Robbeets (2015) (but see Grant 2008: 166, with the proviso that the so-called *Ludolf's rule,* that is, the idea that morphology is a more reliable source for historical reconstruction than phonology or basic vocabulary, might lead to wrong analyses).

Under specific sociological conditions, including intense bilingualism and socio-economic dominance, morphological formatives can be transferred from a Source Language (SL) to a Recipient Language (RL). Prototypically, morphological borrowing occurs when SL formatives apply to native lexemes of an RL (Gardani 2008, 2012, 2018). As a case in point, consider the following instance in Bolivian Quechua, which has borrowed the plural formative *-s* from the contact language, Spanish, and compulsorily uses it to mark plural on all Quechua nouns ending in a vowel (Bolivian Quechua data from Muysken 2012: 33–34, based on Urioste 1964).

(1)	Quechua	Bolivian Quechua	Spanish
	a. *wasi*	b. *algu*	c. *perro*
	'house'	'dog'	'dog'
	wasikuna	*algus*	*perros*
	'houses'	'dogs'	'dogs'

The example in (1b) shows that a Spanish formative (1c) is used in Bolivian Quechua to mark nominal plural, in spite of the existence in Quechua of a nominal plural formative *-kuna* (1a). Clearly, such a process of mixing presupposes high bilingual competence, at least in some phases of the change process.

One of the mechanisms commonly regarded as leading to stabilized change is codeswitching, also with respect to morphology. For example, research in codeswitching has shown that some morpheme types, precisely plural formatives, are often maintained in bilinguals during codeswitching (Myers-Scotton 2013). The hypothesis is that the insertion of plural forms of an embedded language (corresponding to SL) into a matrix language (corresponding to RL) acts as an anchoring of such morphemes and paves the way for their later spreading to lexemes belonging to the native stock of the matrix language. Data on idiolectal use from the conversational *Siarad corpus* of Welsh-English bilinguals (ESRC Centre

for Research on Bilingualism in Theory and Practice 2011) seems to support this claim. In (2a-d), we see four Welsh nouns, all belonging to the native Celtic lexical stratum, which mark the plural by means of a formative *-s* (and its allomorph -/is/ in (2d)), which is clearly borrowed from English. In the parallel data set in (2a'-d';), the same nouns have different forms as they mark the plural by native inflectional formatives and patterns.

(2)	Welsh (idiolectal)	Welsh (standard)
a.	*taids* 'grandfathers'	a'. *teidiau*
b.	*crancs* 'crabs'	b'. *crancod*
c.	*annwyds* 'colds'	c'. *anwydau*
d.	*enfysys* 'rainbows'	d'. *enfysau*

The data presented in (1) and (2) show that there are multiple interactions between the different language systems mastered by bilingual speakers. In his macroecological approach to language evolution, Mufwene (2001, 2008) understands interaction in terms of feature competition and selection. The competition of grammatical patterns which may lead to processes of linguistic diversification is amplified in situations of language contact: all languages involved in the contact setting make concurrent contributions to a pool of features which the speakers exploit in order to create their idiolect. Also, the use of different grammatical systems can relate to the need to serve different communicative purposes or depend on different pragmatic contexts. For example, from the viewpoint of his 'activity-oriented' approach, Matras (2015: 76) argues that inflection is indicative of the language choice made by the bilingual speaker and related to their identity, and so "the purpose of borrowed inflectional morphology is to re-draw social boundaries".

In what follows, our theoretical starting point will be the hypothesis that most of these interactions presuppose mental representations that are based on morphological knowledge, effectively emerging from the self-organization and interaction of possibly diverse language systems (Bybee 1988, 1995, 2006, 2007, 2010). In the 'emergent lexicon' approach proposed by Joan Bybee (2007: 280), the lexicon reflects the speakers' linguistic experience, and lexical storage is highly affected by language use. Bybee (1985, 1995, 2007) uses the notion of *lexical strength* to illustrate the fact that "memory for linguistic units is superpositional: "[. . .] every time a word or a larger linguistic unit (a phrase or idiom) is

processed, it is mapped onto, or superimposed on, some existing mental representation" (Bybee 1995: 232). Following this approach, there is no real separation of lexicon and grammar, in the sense that the 'knowledge' underlying the fluent use of language is procedural knowledge based on memorized 'chunks' of linguistic experience much larger than the analytic units of morphemes or even words. These chunks give rise to emergent grammatical patterns, which can possibly be based on competing grammatical systems if the speaker is exposed to more than one language. In what follows, we will focus on the empirical import of this hypothesis by looking at data from language contact and change, as well as what we know about speakers' morphological knowledge, as it can be elicited by means of experimental protocols tapping into bilingual competence.

1.3 Cognate and non-cognate effects in cross-language processing: Focus on cross-script studies

As already mentioned above, for most psycholinguists, cognates are translation equivalents sharing significant formal overlap. In a full bottom-up approach to bilingual lexical access, written word recognition starts at the level of visual features (letters) and activation spreads up to the lexical level (e.g., in the Bilingual Interactive Model, BIA, of Dijkstra, van Heuven, and Grainger 1998). In bottom-up protocols, maximal formal overlap is crucial, as it constitutes the necessary condition in order to attribute the cognate status to a pair of words. For instance, *hotel* or *sport* in English, French and Dutch (e.g., Dijkstra et al. 1999), or *gat-gato* 'cat', in Catalan-Spanish (Costa, Caramazza, and Sebastien-Gales 2000) are considered as cognates,[4] whereas other pairs of words, though morphologically and historically related, are not always given the same status. For instance, Dijkstra et al. (1999) suggest that the term 'semi-cognate' would be preferable for pairs such as *height – hoogte* or *rain – regen* in English-Dutch. In our opinion, this reluctance to attribute the cognate status to pairs of items sharing medium or reduced formal overlap (especially orthographic) reflects the overreliance, at least until recently, on formal/visual factors and a

4 One may wonder whether the studies using cognate pairs, especially those with maximal orthographic overlap, really assess the semantic level of processing or whether they simply report formal overlap effects: this objection, however, runs contrary to evidence that these effects do not occur for monolinguals (Garcia-Albea et al. 1985) and that proficiency level seems to play an important role (de Groot et al. 2002). However, the role of formal overlap is acknowledged to be important, especially in visual masked priming protocols (e.g., Forster 1999; Forster, Mohan, and Hector 2003). We will come back to this question further.

comparative neglect of factors related to the core levels of lexical processing, i.e., those implying meaning. The fact that certain aspects of the form-meaning relation that undoubtedly form the basis for cross-language effects have been neglected (i.e. such as those observed with cognates and non-cognates) can be seen as a side-effect of different approaches adopted in word-recognition vs. word-production studies (cf. Section 1.4.1).

Contrary to the strict definition of the cognate relation we saw above, experimental data showed that even word pairs with low formal similarity induce robust cognate effects. In many studies, very often published by the proponents of Kroll and Stewart's (1994) Revised Hierarchical Model (as well as its early version, the Word Association Model), a more flexible definition of the cognate relation is used, and pairs of words such as *height – hoogte* are found to induce cognate effects of large amplitude, comparable to those sharing maximal formal overlap. For example, de Groot and Nas (1991), under masked conditions, obtain robust facilitatory cognate effects (exp. 2: 58ms from L1 to L2 and 39ms from L2 to L1, with Dutch-English bilinguals; see also Dufour and Kroll 1995; Van Hell and de Groot 1998, for similar effects).

Additionally, results from cross-script studies reinforce this looser conception of cognateness, given that under these conditions and in the visual modality (masked priming), formal overlap is discarded because of the difference between the alphabet of the prime and that of the target. Although cross-script cognate priming is not automatic, as shown by the lack of facilitation found in the Arabic-French study by Bowers, Mimouni, and Arguin (2000), in most of the experimental situations tested, cross-script cognate effects are observed. In Gollan, Forster, and Frost 1997, for example, with the masked priming technique and a 50ms Stimulus-Onset Asynchrony (henceforth SOA), Hebrew-English bilinguals exhibit a 53ms effect for cognates in exp. 1 (and a 36ms effect for non-cognates),[5] with pairs of words such as *television – televizya* in English-Hebrew. This cognate effect, independent of visual overlap, is found for other pairs of languages, sharing more or less dissimilar writing systems, e.g., Chinese-English (e.g., Jiang 1999; Jiang and Forster 2001), or alphabets, e.g., Greek-French (e.g., Voga and Grainger 2007). In Voga and Grainger's study, the cognate effect induced by the

5 This is an important finding, given that in many of the previously published studies non-cognates either induce no effect (e.g., Sanchez-Casas, Davis, and Garcia-Albea 1992), either induce effects of smaller amplitude (de Groot and Nas 1991). Non-cognate effects can only result from shared semantic representations, given that they share no orthographic or phonological overlap (e.g., λάθος /'laθos/ – *erreur* 'error') in Greek-French. Some recent studies on language co-activation report on non-cognate effects (e.g., Dimitropoulou, Duñabeitia, and Carreiras 2011a; 2011b).

L1 Greek prime *κύκλος* /'kyklos/ 'cycle' on the L2 French target *cycle* 'cycle', under conditions very similar to those of Gollan, Forster, and Frost (1997), induces a 36ms facilitation (exp. 1). It is noteworthy that this robust cross-script cognate effect is found relative to a phonological control baseline, and not an unrelated one, as in most of the published studies. Experiment 2 goes further, controlling the role of phonological similarity of cognates, given that orthographic overlap is greatly reduced: the effect induced by two types of cognates, high-overlap ones, such as *μετρό* (/me'tro:/) – *metro* 'subway', and low-overlap ones, such as *κέντρο* (/'kendro/) – *centre* 'center' is assessed relatively to two types of controls. Results show that both categories of cognates induce significant priming compared both to the unrelated (55 and 45ms respectively) and to the phonological control (38 and 46ms respectively). The classic interpretation of the cognate effect attributes a part of the facilitation to the semantic priming component, which is common to all translations, and another part on the form-priming component, which is specific to cognate translations. What the above results demonstrate is that even in these very early stages of processing, it is mainly the semantic component of the cognate relation that underpins the effect. The fact that significant non-cognate effects are found in the same study, and within the same experiment, also advocates in favor of this interpretation, thus assigning an important role to semantics during the early stages of cross-language lexical processing. Using translation equivalents (non-cognates)[6] such as *λάθος* /'laθos/ – *erreur* 'error', in exp. 2, Voga and Grainger (2007) obtain a 36ms effect (relative to a phonological control) and a 23ms effect (relative to an unrelated control); in exp. 3, with different stimuli, such as *δώρο* /'ðoro/ – *cadeau* 'gift', they obtain 27 and 22ms of translation priming effect. These effects

6 The term 'non-cognates' here means exactly the same as 'translation equivalents', traditionally used to designate words that do not bear any formal relation (orthographic and/or phonological) but have the same meaning. Here, we chose to use this term instead of 'translation equivalents', following other works (Dimitropoulou, Duñabeitia, and Carreiras 2011b; Peeters, Dijkstra, and Grainger 2013; but contrary to Dimitropoulou, Duñabeitia, and Carreiras 2011a). Additionally, it is clear from Section 1.3 that the term 'cognate' takes various definitions in the psycholinguistic literature. In the light of the cross-script perspective of our experiments and of a considerable amount of data, we consider that words presenting formal differences but sharing a common etymology (e.g., κέντρο /'kendro/ 'center' in Greek-English) should be considered as cognates, exactly as *sport* – *sport*, to which recent literature refers as 'orthographically identical cognates' (e.g., Peeters et al. 2013). We thus call all these words 'cognates', without using the term 'semi-cognates', which is rather scarce in the psycholinguistic literature. The issue of the different mappings, mainly of morphological nature, between Greek and French words, and their cognate or cognate-like effects in processing protocols, is specifically addressed in Voga and Anastassiadis-Symeonidis (2018).

are roughly of the same amplitude as the non-cognate effects found in the Gollan, Forster, and Frost (1997) study, and they should be interpreted as evidence in favor of an early participation of factors related to lexical meaning.

It should be noted at this point that the compatibility between the Greek-French and the Hebrew-English data stressed above, should not overshadow the fact that the two pairs of languages are not equivalent with respect to the orthographic overlap they share. We could even hypothesise that given the alphabetic nature of French and Greek, as well as the fact that 14 out of 24 (uppercase) letters of the Greek alphabet are common to letters of the Latin alphabet[7] (and 12 out of 24 for lowercase letters), some kind of letter-to-letter correspondence does exist between the Latin and the Greek alphabet, attested for instance by the fact that a Greek speaker can easily spell a French/English word to another Greek speaker using exclusively Greek letters (with some exceptions). Obviously, this is not the case between Hebrew and English, where not only the consonants representing Hebrew roots are graphically different from Latin characters, but also the morphological structure of the two languages differs considerably, since Hebrew has a non-linear morphology. It is thus possible that cross-language effects (L1 to L2 or L2 to L1) such as those we are presenting in Section 2 with Greek-French materials may not be replicable with language pairs sharing reduced orthographic overlap.

To sum up, the implications of cross-script cross-language priming results for the questions above (selective vs. non-selective access, independent lexica vs. integrated lexicon, 'prerequisites' of maximal formal overlap for the cognate relation) are quite straightforward. First, the non-target language, at least when it is L1 (as in Gollan, Forster, and Frost 1997, as well as Voga and Grainger 2007) cannot be suppressed[8] and exerts its influence, even when the duration of the prime is below the conscious perception threshold. Second, this transfer of activation from one language to another, shown here by the abundant evidence of the cognate effect, can survive also in cases of null orthographic

7 Clearly, a mapping at the level of letters does not imply a mapping at the level of phonemes. For instance, the Greek grapheme P/ρ corresponds to French grapheme R/r, but Greek [r] is different from French [R].

8 Recall that in the masked priming technique, participants respond to stimuli in the target language and are completely unaware of the existence of the prime in the other language (see also the 'procedure' section of the present study), for example the L1 Greek subject in Voga and Grainger (2007), is not aware that L1 primes, e.g., *κύκλος*, appear in the screen before the French target, e.g., *cycle*, he thus thinks that he is responding to a 'French' experiment, using exclusively French stimuli. The cross-language masked priming protocol is thus bilingual in nature (two languages implied), even if participants cannot consciously process, or even perceive, the stimuli presented as primes.

overlap, as illustrated by evidence of Hebrew-English or Chinese-English bilinguals, at least if there is a certain amount of phonological overlap (e.g., *television* – *televizya*). Moreover, the cognate effect can also survive reduced phonological overlap combined with largely reduced orthographic overlap, as demonstrated in the case of Greek-French cognates (*κέντρο* /'kendro/ – *centre*).[9] In such an experimental situation, the cognate and non-cognate effects occur relative to phonological controls (Voga and Grainger 2007). Non-cognate effects occur relatively easily under certain circumstances, namely cross-script conditions (e.g., Gollan, Forster, and Frost 1997 for Hebrew-English; Voga (in press) and Voga and Grainger 2007 for Greek-French), i.e., in the presence of an orthographic cue. The orthographic cue is thought to orient the language processing system towards the appropriate lexicon, therefore rendering processing of the prime more efficient and enabling thus the contact to the semantic representation of the target. This is found to be the case even for long and less familiar non-cognate words (Voga 2017, e.g. αποκλειστικός /apoklisti'kos/ 'exclusive', 40ms of translation effect and 40ms of morphological effect in the L1 to L2 direction).[10]

A possible objection to the summary above, is that masked priming was initially developed to study form-related factors in lexical access (for a review, see Forster, Mohan, and Hector 2003), that is sensitive to perceptual similarity between primes and targets and, finally, that priming effects can be task-specific, e.g., present in a lexical decision task but absent in a same-different task (Kinoshita and Lupker 2003; Norris and Kinoshita 2008; see also Baayen 2014). As far as bilingual data are concerned, the fact that effects with translation equivalents, which are effects based on a common semantic representation, appear under masked priming conditions, i.e., under conditions where the conscious perception of the prime is not possible (usually SOAs around 50 milliseconds), indicates that lexical access includes a semantic component, not only a formal one. Additionally, the fact that cross-script cognate words manage to prime each other in both directions (L1 to L2 and L2 to L1)[11] even when the effects are estimated relative to phonological controls (and not only unrelated controls), argues in favor of a semantic participation in cross-language priming effects. These facts

9 The two cross-script situations (Hebrew-English and Greek-French) differ not only with respect to orthographic overlap, but also historically: words such as *κέντρο* and *centre* bear a diachronic relationship, leading to a rich morphological family in the 'other' language, here, French.

10 These words bear, however, similar morphological structure. For a review of priming results of different morphological mappings on Greek-French words, cf. Voga and Anastassiadis-Symeonidis (2018).

11 The L2 to L1 direction gives somehow mixed results, as we will see in Section 1.4.2.

suggest an early involvement of semantics in cross-language processing, an aspect that should not be neglected. The interaction of the meaning component with (more or less) shared form should be studied more precisely. In other words, in accordance with the definition of cognate in historical linguistics, the cognate effect should be studied with respect to the 'larger chain of morphological relations' (Mulder et al. 2014). The experimental results presented in Section 2 explore this interaction between meaning and form through cross-language morphological effects.

1.4 Indirect ways to study the issue of *unified lexicon vs. separate lexica* and the role of morphology

1.4.1 Word-recognition vs. word-production perspectives

The Revised Hierarchical Model (RHM, Kroll and Stewart 1994; for a critical review, see Kroll et al. 2010) is one of the very first models of bilingual processing, and for this reason it is quite influenced by data in favor of selective access. It operates a distinction between the lexical and the conceptual level. At the lexical level, the two lexica are distinguished, one for the words of the mother tongue (L1) and another one for the words of the other language (L2). These two lexica are connected through a shared conceptual system which contains the meanings of the words.

As shown in Figure 1, the model assumes that both lexical and conceptual links are bidirectional, but that they differ in strength. The lexical link from L2 to L1 is assumed to be stronger than the lexical link from L1 to L2, because L2 words were initially associated to L1, and in this sense, the model is hierarchical. Likewise, the link from L1 to conceptual memory is assumed to be stronger than the link from L2 to conceptual memory (Kroll and Stewart 1994: 158). It should be noted that this model was designed to make predictions about translation effects from L1 to L2 and vice versa, especially for production protocols. Consequently, semantic and conceptual aspects are of particular relevance, and this is one of the main reasons why its authors assume different strength of connections between the lexical and the conceptual level for the two languages.

This is not the case with word recognition models, such as the equally influential BIA Model (Dijkstra, van Heuven, and Grainger 1998; van Heuven, Dijkstra, and Grainger 1998), focusing on perception effects. Initially, this model was an extension of the Interactive Activation Model of visual word recognition, first proposed by McClelland and Rumelhart (1981), and as such, did not deal with

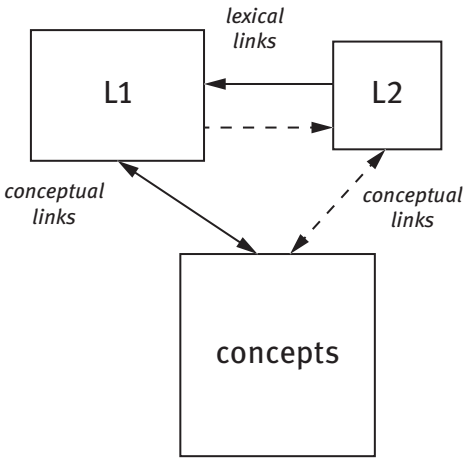


Figure 1: Revised Hierarchical Model of lexical and conceptual representation in bilingual memory (Kroll and Stewart 1994).

semantics (cf. Figure 2). Semantics were introduced in the BIA+ Model (cf. Figure 3), along with phonological information, in order to capture cross-script effects (like those we saw in Section 1.2), as well as a task schema, designed to capture the fact that bilingual word identification also has to reflect the task context (e.g., the fact that participants are responding to a monolingual or bilingual task).

We can observe that quite often in the recent literature, the still very influential RHM is taken to be a model based on independent, separate lexica (see, e.g., Brysbaert and Duyck 2010: 360). This fact, along with others, reflects the strict dichotomy between lexical access – perception (bottom-up) models and production (top-down) models. Recently, psycholinguistic research has started emphasizing the need for a unified account, based not on a separation between production and perception, but on an integrative approach (Pickering and Garrod 2013), and empirical evidence supporting integrative theories is beginning to emerge (Silbert et al. 2014).

As mentioned above, the issue of empirically distinguishing between parallel non-selective access with separate lexica vs. parallel access with an integrated, unified lexicon, is a very difficult one. We can only have indirect evidence coming from various kinds of interaction between the two languages. For much of the 'word recognition' research, this issue has been addressed through the study of interferences between word-forms of the two languages: for instance, van Heuven, Dijkstra, and Grainger (1998) show that the number of L1 (Dutch) orthographic neighbors influences processing when identifying L2 (English) words. This piece of evidence, while being among the first ones proving that

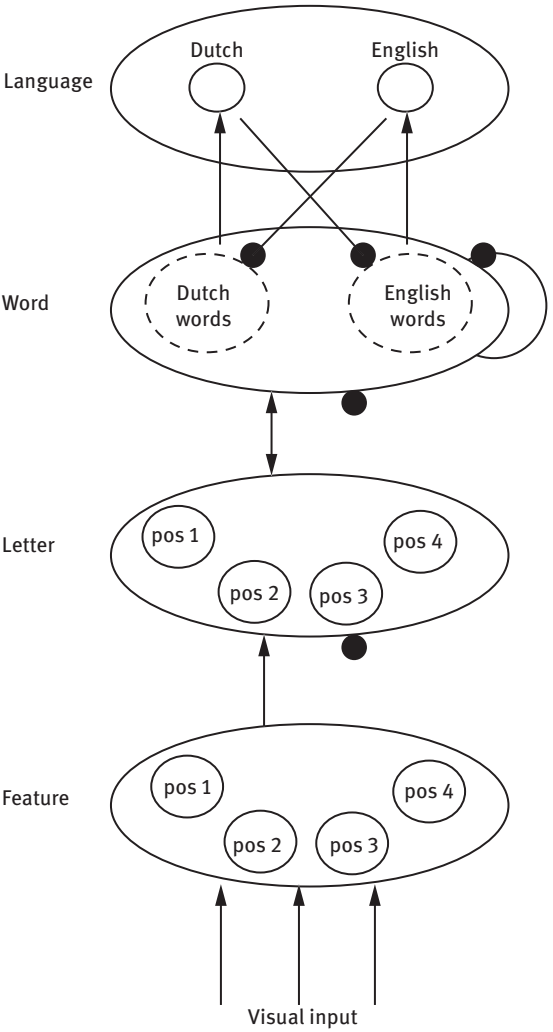


Figure 2: The Bilingual Interactive Activation Model of Visual Word Processing (van Heuven, Dijkstra, and Grainger 1998).

the two lexica (or words from the unified lexicon) do interact, focuses, following the logic of bottom-up models, on orthographic factors, which do not tell us the whole story. One of the merits of the RHM is that it attempted to address, mainly from a word production, top-down perspective, the interactions between the various components on a more central level ('core' level) than most bottom-up studies, by investigating the connections from the L1 lexicon

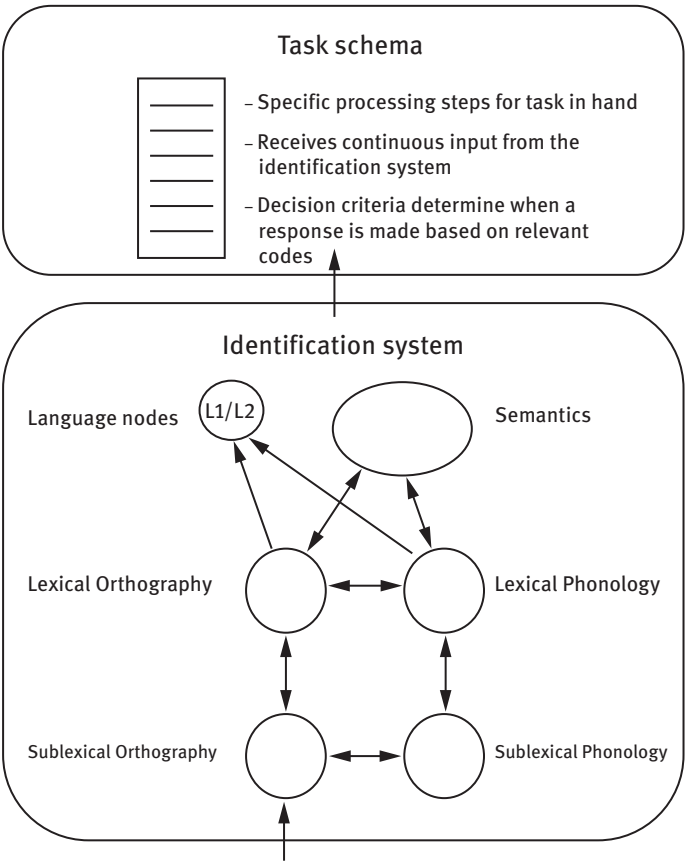


Figure 3: The BIA+ Model (Dijkstra and van Heuven 2002).

to the conceptual level, from the conceptual level to the L2 lexicon, etc. This kind of approach is of particular interest, not only locally for the study of cognates, but also, more generally, in order to answer the question as to whether the connection between the two lexica (or the words from the unified lexicon) is morphological in nature.

Indeed, if the cognate effect arises from the combined interaction of shared meaning and shared form, attributing the effect to morphological factors seems a natural step to take. The first researchers who have expressed this idea are Bybee (1985, 1988), on more theoretical grounds, and Kirsner (1986) based on experimental work. Bybee describes the monolingual lexicon as consisting of lexical paradigms (or 'clusters'), formed by a base-word and its derivatives: an organization transcending languages. While this approach, tested mainly through long-term

priming in several studies (e.g., Kirsner, Lalor, and Hird 1993) is attractive, it nevertheless loses some of its appeal when it has to face two types of data. The first type of data concerns the priming asymmetries presented in some detail below (Section 1.4.2). The second type of evidence concerns the existence of non-cognate effects, such as those reviewed in Section 1.3, since non-cognates cannot belong to the same lexical paradigm, and hence should not produce priming effects. As we have seen in Section 1.3, non-cognate effects are found systematically under cross-script conditions, i.e., more easily than in same-script conditions. However, we have to concede that the influence of the orthographic cue is, by definition, related to a purely 'bottom-up-word-recognition' perspective. Consequently, it would be a little bit far-fetched to disregard entirely the role of morphology in bilingual processing, because of the existence of non-cognate effects, and despite the existence of robust cross-language morphological effects, both same-script and cross-script (e.g., Duñabeitia et al. 2013; Voga 2014, 2017; Sánchez-Casas and García-Albea 2005; Voga and Anastassiadis-Symeonidis 2018). Moreover, it would be an oversight if we did not attempt to exploit the opportunity given by the orthographic cue, in order to specifically address the role of morphological factors in bilingual processing and to examine the strength of morphological mappings across languages.

1.4.2 The question of priming asymmetries

A piece of evidence that, at first glance, seems at odds with an organization of the bilingual lexicon based upon morphological principles, is the asymmetry between the two priming directions. If words from the (separate or integrated) lexica belonged to the same 'lexical cluster' (following Bybee 1985, 1988) or to a kind of 'cross-language morphological family' (e.g., Mulder et al. 2014; Mulder, Dijkstra, and Baayen 2015), cross-language facilitation should be found in both priming directions, and not only in the L1 to L2 direction.

One of the first studies to show an asymmetry between the two priming directions is Keatley, Spinks, and de Gelder (1994), where the L2 to L1 direction does not induce significant cognate priming, neither for Chinese-English nor for French-English bilinguals. In their classic study with Hebrew-English bilinguals, Gollan, Forster, and Frost (1997) obtained a 53ms cognate priming effect in the L1 to L2 direction, but a non-significant effect in the opposite direction (9ms). This asymmetry is found in other studies (e.g., for Chinese-English: Jiang and Forster 2001; Chen et al. 2014; Allen, Conklin, and van Heuven 2015, for Japanese-English cognates).

However, there are studies that do not report asymmetrical effects (e.g., Duyck and Warlop 2009, for Dutch-French non-cognates), as well as studies in which an asymmetry is found for one type of cognate stimuli but not for the other. Data from Greek-French bilinguals (Voga 2014), having lived for several years in the L2 country, show that for cognates of Greek etymology, e.g., *ιδέα* /i'ðea/ – *idée* 'idea', the priming direction L1 to L2 gives a 56ms cognate effect and the opposite direction gives a 24ms significant effect,[12] which is not a clear asymmetry. On the other hand, the etymologically French (Latin) cognates, e.g., *role* – *ρόλος* /'rolos/ 'role' or *cuisine* – *κουζίνα* /ku'zina/ 'kitchen' fail to induce any significant effect in the L2 to L1 direction, despite the fact that they manage to prime in the L1 to L2 direction (34ms for cognate and 28ms for morphological priming),[13] and in spite of the fact that participants were living in the L2 country, i.e., they represented the type of bilingual who has the greatest chances to exhibit L2 to L1 priming effects (Finkbeiner et al. 2004; Grainger and Frenck-Mestre 1998). In Voga (2014), the etymologically L2 cognates, contrary to their L1 counterparts, confirm the asymmetrical pattern between the two priming directions and behave similarly to the non-cognates tested with low-proficiency Greek learners of Spanish (Dimitropoulou, Duñabeitia, and Carreiras 2011a).

The aforementioned findings do not constitute an exhaustive review on priming asymmetries. They nevertheless clearly illustrate the fact that these asymmetries can diverge according to several factors.

i) The nature of the task, i.e., tasks explicitly relying on the semantic component such as semantic categorization, vs. those in which perceptual factors are more implied, such as the lexical decision task (Finkbeiner et al. 2004, with non-cognates);
ii) Participants' level of proficiency. As it is acknowledged, low-proficient bilinguals perform worse than more proficient bilinguals in tasks requiring lexico-semantic activation of L2 items (for a review, see Kroll et al. 2010);
iii) Language environment (e.g., Finkbeiner et al. 2004);

12 A 56ms effect is certainly not equivalent to a 24ms one, but the latter still constitutes a real, significant effect, especially if we consider the fact that participants are faster when they respond to L1 than L2 stimuli, a trend inversely proportional to their L2 proficiency. This behavioral fact, which can potentially function as a bias, is not sufficiently discussed in the majority of published studies reporting priming asymmetries.

13 It should be noted that, as far as morphological priming is concerned, the two types of morphological primes, etymologically Greek cognate derivatives, as well as their Latin-French counterparts, are equally decomposable in terms of morphemes (base + suffix).

iv) The types of materials used, cognates in Voga (2014) vs. non-cognates[14] in Dimitropoulou, Duñabeitia, and Carreiras (2011a), or features of the materials, e.g., cognates of L1 vs. L2 etymology (Voga 2014). This last factor suggests that the question of priming asymmetries could be related to the morphological organization of the bilingual lexicon and that the reliance of historical linguistics on factors such as etymology can have a psychological reality.

2 Etymology and Morphological Family Size in the bilingual lexicon: Evidence from cross-script cognates

In order to describe the structure of the lexicon as well as the mechanisms responsible for processing words coming from two languages, we have to define the extent to which words from the languages of the bilingual are linked. Another related question is whether this connection takes place at a syntagmatic level, inside the boundaries of the word to be recogniszd, or at a paradigmatic level, i.e. extending beyond the limits of the lexical unit presented as a target in the experiment. The study we report here aims to provide experimental evidence on this question by manipulating a paradigmatic variable, the Morphological Family Size (MFS, de Jong, Schreuder, and Baayen 2000; Schreuder and Baayen 1997). The MFS has been found to influence bilingual processing (Dijkstra et al. 2005, on English-Dutch interlingual homographs; Mulder et al. 2014; Mulder, Dijkstra, and Baayen 2015, both with Dutch-English cognates and the lexical decision task). The role of MFS will be examined along with the etymological origin of the cognates, since simultaneous manipulation of these variables will inform us about the asymmetries between the two languages of the bilingual. It can also reveal the effect of the network of paradigmatic relations lying behind an individual word-form. This issue is strongly related to the other question of whether bilinguals have separate or unified lexica. From this perspective, Greek-French bilingualism constitutes a particularly interesting ground, since it is characterized by an important proportion of cognate words, originating from both etymologies

14 In fact, priming asymmetries have been studied more often through non-cognate rather than cognate materials. This may look surprising; however, from an experimental point of view, it is undoubtedly easier to find balanced materials among non-cognate translation equivalents than among cognates.

(Anastassiadis-Symeonidis 1994, 2007) as a result of intense borrowing in both directions, through different historical periods.

The experiments below are based on a non-selective access approach, according to which the possible interactions between two languages constitute evidence in favour of the integrated lexica hypothesis. Given that cross-script protocols (e.g., Greek-French), albeit bottom-up (i.e., masked priming), exhibit particular sensitivity to 'core' factors, one of the most informative ways to test the morphological account of the bilingual lexicon would be through a cross-script protocol using materials that can be distinguished on the basis of a morphological variable, i.e., the MFS. In the experiments reported below, the MFS is controlled along with the etymological origin of our materials. Importantly, the cross-script nature of the experiment limits the participation of low-level form factors and enables the orthographic cue to immediately 'channel' the activation induced by the prime in the appropriate direction (i.e., towards the appropriate node of the unified lexicon).

2.1 Participants, stimuli and design

The experimental task was primed lexical decision, tested in two directions: Greek to French priming (exp. 1a) and French to Greek priming (exp. 1b). The 42 participants were Greek native speakers who had been studying and/or living in France for 4 to 8 years.[15] All of them responded to both experiments (1a and 1b) with the appropriate design. 192 targets were used overall, 96 words and 96 pseudowords. The 96 targets were all Greek-French cognates, nouns or adjectives and their frequency was assessed via the Lexique database (New et al. 2001). The 96 word stimuli were divided in four categories (see Table 1 for examples):

i) 24 cognates of Greek etymology and large MFS (GrMFS+)
ii) 24 cognates of Greek etymology and small MFS (GrMFS–)
iii) 24 cognates of French-Latin etymology and large MFS (FrMFS+)
iv) 24 cognates of French-Latin etymology and small MFS (FrMFS–)

The MFS count was based on the Modern Greek Dictionnary (2003) and the Reverse Modern Greek Dictionary (Anastassiadis-Symeonidis 2002, and its digital version). To illustrate, a lexical unit such as αθλητής /aθli'tis/ 'athlete' is part of a

15 Prior to experiments, participants were asked to fill in a short questionnaire on their study/work experiences, and were tested for their French naming skills (following the naming test of Jared and Kroll, 2001).

rich morphological family including: αθλητισμός /aθlitiz'mos/ 'athletism', αθλητικός /aθliti'kos/ 'athletic', άθληση /'aθlisi/ 'sport', αντιαθλητικός /andi aθliti'kos/ 'antiathletic', έπαθλο /'epaθlo/ 'trophy', δίαθλο /'ðiaθlo/ 'diathlon', τρίαθλο /'triaθlo/ 'triathlon', πένταθλο /'pendaθlo/ 'pentathlon', πολυαθλητής /poliaθli'tis/ 'polyathlete', δεκαθλητής /ðecaθli'tis/ 'decathlete', συναθλητής /sinaθli'tis/ 'sports partner', συνάθληση /si'naθlisi/ 'sports partnership', υπεραθλητής /iperaθli'tis/ 'super-athlete', αθλώ /a'θlo/ 'train', αθλούμαι /a'θlume/ 'train oneself', and has thus an MFS of 15. On the other hand, a lexical unit such as στομάχι /sto'maxi/ 'stomach' has a very small MFS, formed by 3 lexical units στομαχάκι /stoma'xaki/ 'stomach$_{DIM}$', στόμαχος /'stomaxos/ 'stomach' in medical terminology, and στομαχιάζω /stoma'x͡iazo/ 'to have a difficult digestion').[16]

Every target could be preceded by one of the three following types of prime, which constitute the three priming conditions:

i) the prime was the translation of the cognate in the other language, e.g., for the prime *αθλητής* /aθli'tis/ in Greek, the target was *athlète* in French. Primes were always presented in the nominative singular for Greek and in the singular for French;
ii) the prime had a morphological relation to the target, e.g., for the target *crème* (in the L1 to the L2 direction), the prime was *κρεμούλα* /kre'mula/ 'cream$_{DIM}$'. As Table 1 shows, the derivations used in this condition were diminutives, augmentatives as well as some adjectives;
iii) the last type of prime is the unrelated one, on the basis of which the results were estimated. In the experiments reported here, the unrelated prime is a word from the other language without any grapho-phonological or etymological relation to the target.

The 96 pseudowords were created in such a way that they respected the phonotactic constraints of each language (French and Greek) and were preceded by pseudo-primes mimicking primes of real words. The materials (words and pseudowords) were distributed in three experimental lists. The stimuli were distributed in the three lists according to a Latin square design.

As Table 1 shows, stimuli sample (number of letters and lexical frequency) and orthographic and phonological overlap for the 12 experimental conditions (3 priming conditions × 4 types of target). In exp. 1a, where the priming direction is from the L1 to the L2, the prime is *αθλητής* /aθli'tis/ and the target is

16 Following De Jong, Schreuder, and Baayen (2000), neither inflected verb forms nor compounds were included in the count. Although the calculation of MFS was based on Greek, and not on French, special care was taken in order to avoid cognates that had a large MFS in one language and a much smaller one in the other.

Table 1: (exp. 1a and 1b, here the L1→ to L2 direction is showed).

	Primes					
	Targets	**translation**	**Phon. overlap**	**Orth. overlap**	**morphological**	**Unrelated**
Cognates of Greek etym. MFS+	athlète 6.5 lett. 39 occ/m.	αθλητής 'athlete'	76%	31%	αθλητικός 'athletic'	μάγουλο 'cheek'
Cognates of Greek etym. MFS–	estomac 6.1 lett. 15.4 occ/m.	στομάχι 'stomach'	77%	33%	στομαχικός 'of the stomach'	κατσίκα 'goat'
Cognates of French etym. MFS+	cuisine 6 lett. 61.4 occ/m.	κουζίνα 'kitchen'	85%	36%	κουζινίτσα 'kitchen$_{DIM}$'	στέμμα 'crown'
Cognates of French etym. MFS–	crème 5.5 lett. 43.7 occ/m.	κρέμα 'cream'	87%	35%	κρεμώδης 'creamy'	ευρύς 'broad'

athlète 'athlete', while in exp. 1b, where the priming direction is from the L2 to the L1, the prime is *athlète* and the target is *αθλητής* /aθli'tis/. This design, i.e., primes and targets changing following the priming direction, is the same for all the conditions, translation, morphological and unrelated.

2.2 Procedure and apparatus

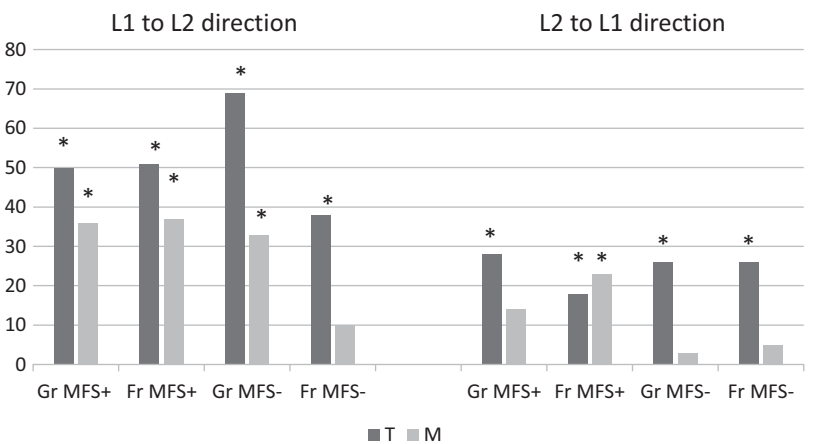
The experiment was conducted on a PC computer using the DMDX software (Forster and Forster 2003). Each trial consisted of three visual events. The first was a forward mask consisting of a row of ten hash marks that appeared for 500ms. The mask was immediately followed by the prime. The prime was in turn immediately followed by the target word which remained on the screen until participants responded. The prime duration used in this experiment was 50ms. All stimuli appeared in the middle of the screen presented in lowercase characters[17] in order to preserve stress markers over the appropriate vowels. In

17 It should be noted that for the application of the masked priming technique in Modern Greek, and, contrary to what is generally applied for other languages, e.g., English, targets as well as primes are presented in lowercase letters (and not in uppercase letters for the target and lowercase letters for the prime). This adjustment aims to avoid disguising the

order to prevent orthographic overlap being confounded with visual overlap, the size of the font was manipulated (Times New Roman 16 point for targets and Arial 12 point for primes; for a similar presentation see Frost, Forster, and Deutsch 1997). Participants were seated 50 cm from the computer screen. They were requested to make lexical decisions (YES, it is a word; NO, it isn't) on the targets as quickly and as accurately as possible, by pressing the appropriate button of the keyboard.

2.3 Results

The analysis of results was conducted on the reaction times (RTs) of correct answers after exclusion of errors[18] as well as outliers (RT> 1500ms and RT< 350msec, less than 3% of the overall data). Three items were excluded from the statistical analysis because of high error rates. The results for words are presented in graphic below, and in a more detailed way in Tables 2 and 3 in the Appendices. The details of the statistical analysis (ANOVA) are given in the Appendices 1a and 1b.



Graph 1: Translation (T) and morphological (M) net priming effects (in milliseconds) for the four types of cognate (etym. Greek MFS+, etym. French MFS+, etym. Greek MFS- and etym. French MFS-) in the two priming directions. Significant priming effects (translation and morphological) are denoted by an asterisk.

phonological identity of the stimulus, given that lexical stress, always marked on words of more than one syllable, serves also to disambiguate lexemes.

18 The ANOVA on the errors as well as the analysis for pseudowords will not be presented here.

2.4 Discussion of the results (exp. 1a and exp. 1b)

Summarizing the above results, we have demonstrated that:

i) With respect to the main effect of the MFS variable, the results show that it is significant for the L2 to L1 priming direction. In other words, when participants are making lexical decisions on targets in their L1 (*κουζίνα*, /ku'zina/, 'kitchen'), their RTs are influenced by the MFS of the L2 (since the prime was in L2, e.g., *cuisinière*, 'cooker'). This suggests an interaction between words from the two lexica, or inside the integrated lexicon.

ii) In the L1 to L2 direction, the main effect of the MFS factor is not found to be significant, but the MFS x etymology interaction can also be interpreted in the same terms: MFS interacts with etymology of the prime (κουζίνα /ku'zina/ 'kitchen'), and this influences RTs for lexical decisions in the other language (L2). This also provides evidence in favor of an integrated lexicon. If the words of the two languages belonged to different lexica, it would be difficult to have this type of influence on the participants' RTs, i.e., the global effect of the MFS (L1 to L2 direction) or the MFS x etymology interaction.

iii) What our results also show is that etymology, i.e., whether the cognate comes from the L1 or the L2, also plays a role, since this factor is significant in both directions of priming. This illustrates the fact that the words from the two languages do not behave in a strictly equivalent way, as we can see in the results of the planned comparisons (see Appendices 1a and 1b).

iv) As far as priming effects are concerned, it is clear that cognates manage to induce translation priming in both directions (L1 to L2 as well as L2 to L1). While the results are not of the same amplitude (52ms on average for the L1 to L2 direction and 24,5ms in average in the opposite direction), they do not exhibit the clear asymmetry found in other studies.

v) Both types of cognates, etymologically Greek and French ones, induce significant translation priming, though its amplitude is not strictly equivalent, particularly in the L1 to L2 direction. In this direction, etymologically Greek cognates induce on average 60ms of facilitation, whereas French cognates induce on average 44.5ms. Once again, we cannot talk about an asymmetry related to the etymological origin of our stimuli. We observe however that words of L1 etymology do not behave exactly in the same way as words of L2 etymology, even when these words are presented in the L2.

vi) Regarding the pattern of effects in the L1 to L2 direction, i.e., statistically equivalent translation and morphological effects for MFS+ stimuli, combined to morphological priming effects for three out of four types of cognates, we observe that morphological effects occur more broadly in the L1 to L2 direction than in the opposite one. In the L2 to L1 priming direction, only one category

of items, French MFS+ cognates, manages to induce morphological effect. Moreover, in the L1 to L2 priming direction, the morphological effect occurs *simultaneously* to the translation effect for the three out of four conditions. This result suggests that the strength of morphological connections is *greater* among etymologically L1 words (as well as etymologically L2 MFS+ words) than among etymologically L2 words (especially MFS- ones). This difference in the strength of connections is a result predicted by the RHM, as we shall see below (Section 3.2). The results of the L2 to the L1 direction point to the same type of interpretation: while all L2 translation primes are connected to their L1 cognate target word, and no asymmetry is found for the cognate effect, only L2 morphologically complex words from big families (e.g., *cuisinière*) have strong enough connections with the representation of the target (e.g., *κουζίνα* 'kitchen') to induce morphological cross-language priming effects.

However, before interpreting the differences between the two directions as being related to the organization of the bilingual lexicon, we have to acknowledge that the reaction times on the whole are slower when participants respond to L2 stimuli rather than when they respond to L1 ones (e.g., for the morphological condition of etymologically Greek cognates, 615ms in the L2 to L1 direction vs. 662ms in the opposite one). This is normal, given that our participants are proficient yet unbalanced bilinguals, who learned French as a foreign language. This pattern of RTs[19] is not an exception, it is related to language dominance and characterizes a majority of studies with unbalanced bilinguals and L2 learners. Therefore, there is the possibility that some effects, in this direction (L2 to L1), e.g., morphological, did not have the time to emerge during the 50ms time-window of our experiments. We can therefore make the assumption that the bilingual processing system was able to directly recognize the L1 target, thanks to the presence of the orthographic cue, but by doing so, no time was left for the morphological effect to emerge. In order to test this assumption other SOAs should be tested, and particularly the 66ms SOA.[20]

19 As well as of errors, much more frequent in the L1 to L2 direction than when participants respond to stimuli of their mother tongue.

20 The 66ms SOA is the following SOA, given that the prime duration depends on screen refreshing times (usually around 16ms). This prime duration has been shown to be sensitive to morphological effects.

3 Interpretation of the psycholinguistic data

One of the main interests of the psycholinguistic study presented above is that Greek and French scripts present a somewhat intermediate orthographic overlap, i.e. much greater than Hebrew and English scripts, or Chinese and English scripts. This is of special interest, given that the Greek-French combination still is cross-script, and Greek is a morphologically rich language. Although some recent studies focus on this language combination, for instance Dimitropoulou et al. (2011a), who study priming asymmetries with non-cognate words and low-proficiency ESL speakers, the number of studies involving it still remains limited. Despite reduced orthographic overlap, Greek and French (or English) share a significant number of lexical units. This renders the creation of the linguistic materials needed to test the kind of hypothesis we entertain here much easier. It also proves that combining variables such as the MFS, which is realized synchronically through the connections that constructed words share, with a variable of a diachronic nature such as etymology, is possible, in a psycholinguistic experimental setting.

3.1 Language co-activation in the 'unified lexico-semantic architecture'

The linguistic (Section 1.2) and psycholinguistic data (Section 2) discussed above point to the question of how bilinguals manage to prevent interferences between their two languages, presented in the introduction through the distinction between the storage component (separate lexica vs. unified/integrated lexicon), and selective vs. non-selective access. From this point of view, the psycholinguistic data we present here call for an interpretation in terms of a 'unified lexico-semantic architecture' (with non-selective access, which is a well-established assumption). In the experiment above, despite the reduced orthographic overlap between Greek and French, all four types of cognate, etymologically Greek or French-Latin, coming from large or small morphological families, induced significant cross-language translation priming in both directions. The asymmetry between the two directions of priming, found in some studies (e.g., Allen, Conklin, and van Heuven 2015; Chen et al. 2014; Gollan, Forster, and Frost 1997) but not in others (e.g., Duyck and Warlop 2009; Voga 2014) is not really found in our data. While cognate translation effects are of lesser amplitude in the L2 to L1 direction, they are nevertheless significant and cannot be interpreted as 'weak' (compared to the L1 to L2 direction) especially given that RTs, on the whole, are

faster in the L2 to L1 direction. Our results thus constitute another demonstration of the well-known fact that, even in the context of the L2 to L1 priming direction, our proficient yet unbalanced bilinguals show themselves unable to 'suppress' their L2 when responding to L1 targets.

Our study demonstrates for the first time that this 'impossibility to deactivate' the L2 is observed not only when processing targets belonging etymologically to the L2 (e.g., κρέμα /'krema/ 'cream'), but also when processing targets belonging to L1 (presented in the L1 language and alphabet, e.g., *αθλητής* /aθli'tis/ 'athlete'). In the case of etymologically L1 words (presented in the L1 alphabet), we could have hypothesized a reduced participation of the L2 'part of the lexicon', since these words have nothing to do with the L2. If words from the two languages were represented separately in the bilingual lexicon of our Greek (L1) participants, we would expect a word such as *αθλητής* /aθli'tis/ 'athlete' to be recognized without any, or with a minimal participation of its French translation *athlète*, especially in the light of several studies showing asymmetrical effects between the two priming directions (e.g., Allen, Conklin, and van Heuven 2015; Chen et al. 2014; Gollan, Forster, and Frost 1997). This does not seem to be the case, however, since we observe robust translation effects induced by L2 primes on L1 targets (28ms, in the MFS+ etymologically Greek condition), which provides evidence for a unified lexicon with parallel access, at least for participants having reached a certain level of proficiency. The fact that the L1 target *αθλητής* /aθli'tis/ 'athlete' benefits from the L2 prime *athlète,* in the same way (same amplitude) as the etymologically L2 target *κρέμα* /'krema/ 'cream' benefits from its L2 prime *crème*, suggests that these two effects have little chance of coming from functionally separate lexica, as certain accounts assume (mainly the RHM, e.g., Schwartz, Kroll, and Diaz 2007). Therefore, these effects should be interpreted in favor of what Schoonbaert et al. (2009) call a 'unified lexico-semantic architecture'.

It is useful to appreciate that this co-activation, while it is enhanced through variables of orthographic nature (here the orthographic cue, see also Dimitropoulou, Duñabeitia, and Carreiras 2011a, 2011b) does not restrict itself to the low levels of processing, neither does it depend on any kind of decomposition into morphemes (e.g., Crepaldi et al. 2010; Rastle and Davis 2008) as the above results clearly show. It extends to the more central levels ('core levels'), at which the content of lexical units is represented (de Jong et al. 2000; Dijkstra et al. 2005; Mulder, Dijkstra, and Baayen 2015; Mulder et al. 2014) and which seem to be organized paradigmatically.

3.2 Implications for models of bilingual processing

If we assume that the bilingual processing system has to activate some kind of semantic/conceptual representation in order to pass from the L2 prime to the L1 target[21] (or the other way round), cognate translation priming effects provide strong evidence that L2 semantic representations are related to those of the L1. In the L1 to L2 direction, the fact that the cognate and morphological effects do not differ in amplitude or time-course (at least for the MFS+ words) provides evidence in favor of a paradigmatic or paradigm-like organization of the cognate words contained in the bilingual unified lexicon. This organization can be described in terms of a 'cross-language derivational family' in which morphologically complex L1 words containing salient suffixes (Giraudo and Dal Maso 2016), for instance κρεμούλα 'cream$_{DIM}$' or αθλητικός 'athletic' will automatically activate the base word in the other language (*crème, athlète*). In other words, presentation of an L1 morphologically complex word as a prime to the processing system will automatically activate the L2 representation of the words morphologically related to it (target).

However, the same is not true for the L2 to L1 priming direction. In our data, the fact that L2 primes have not managed, on the whole, to induce morphological facilitation on the L1 target, could be interpreted in terms of a looser link between L2 words and the semantic-conceptual level, compared to the link between L1 words and the corresponding concepts, exactly as the RHM assumes (Kroll et al. 2010; Kroll and Stewart 1994). Though the RHM assumes functionally distinct lexicons for L1 and L2 words, it posits a common semantic/conceptual store to which words from both languages are linked: during progress in L2 proficiency, links between L2 words and their corresponding concepts are strengthened in such a way that lexical and semantic connections of L2 words become comparable to those of L1 words. According to this model, in word production, translation from L2 to L1 can be accomplished lexically, without semantic access, if the L2 word enabled lexically mediated retrieval of the translation. In contrast, L1 to L2 (forward) translation would be semantically mediated because of the strong L1 link to meaning. Our general pattern of morphological results in the L2 to L1 direction is compatible with such an approach, given the absence of morphological effects for three out of four types of cognates, suggesting lexically rather than semantically mediated processing. This

21 The alternative hypothesis here would be to assume that the effects described above are nothing more than form effects. However, this is unlikely, given the very limited (and stable, see Table 1) orthographic overlap combined with stable phonological overlap through the cross-script experiments reported here.

does not mean however, that morphology is absent from L2, as certain accounts assume on the basis of L2-L2 morphological priming data (e.g., Clahsen et al. 2010; Silva and Clahsen 2008; but see Dal Maso and Giraudo 2014; Voga, Anastassiadis-Symeonidis, and Giraudo 2014). The data of exp. 1b (L2 to L1) show robust morphological priming for stimuli from big morphological families (Graph 1, FrMFS+).

The fact that both translation and morphological L2 primes produce less facilitation when processing the L1 targets (cf. Graph 1) can also be interpreted in an interactive activation perspective (IA, McClelland and Rumelhart 1981) with a unified lexicon, in which words which are partially compatible with the stimulus will be activated at the same time, as a function of criteria such as their frequency in the language(s). If we assume that L2 words have a lower lexical frequency, the direct consequence would be that resting levels of activation are very different for L1 and for L2 cognates: L1 cognates whose resting level of activation is higher are accessed more rapidly than L2 cognates which are characterized by lower resting levels of activation. When an L1 cognate is presented as the prime, its word representation is instantly active and this activation will rapidly flow to the semantic level, whereas more time (and/or more activation) may be needed for an L2 cognate which will not be able to activate the semantic level quickly enough (Voga and Giraudo, 2017 for a similar explanation in inflectional processing). While the presence of the orthographic cue (i.e., due to cross-script conditions) manages to neutralize the effect of inhibitory connections between words from the two languages (see option (d) in the introduction) thus rendering cognate translation effects possible, this activation remains weaker in the L2 to L1 direction than in the opposite one. Consequently, this weaker activation does not manage to reach the semantic level, at least not in a way that would be able to induce morphological facilitation (as in the L1 to L2 priming direction). In such an interpretation of our effects, the fact that one category of morphological primes still manages to induce facilitation (i.e., the MFS+ etymologically French primes) should be interpreted in terms of the positive action of the rich morphological family that managed to reinforce activation of the L1 target.

4 Interpretation of the language change data

Aiming at describing the structure of the bilingual lexicon, we wanted to define the extent to which words from the languages of a bilingual individual are linked. As we have seen in Section 2.4, the results of the exp. 1a and exp. 1b show that etymology, i.e., whether the cognate comes from an L1 or an L2,

plays a role in priming. Words from the two languages, therefore, do not behave in a strictly symmetric way. Is this asymmetry related to the morphological organization of the lexicon? Evidence from language contact seems to support this view: the tenuous link between L2 vocabulary and a morphological/conceptual level of organization is mirrored by morphological integration of loan words into a matrix language, as this can represent significant steps in the direction of a full conceptual integration (Section 4.1). Other data drawn from research in language contact, concerning the existence, in one and the same language, of parallel morphological systems in settings characterized by balanced high proficiency bilingualism, provide supporting evidence for a unified lexicon with parallel access (Section 4.2).

4.1 Evidence from morphological integration

When loans enter a recipient language, they can be fitted morphologically in order to serve the specific morphosyntactic requirements of the recipient language. Morphological integration is a matter of degree, so that 'full integration' occurs when loanwords are treated as if they were native items, for example, the Ancient Greek noun *lampás* (feminine; genitive singular *lampádos*) 'torch' was integrated into Latin as *lampada* (feminine; genitive singular *lampadae*) (Gardani 2013: 48). In other cases, however, loanwords are not assigned any paradigmatic pattern, they are, as it were, undigested, to use Mifsud's (1995: *passim*) terminology. An example of such a case is found in the Tūrōyo dialect of New Aramaic (spoken in the village Mīdin, south-eastern Turkey, and in the diaspora). Here, the Kurdish (i.e., Indo-European) adjectival feminine ending *-e* has remained confined to one Kurdish-borrowed adjective, *rāṣṭ* 'right' (data from Jastrow 1985: 238).

(3) Tūrōyo New Aramaic
ʔídi *ʔí-rāṣṭe*
hand DET.SG.F-right
'the right hand'

Given that the formative *-e* has not spread to native lexemes of the recipient language and is not found on other Kurdish-origin adjectives, one can argue that this form has not been perceived as a morphological entity by the speakers of the recipient language.

However, we know that the borrowing agents can be sensitive to morphological formatives. Let us consider the case of Arvanítika, a variety of Tosk Albanian

which has been involved in intense and four centuries long language contact with dominant Greek. When Greek nouns ending in [a] are borrowed into Arvanítika, the segment [a] is automatically replaced by [ə] because speakers perceive and reanalyse [a] as the Albanian postposed definite feminine article (Tsitsipis 1998: 22). Thus, given a Green noun velóna 'needle', the resulting Arvanítika base form is *velónë*, and *velóna* is the definite form; see example (4a), where the forms are contrasted with their standard Albanian counterparts (4b).

(4)

	Arvanítika		Albanian
a.	*velónë*	b.	*gjilpërë*
	'needle'		'needle'
	velón-a		*gjilpër-a*
	needle-DET		needle-DET
	'the needle'		'the needle'

An even more impressive case of morphological awareness is provided by the adaptation of loan-nouns in the Romani varieties of Bugurdzi Romani and Romungro Romani. The data in (5), from Elšík (2000: 21), show a systematic coincidence of the morphotactic boundaries of the stems in the SLs and in the respective RLs, in spite of the paradigmatic allomorphy in the SLs, as is visible by comparing the stems with the base forms (i.e., nominative singular) of the SLs.

(5)

	SL	base form in SL	stem in SL	base form in Romani (RL)
a.	Serbo-Croatian	*orao* 'eagle'	*orl-*	*orl-os* (Bugurdzi)
b.	Albanian	*ahër* 'stable'	*ahr-*	*ahr-i* (Bugurdzi)
c.	Hungarian	*majom* 'monkey'	*majm-*	*majm-o* (Romungro)

Noticeably, the Romani forms are based on the stem without the epenthetic second vowel /a/, e.g., *orl-*, which recurs in most of the paradigm, while the purely phonological epenthesis occurs only in the nominative singular, *orao*. Thus the (often much) higher type and token frequency of the paradigm slots lacks this vowel (6). This clearly points to the fact that the higher type and token frequency of the paradigm cells lacking this vowel plays a major role in processing and consequently in morphological integration.

(6) Serbo-Croatian

	singular	plural
nominative	*òrao*	*òrlovi*
genitive	*òrla*	*orlova*
dative	*orlu*	*orlovima*
accusative	*orla*	*orlove*
vocative	*orle*	*orlovi*
locative	*orlu*	*orlovima*
instrumental	*orlom*	*orlovima*

Both the Arvanítika and the Romani cases unambiguously demonstrate that bilingual speakers have access to the morphological structure of complex forms of different source languages and are able to manipulate meaningful or compositional strings.

4.2 Evidence from co-morphologies

In Section 1.2, we have discussed cases in which morphological material of an SL spreads to RL-native bases. We have also referred to codeswitching studies showing that often plural forms of an embedded language are maintained into the matrix language. We have evidence that this process can not only go beyond individual codeswitching practices but also involve large sets of formatives. The stock example is the English paradigm *alumnus alumni*,[22] borrowed *tout court* in its orthographic format from Latin, by retaining the Latin paradigmatic inflections that are relevant to English morphosyntax, that is, those realizing the number values of singular and plural. A more notable manifestation of the phenomenon can be illustrated by the use of Latin genitives in Church holiday names (7a) and formulae (7b) in German (see Gardani 2018: 2–3).

(7) German

a. *Christi* *Himmelfahrt*
Christ.GEN.SG ascension
'The ascension of Jesus'

b. *Geburt* *Mariae*
birth Mary.GEN.SG
'Nativity of Mary'

22 See also the English pair *lexicon lexica*, from Ancient Greek, which occurs so frequently in our chapter.

Still, such cases are a marginal phenomenon in English and German, not only in quantitative but also in qualitative terms. For example, it is questionable whether speakers of German are generally able to analyse *Christi* and *Mariae* as complex forms containing the inflectional formatives *-i* and *-ae*, respectively. Most likely, cases such as the German ones qualify as fossilized forms belonging to inactive morphology.

The situation is different in languages with elaborated paradigms, where this type of transfer can reach more prominent levels. In a study mainly focusing on Berber, Kossmann (2008, 2010) has labeled the phenomenon *parallel system borrowing* because it is a process whereby loanwords retain (parts of) their original paradigms and, in this way, come to establish themselves as inflectional systems that are parallel to the native paradigms of the RL. Kossmann stresses that "different morphologies occur in different etymological strata" (Kossmann 2008: 18).

The idea that a language can have different grammars is not new. A great deal of research taking this perspective has focused on phonology (e.g., Itô and Mester 1999; Inkelas and Zoll 2007; Calabrese and Wetzels 2009; Mansfield 2015), prosody (Kubozono 2006; Kang 2010; Davis, Tsujimura, and Tu 2012), syntax (Pintzuk 1996) and also on morphology (e.g., Kiparsky 1982a, 1982b). With respect to the selectional restrictions on the occurrence of non-inherited material in an RL, Matras (2002: 193) speaks of 'compartmentalized grammar', based on the observation that in some languages (contextually, Romani) "different sets of grammatical markers are employed with different parts of the vocabulary" (see also Elšík and Matras 2006: 324–333; Friedman 2013; Matras 2015: 66–75). We shall illustrate etymon-based 'morphological compartmentalization' (Matras 2015: 66–75) with data from Romani. Here, there exist distinct inflectional classes which occur either with native vocabulary or with borrowed vocabulary (see Adamou 2012; Bakker 1997; Boretzky 1989; Boretzky 1994; Boretzky and Igla 1991; Boretzky and Igla 1999; Elšík 2000; Elšík and Matras 2006; Friedman 2013; Igla 1996; Matras 2002). In (8), the present paradigm of the native Indo-Aryan verb *astaráv* 'hold' is compared with that of the Turkish-borrowed verb *beklérim* 'wait'. While *astaráv* inflects according to native Indo-Aryan morphology, *beklérim* is morphologically identical to the Turkish original (data from Igla 1996: 61). Crucially, the Turkish inflections occur exclusively with lexemes borrowed from Turkish.

(8) Ajia Varvara Romani (Igla 1996: 61)

		Romani:	Romani:
Present	Turkish	Turkish morphology	Indo-Aryan morphology
1sg	*bekle-r-im*	*beklé-rim*	*astar-áv*
2sg	*bekle-r-sin*	*beklé-rsin*	*astar-és*

3sg	*bekle-r*	*beklé-r*	*astar-él*
1pl	*bekle-r-iz*	*beklé-ris*	*astar-ás*
2pl	*bekle-r-siniz*	*beklé-rsinis*	*astar-én*
3pl	*bekle-r-lar*	*bekle-rlár*	*astar-én*
	'wait'	'wait'	'hold'

In the same language, we find a less strict instantiation of compartmentalization. Ajia Varvara Romani has borrowed the participle *-(i)mé* from the Greek passive participle *-ménos*. The formative *-(i)mé* does not occur on inherited Indo-Aryan verbs; however, despite its Greek origin, it applies not only to the Greek lexical stratum but also to other European loans. The following examples of loanwords from Greek (9a), Romanian (9b), Slavic (9c) and Turkish (9d) (Igla 1996: 73) illustrate this point nicely.

(9) Ajia Varvara Romani

a.	*xolamé*	*xolá(v)ol*
	'angered'	'to get angry'
b.	*logodimé*	*logodisá(v)ol*
	'engaged'	'to affiance'
c.	*ožonimé*	*ožonisá(v)ol*
	'married'	'to marry'
d.	*sastimé*	*sastú*
	'wondered'	'he wondered (3.SG.PST)'

Of course, one could argue that the Romani data just mirror the geo-political circumstances and the several historical stages in which lexical borrowing occurred, but the fact that the borrowed formatives have not been extended to the inherited Indo-Aryan lexicon seems to point to the speakers' reactivity to the existence in their lexicon of different etymological strata, in the sense of networks of cognates, and of different morphological systems which come to co-exist under one roof. The data presented in this section confirm the view of a unified lexicon with parallel access emerging from the experimental evidence.

5 Conclusion

In this paper, we have explored the connections between related, albeit not necessarily converging research fields, such as psycholinguistics and historical linguistics, by focusing on the role of morphological factors in influencing both

human processing and mental representation of cognates. We have presented two masked priming experiments conducted on Greek native speakers who had French as L2, in which we tested two variables (Morphological Family Size and etymology) related to the cognate 'advantage' in processing and production. We found (a) evidence in favor of language co-activation, whereby words from the two lexica interact, irrespective of the language they belong to; (b) the strength of morphological connections is greater among etymologically L1 words than among etymologically L2 words; (c) it is 'impossible to deactivate' the L2, not only with processing targets belonging etymologically to the L2, but also with processing targets belonging to L1. The results of the experiment square well with data from loanword integration and coexisting morphological systems. The morphological integration of loan words into a matrix language confirms that the link between the L2 vocabulary and a morphological level of organization is tenuous and that there is an asymmetry between L1 words and L2 words. Other set of data on compartmentalized morphological systems in one and the same language supports evidence for a view of bilingual lexical representation as a unified lexicon with parallel access.

References

Adamou, Evangelia. 2012. Verb morphologies in contact: Evidence from the Balkan area. In Martine Vanhove, Thomas Stolz, Aina Urdze & Hitomi Otsuka (eds.), *Morphologies in contact*, 143–162. Berlin: Akademie Verlag.

Allen, David, Kathy Conklin & Walter J.B. van Heuven. 2015. Making sense of the Sense Model: Translation priming with Japanese-English bilinguals. *The Mental Lexicon* 10. 32–55.

Altenberg Evelyn P. & Helen Smith Cairns. 1984. The effects of phonotactic constraints on lexical processing in bilingual and monolingual subjects. *Journal of Verbal Learning and Verbal Behavior* 22. 174–188.

Anastassiadis-Symeonidis, Anna. 1994. *Neological borrowing in Modern Greek. Direct loans from French and Anglo-American: A morpho-phonological analysis*. Thessaloniki: Aristotle University. [*Νεολογικός δανεισμός της νεοελληνικής. Άμεσα δάνεια από τη γαλλική και αγγλοαμερικανική. Μορφοφωνολογική ανάλυση*.]

Anastassiadis-Symeonidis, Anna. 2002/2008. Reverse Modern Greek Dictionnary. Aristotle University of Thessaloniki: Manolis Triantafyllidis Institute. [*Αντίστροφο λεξικό της Νέας Ελληνικής*. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης : Ινστιτούτο Νεοελληνικών Σπουδών Ίδρυμα Μανόλη Τριανταφυλλίδη].
http://www.greek-language.gr/greekLang/modern_greek/tools/lexica/reverse/index.html

Anastassiadis-Symeonidis, Anna. 2007. L'emprunt du grec moderne au français. In Jean Pruvost (éd.), *Les journées des dictionnaires 2007-Dictionnaires et mots voyageurs-Les 40 ans du Petit Robert de Paul Robert à Alain Rey*, 137–152. Paris: Éditions de Silves.

Baayen, R. Harald. 2014. Experimental and psycholinguistic approaches to studying derivation. In Rochelle Lieber & Pavol Štekauer (eds.), *The Oxford handbook of derivational morphology*, 95–117. Oxford University Press.

Bakker, Peter. 1997. Athematic morphology in Romani: The borrowing of a borrowing pattern. In Yaron Matras, Peter Bakker & Hristo Kyuchukov (eds.), *The typology and dialectology of Romani* (Current Issues in Linguistic Theory 156), 1–21. Amsterdam & Philadelphia: John Benjamins.

Basnight-Brown, Dana M. & Jeanette Altarriba. 2007. Differences in semantic and translation priming across languages: the role of language direction and language dominance. *Memory and Cognition* 355. 953–65.

Boretzky, Norbert & Birgit Igla. 1991. *Morphologische Entlehnung in den Romani-Dialekten*. Essen: Universität GH Essen: Universität GH Essen.

Boretzky, Norbert & Birgit Igla. 1999. Balkanische (südosteuropäische) Einflüsse im Romani. In Uwe Hinrichs (ed.), *Handbuch der Südosteuropa-Linguistik*, 709–731. Wiesbaden: Harrassowitz.

Boretzky, Norbert. 1989. Zum Interferenzverhalten des Romani. *Zeitschrift für Phonetik, Sprachwissenschaft und Kommunikationsforschung* 42 (3). 357–374.

Boretzky, Norbert. 1994. *Romani*: *Grammatik des Kalderaš-Dialekts mit Texten und Glossar* (Balkanologische Veröffentlichungen 24). Wiesbaden: Harrassowitz.

Bowers, Jeffery S., Zohra Mimouni & Martin Arguin. 2000. Orthography plays a critical role in cognate priming: Evidence from French/English and Arabic/French cognates. *Memory & Cognition* 28. 1289–1296.

Brysbaert, Maarc & Wouter Duyck. 2010. Is it time to leave behind the Revised Hierarchical Model of bilingual language processing after fifteen years of service? *Bilingualism: Language & Cognition* 133. 359–371.

Bybee, Joan L. 1985. *Morphology: A study of the relation between meaning and form*. Amsterdam: John Benjamins.

Bybee, Joan L. 1988. Morphology as lexical organisation. In Michael Hammond & Michael Noonan (eds.), *Theoretical morphology. Approaches to modern linguistics*, 119–142. San Diego: Academic Press.

Bybee, Joan L. 1995a. Regular morphology and the lexicon. *Language and Cognitive Processes* 10 (5). 425–455.

Bybee, Joan L. 1995b. Diachronic and typological properties of morphology and their implications for representation. In Laurie B. Feldman (ed.), *Morphological aspects of language processing*, 225–246. Hillsdale NJ: Lawrence Erlbaum Associates Inc.

Bybee, Joan L. 2006. From usage to grammar: The mind's response to repetition. *Language* 82 (4). 711–733.

Bybee, Joan L. 2007. *Frequency of use and the organization of language*. Oxford & New York: Oxford University Press.

Bybee, Joan L. 2010. *Language, usage and cognition*. Cambridge & New York: Cambridge University Press.

Calabrese, Andrea & Leo W. Wetzels (eds.). 2009. *Loan phonology* (Current Issues in Linguistic Theory 307). Amsterdam & Philadelphia: John Benjamins.

Chen, Baoguo, Huixia Zhou, Yiwen Gao & Susan Dunlap. 2014. Cross-language translation priming asymmetry: A test of the Sense model. *Journal of Psycholinguistic Research* 433. 225–40.

Clahsen, Harald, Claudia Felsen, Kathleen Neubauer, Mikako Sato & Renita Silva. 2010. Morphological structure in native and non-native language processing. *Language Learning* 60. 21–43.

Costa, Albert, Alfonso Caramazza & Nuria Sebastian-Galles. 2000. The cognate facilitation effect: implications for models of lexical access. *Journal of Experimental Psychology: Learning Memory and Cognition* 26. 1283–1296

Crepaldi, Davide, Kathleen Rastle, Max Coltheart & Lindsey Nickels. 2010. Fell primes fall but does bell prime ball? Masked priming with irregularly-inflected primes. *Journal of Memory and Language* 631. 83–99.

Dal Maso, Serena & Hélène Giraudo. 2014. Masked morphological priming in Italian L2: Evidence from masked priming. *Linguisticae Investigationes* 37 (2). 322–337.

Davis, Stuart, Natsuko Tsujimura & Jung-yueh Tu. 2012. Toward a taxonomy of loanword prosody. *Catalan Journal of Linguistics* 11. 13–39.

de Groot, Annette M. B. & Jerard L. J. Nas. 1991. Lexical representation of cognates and noncognates in compound bilinguals. *Journal of Memory and Language* 30. 90–123.

de Groot, Annette M. B., Susanne Borgwaldt, Mieke Bos & Ellen van den Eijnden. 2002. Lexical decision and word naming in bilinguals: Language effects and task effects. *Journal of Memory and Language* 47. 91–124.

de Groot, Annette M. B., Philip Delmaar & Stephen Lupker. 2000. The processing of interlexical homographs in translation recognition and lexical decision: Support for nonselective access to bilingual memory. *Quarterly Journal of Experimental Psychology* 53A. 397–428.

de Jong, Nivja H., Robert Schreuder & R. Harald Baayen. 2000. The morphological size effect and morphology. *Language and Cognitive Processes* 15. 329–365.

de Jong, Nivja H., Robert Schreuder & R. Harald Baayen. 2003. Morphological resonance in the mental lexicon. In R.H. Baayen and R. Schreuder (eds.), *Morphological structure in Language processing*, 65–88. Berlin: Mouton de Gruyter.

Dijkstra, Ton, Jonathan Grainger & Walter J. B. van Heuven. 1999. Recognition of cognates and interlingual homographs: The neglected role of phonology. *Journal of Memory and Language* 41. 496–518.

Dijkstra, Ton, Fermín Moscoso del Prado Martín, Béryl Schulpen, Robert Schreuder & R. Harald Baayen. 2005. A roommate in cream: Morphological family size effects on interlingual homograph recognition. *Language and Cognitive Processes* 20. 7–41.

Dijkstra, Ton & Walter J.B. van Heuven. 2002. The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism: Language and Cognition* 5. 175–197.

Dijkstra, Ton, Henk Van Jaarsveld & Sjoerd Ten Brinke. 1998. Interlingual homograph recognition: Effects of task demands and language intermixing. *Bilingualism: Language and Cognition* 1. 51–66.

Dimitropoulou, Maria, Jon Andoni Duñabeitia & Manuel Carreiras. 2011a. Masked translation priming effects with low proficient bilinguals. *Memory & Cognition* 392. 260–275.

Dimitropoulou, Maria, Jon Andoni Duñabeitia & Manuel Carreiras. 2011b. Two words, one meaning: evidence for automatic co-activation of translation equivalents. *Frontiers in Psychology* 2. doi:10.3389/fpsyg.2011.00188.

Dufour, Robert & Judith F. Kroll. 1995. Matching words to concepts in two languages: A test of the concept mediation model of bilingual representations. *Memory and Cognition* 23. 166–180.

Duñabeitia, Jon Andoni, Maria Dimitropoulou, Joanna Morris & Kevin Diependaele. 2013. The role of form in morphological priming: Evidence from bilinguals. *Language and Cognitive Processes* 287. 967–987.

Duyck, Wouter & Nele Warlop. 2009. Translation priming between the native language and a second language: new evidence from Dutch-french bilinguals. *Experimental Psychology* 563. 173–9.

Elšík, Viktor & Yaron Matras. 2006. *Markedness and language change*: *The Romani sample* (Empirical Approaches to Language Typology 32). Berlin: Mouton de Gruyter.

Elšík, Viktor. 2000. Romani nominal paradigms: Their structure, diversity, and development. In Viktor Elšík & Yaron Matras (eds.), *Grammatical relations in Romani: The noun phrase* (Current Issues in Linguistic Theory 211), 9–30. Amsterdam & Philadelphia: John Benjamins.

Esposito, Alena G., Lynne Baker-Ward & Shane Mueller. 2013. Interference suppression vs. response inhibition: An explanation for the absence of a bilingual advantage in preschoolers' stroop task performance. *Cognitive Development* 28 (4). 354–363.

ESRC Centre for Research on Bilingualism in Theory and Practice. 2011. The Siarad corpus. http://siarad.org.uk/speakers.php?c=siarad.

Finkbeiner, Matthew, Kenneth Forster, Janet Nicol & Kumiko Nakamura. 2004. The role of polysemy in masked semantic and translation priming. *Journal of Memory and Language* 511. 1–22.

Forster, Kenneth I. & Jonathan C. Forster. 2003. DMDX: A Windows display program with millisecond accuracy. *Behavioral Research Methods: Instruments & Computers* 35. 116–124.

Forster, Kenneth I., Kathleen Mohan & Jo Hector. 2003. The mechanics of masked priming. In S. Kinoshita & S. J. Lupker (eds.), *Masked priming: State of the art*, 3–37. Hove: Psychology Press.

Forster, Kenneth I. 1999. The microgenesis of priming effects in lexical access. *Brain and Language* 68. 5–15.

Friedman, Victor A. 2013. Compartmentalized grammar: The variable (non)-integration of Turkish verbal conjugation in Romani dialects. *Romani Studies* 23 (1). 107–120.

Frost, Ram, Kenneth I. Forster & Avital Deutsch. 1997. What can we learn from the morphology of Hebrew? A masked priming investigation of morphological representation. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23. 829–856.

Gardani, Francesco. 2008. *Borrowing of inflectional morphemes in language contact*. Frankfurt am Main: Peter Lang.

Gardani, Francesco. 2012. Plural across inflection and derivation, fusion and agglutination. In Lars Johanson & Martine I. Robbeets (eds.), *Copies versus cognates in bound morphology*, 71–97. Leiden & Boston: Brill.

Gardani, Francesco. 2013. *Dynamics of morphological productivity*: *The evolution of noun classes from Latin to Italian* (Empirical Approaches to Linguistic Theory 4). Leiden & Boston: Brill.

Gardani, Francesco. 2018. On morphological borrowing. *Language and Linguistics Compass* 12(10). 1–17.

Gerard, Linda D. & Don L. Scarborough. 1989. Language-specific lexical access of homographs by bilinguals. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 15 (2). 305–315.

Giraudo, Hélène & Serena Dal Maso. 2016. The salience of complex words and their parts: Which comes first? *Frontiers in Psychology* 7. 1778.

Giraudo, Hélène & Jonathan Grainger. 2000. Effects of prime word frequency and cumulative root frequency in masked morphological priming. *Language and Cognitive Processes* 15. 421–444.

Giraudo, Hélène & Jonathan Grainger. 2001. Priming complex words: Evidence for supralexical representation of morphology. *Psychonomic Bulletin and Review* 81. 127–131.

Gollan, Tamar, Kenneth I. Forster & Ram Frost. 1997. Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew-English bilinguals. *Journal of Experimental Psychology: Learning Memory and Cognition* 23. 1122–1139.

Grainger, Jonathan & Cheryl Frenck-Mestre 1998. Masked priming by translation equivalents in proficient bilinguals. *Language and Cognitive Processes* 13 (6). 601–623.

Grant, Anthony. 2008. Contact-induced change and the openness of 'closed' morphological systems: Some cases from Native America. *Journal of Language Contact* 2 (1). 165–186.

Hoshino, Noriko & Judith F. Kroll. 2008. Cognate effects in picture naming: Does cross-language activation survive a change of script? *Cognition* 106(1). 501–511.

Igla, Birgit. 1996. *Das Romani von Ajia Varvara: Deskriptive und historisch-vergleichende Darstellung eines Zigeunerdialekts*. Wiesbaden: Harrassowitz.

Inkelas, Sharon & Cheryl Zoll. 2007. Is grammar dependence real? A comparison between cophonological and indexed constraint approaches to morphologically conditioned phonology. *Linguistics* 45 (1). 133–171.

Itô, Junko & Armin Mester. 1999. The phonological lexicon. In Natsuko Tsujimura (ed.), *The handbook of Japanese linguistics*, 62–100. Malden, Mass: Blackwell.

Jared, Debra & Judith F. Kroll. 2001. Do bilinguals activate phonological representations in one or both of their languages when naming words? *Journal of Memory and Language* 44. 2–31.

Jastrow, Otto. 1985. *Laut- und Formenlehre des neuaramäischen Dialekts von Mīdin im Tūr ʿAbdīn*, 3rd edn. Wiesbaden: Harrassowitz.

Jiang, Nan & Kenneth I. Forster. 2001. Cross-language priming asymmetries in lexical decision and episodic recognition. *Journal of Memory and Language* 44. 32–51.

Jiang, Nan 1999. Testing processing explanations for the asymmetry in masked cross-language priming. *Bilingualism: Language and Cognition* 21. 59–75.

Kang, Yoonjung. 2010. Tutorial overview: Suprasegmental adaptation in loanwords. *Lingua* 120 (9). 2295–2310.

Keatley, Catharine W., John A. Spinks & Beatrice de Gelder. 1994. Asymmetrical cross-language priming effects. *Memory & Cognition* 22 (1). 70–84.

Kinoshita, Sachiko & Stephen Lupker. 2003. *Masked priming: the state of the art*. New York & Hove: Psychology Press.

Kiparsky, Paul. 1982a. From cyclic phonology to lexical phonology. In Harry van der Hulst & Norval Smith (eds.), *The structure of phonological representations*, 131–175. Dordrecht: Foris.

Kiparsky, Paul. 1982b. Lexical morphology and phonology. In The Linguistic Society of Korea (ed.), *Linguistics in the morning calm*: *Selected papers from SICOL-1981*, 3–91. Seoul: Hanshin.

Kirsner, Kim 1986. Lexical representation: Is a bilingual account necessary? In Jyotsna Vaid (ed.), *Language processing in bilinguals: Psycholinguistic and neuropsychological perspectives*, 21–46. Hillsdale NJ: Erlbaum.

Kirsner, Kim, Erin Lalor & Kathryn Hird. 1993. The bilingual lexicon: Exercise meaning and morphology. In Robert Schreuder & B. Weltens (eds.), *The bilingual lexicon*, 215–248. Amsterdam: John Benjamins.

Kossmann, Maarten. 2008. On the nature of borrowing in Cypriot Arabic. *Zeitschrift für arabische Linguistik* 49. 5–24.

Kossmann, Maarten. 2010. Parallel System Borrowing: Parallel morphological systems due to the borrowing of paradigms. *Diachronica* 27 (3). 459–487.
Kroll, Judith F. & Erika Stewart. 1994. Category interference in translation and picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language* 33. 149–174.
Kroll, Judith F., Janet G. van Hell, Natasha Tokowicz & David W. Green. 2010. The Revised Hierarchical Model: A critical review and assessment. *Bilingualism: Language & Cognition* 133. 373–381.
Kubozono, Haruo. 2006. Where does loanword prosody come from? A case study of Japanese loanword accent. *Lingua* 116 (7). 1140–1170.
Law, Danny. 2014. *Language contact, inherited similarity and social difference: The story of linguistic interaction in the Maya lowlands*. Amsterdam & Philadelphia: John Benjamins.
Mansfield, John. 2015. Loan phonology in Murrinhpatha. In Mark Harvey & Alexis Antonia (eds.), *The 45th Australian Linguistic Society Conference Proceedings – 2014*, 153–172: University of Newcastle.
Marian, Viorica, James Bartolotti, Sirada Rochanavibhata, Kailyn Bradley & Arturo E. Hernandez. 2017. Bilingual cortical control of between- and within-language competition. *Scientific Reports* 7 (1). 11763.
Marslen-Wilson, William D. 1987. Functional parallelism in spoken word-recognition. *Cognition* 25 (1–2). 71–102.
Matras, Yaron. 2002. *Romani: A linguistic introduction*. Cambridge: Cambridge University Press.
Matras, Yaron. 2015. Why is the borrowing of inflectional morphology dispreferred? In Francesco Gardani, Peter Arkadiev & Nino Amiridze (eds.), *Borrowed morphology* (Language Contact and Bilingualism 8), 47–80. Berlin, Boston & Munich: De Gruyter Mouton.
McClelland, James L. & David E. Rumelhart. 1981. An interactive activation model of context effects in letter perception: Part 1. An account of basic findings. *Psychological Review* 88. 375–407.
McClelland, James L. & David E. Rumelhart. 1988. *Computational models of cognition and perception. Explorations in parallel distributed processing: A handbook of models, programs, and exercises*. Cambridge, MA: The MIT Press.
Mifsud, Manwel. 1995. *Loan verbs in Maltese: A descriptive and comparative study*. Leiden: Brill.
Mithun, Marianne. 2013. Challenges and benefits of contact among relatives: Morphological copying. *Journal of Language Contact* 6 (2). 243–270.
Modern Greek Dictionary. 2003. Aristotle University of Thessaloniki: Manolis Triantafyllidis Foundation.
Mufwene, Salikoko S. 2001. *The ecology of language evolution* (Cambridge Approaches to Language Contact). Cambridge & New York: Cambridge University Press.
Mufwene, Salikoko S. 2008. *Language evolution*: *Contact, competition and change*. London: Continuum.
Mulder, Kimberley, Ton Dijkstra & R. Harald Baayen. 2015. Cross-language activation of morphological relatives in cognates: The role of orthographic overlap and task-related processing. *Frontiers in Human Neuroscience* 9 (16).
Mulder, Kimberley, Ton Dijkstra, Robert Schreuder & R. Harald Baayen. 2014. Effects of primary and secondary morphological family size in monolingual and bilingual word processing. *Journal of Memory and Language* 72. 59–84.
Muysken, Pieter. 2012. Root/affix asymmetries in contact and transfer: Case studies from the Andes. *International Journal of Bilingualism* 16 (1). 22–36.

Myers-Scotton, Carol. 2013. Paying attention to morpheme types: Making borrowability more precise. In Carol de Féral (ed.), *In and out of Africa. Languages in question. In honour of Robert* Nicolaï. *Volume 1: Language contact and epistemological issues* (Bibliothèque des Cahiers de l'Institut de Linguistique de Louvain (BCILL) 130), 31–42. Leuven: Peeters.

New, Boris, Christophe Pallier, Ludovic Ferrand & Rafael Matos. 2001. Une base de données lexicales du français contemporain sur Internet: Lexique. *L'Année Psychologique* 101. 447–462.

Norris, Dennis & Sachiko Kinoshita. 2008. Perception as evidence accumulation and Bayesian inference: Insights from masked priming. *Journal of Experimental Psychology: General* 1373. 434–455.

Peeters, David, Ton Dijkstra & Jonathan Grainger. 2013. The representation and processing of identical cognates by late bilinguals: RT and ERP effects. *Journal of Memory and Language* 68. 315–332.

Pickering, Martin J. & Simon Garrod. 2013. An integrated theory of language production and comprehension. *Behavioral and Brain Sciences* 36 (4). 329–347.

Pintzuk, Susan. 1996. Old English verb-complement word order and the change from OV to VO. *York Papers in Linguistics* 17. 241–264.

Rastle, Kathleen & Matthew H. Davis. 2008. Morphological decomposition based on the analysis of orthography. *Language and Cognitive Processes* 23. 942–971.

Robbeets, Martine. 2015. *Diachrony of verb morphology*: *Japanese and the Transeurasian Languages* (Trends in Linguistics. Studies and Monographs 291). Berlin & Boston: De Gruyter Mouton.

Sánchez-Casas, Rosa & José E. García-Albea. 2005. The representation of cognate and noncognate words on bilingual memory: Can cognate status be characterized as a special kind of morphological relation? In Judith F. Kroll & Annette M. B. De Groot (eds.), *Handbook of Bilingualism: Psycholinguistic Approaches*, 226–250. New York: Oxford University Press.

Sanchez-Casas, Rosa, José E. García-Albea & Christopher W. Davis. 1992. Bilingual lexical processing: Exploring the cognate/non cognate distinction. *European Journal of Cognitive psychology* 4. 293–310.

Scarborough, Don L., Linda Gerard & Charles Cortese. 1984. Independence of lexical access in bilingual word recognition. *Journal of Verbal Learning and Verbal Behavior* 23. 84–99.

Schoonbaert, Sofie, Wouter Duyck, Marc Brysbaert & Robert J. Hartsuiker. (2009). Semantic and translation priming from a first language to a second and back: Making sense of the findings, *Memory and Cognition* 37(5). 569–586.

Schreuder, Robert & R. Harald Baayen. 1997. How complex simplex words can be. *Journal of Memory and Language* 37. 118–139.

Schwartz, Ana I. & Judith F. Kroll. 2006. Bilingual lexical activation in sentence context. *Journal of Memory and Language* 55(2). 197–212.

Schwartz, Ana I., Judith F. Kroll & Michele Diaz. 2007. Reading words in Spanish and English: Mapping orthography to phonology in two languages. *Language and Cognitive Processes* 22. 106–129.

Sheng, Li, Boji Pak Wing Lam, Diana Cruz & Aislynn Fulton. 2016. A robust demonstration of the cognate facilitation effect in first-language and second-language naming. *Journal of Experimental Child Psychology* 141. 229–238.

Silbert, Lauren J., Christopher J. Honey, Erez Simony, David Poeppel & Url Hasson. 2014. Couple Neural Systems Underlie the Production and Comprehension of Naturalistic

Narrative Speech. *Proceedings of the National Academy of Sciences of the United States of America*, 111 (43). E4687–E4696.
Silva, Renita & Harald Clahsen. 2008. Morphologically complex words in L1 and L2 processing: Evidence from masked priming experiments in English. *Bilingualism: Language and Cognition* 11. 245–260.
Tsitsipis, Lukas D. 1998. *A linguistic anthropology of praxis and language shift*: *Arvanítika (Albanian) and Greek in contact* (Oxford Studies in Language Contact). Oxford & New York: Clarendon Press (Oxford University Press).
Urioste, Jorge L. 1964. *Transcripciones quechuas I–VII*. La Paz: Instituto de Cultura Indígena.
van Hell, Janet G. & Annette M. B. De Groot. 1998. Conceptual representation in bilingual memory: Effects of cognateness and cognate status in word association. *Bilingualism: Language and Cognition* 1. 193–211.
van Hell, Janet G. & Ton Dijkstra. 2002. Foreign language knowledge can influence native language performance in exclusively native contexts. *Psychonomic Bulletin & Review* 9. 780–789.
Van Hell, Janet & Darren Tanner 2012. Second Language Proficiency and Cross-Language Lexical Activation. *Language Learning* 62. 148–171.
van Heuven, Walter J. B., Ton Dijkstra & Jonathan Grainger 1998. Orthographic neighbourhood effects in bilingual word recognition. *Journal of Memory and Language* 39. 458–483.
van Heuven, Walter J. B., Herbert Schriefers, Ton Dijkstra & Peter Hagoort. 2008. Language conflict in the bilingual brain. *Cerebral Cortex* 18. 2706–2716.
Voga, Madeleine & Anna Anastassiadis-Symeonidis. 2018. Connecting lexica in bilingual cross-script morphological processing: Base and series effects in language co-activation. *Lexique* 23. 160–184.
Voga, Madeleine, Anna Anastassiadis-Symeonidis & Hélène Giraudo. 2014. Does morphology play a role in L2 processing? Two masked priming experiments with Greek speakers of ESL. *Lingvisticæ Investigationes* 37 (2). 338–352.
Voga, Madeleine & Hélène Giraudo. 2017. Word and beyond-word issues in morphological processing. *Word Structure*, 10 (2). 235–254.
Voga, Madeleine & Jonathan Grainger. 2007. Cognate status and cross-script translation priming. *Memory and Cognition* 35. 938–952.
Voga, Madeleine. 2014. Διαγλωσσική ομοτυπία και μεταφραστική προτεραιοποίηση: ο ρόλος του ορθογραφικού δείκτη και της ετυμολογίας μέσα από δύο ελληνο-γαλλικά πειράματα [Cognateness and masked priming: the role of the orthographic cue and etymology through two Greek-French experiments]. *Studies in Greek Linguistics* 34. 104–125.
Voga, Madeleine. 2017. Μορφή, μορφολογική δομή και αναπαράσταση στο δίγλωσσο νοητικό λεξικό: Μεταφραστική προτεραιοποίηση με ελληνογαλλικά μεταφραστικά αντίστοιχα [Form, morphological structure and representation in the bilingual mental lexicon: Masked priming with Greek-French cognates and non-cognates]. *Studies in Greek Linguistics* 37. 129–152.
Voga, Madeleine. in press. Lexical co-activation with prefixed cognates and non-cognates: evidence from cross-script masked priming. In Marcel Schlechtweg (ed.), *The learnability of complex constructions from a cross-linguistic perspective*. Trends in Linguistics: Studies and Monographs. Berlin: Mouton De Gruyter.
Whaley, Lindsay. 2012. Deriving insights about Tungusic classification from derivational morphology. In Lars Johanson & Martine I. Robbeets (eds.), *Copies versus cognates in bound morphology*, 395–409. Leiden & Boston: Brill.

Abbreviations

DET	determiner
F	feminine
GEN	genitive
PL	plural
PST	past/preterit
RL	recipient language
SG	singular
SL	source language

Appendices

Appendix 1a: Results and statistical analysis for the L1 to L2 priming direction

Table 2 (exp. 1a): Reaction Times (RTs, in milliseconds) and percentages of errors for lexical decisions in the twelve experimental conditions, translation (T), morphological (M) and unrelated (Unr.) for the four types of target in the L1 to L2 priming direction. Net priming effects are assessed relative to the unrelated condition. The asterisk means that the effect is statistically significant.

Words	Translation (T)		Morphological (M)		Unlreated (Unr)		Net priming effect	
	RT	Error	RT	Error	RT	Error	Unr – T	Unr – M
Cognates of Greek etym. MFS+	632	2,67	646	1,78	682	1,48	50*	36*
Cognates of Greek etym. MFS–	643	3,57	679	2,67	712	2,97	69*	33*
Cognates of French etym. MFS+	664	3,27	678	6,54	715	5,05	51*	37*
Cognates of French etym. MFS–	645	2,67	673	3,86	683	4,16	38*	10

Main factors: the effect of prime condition is significant, $F1(2, 82) = 37.41$, $p<.0001$, $F2(2, 178) = 25.73$, $p<.0001$; the main effect of *etymology* is significant in the analysis by subjects, $F1(1, 41) = 5.95$, $p<.05$, $F2<1$. The MFS factor is not significant (both $Fs<1$), but the interaction between etymology and MFS is significant, $F1(1, 41) = 17.36$, $p<.001$, $F2(1, 89) = 4.64$, $p<.05$.

Planned comparisons were conducted in order to assess the statistical significance of the differences in RTs related to our hypotheses: the differences between the unrelated and the translation conditions (facilitation due to the cognate prime) are significant for all the types of cognates: for cognates of Greek etymology MFS+ (50 ms of effect), $F1(1, 41) = 23.61$, $p<.001$, $F2(1, 23) = 12.81$, $p<.001$; for cognates of Greek etymology MFS– (69 ms of effect), $F1(1, 41) = 43.88$, $p<.001$, $F2(1, 23) = 15.18$, $p<.001$; for cognates of French etymology MFS+ (51 ms), $F1(1, 41) = 15.56$, $p<.001$, $F2(1, 21) = 15.64$, $p<.001$, and, finally, for etymologically MFS– French cognates (38 ms), $F1(1, 41) = 16.8$, $p<.001$, $F2(1, 23) = 6.91$, $p<.05$.

The differences between the unrelated and the morphological conditions (facilitation induced by the Greek derivation on the French target) were statistically significant for the three first types of cognates, for etymologically Greek MFS+ cognates (36 ms), $F1(1, 41) = 6.71$, $p<.05$, $F2(1, 23) = 6.29$, $p<.05$; for etymologically Greek MFS– cognates (33 ms), $F1(1, 41) = 5.43$, $p<.05$ $F2(1, 21) = 8.20$, $p<.01$; for etymologically French MFS+ cognates (37 ms) the difference was significant for subjects $F1(1, 41) = 10.37$, $p<.01$, and marginally significant for items $F2(1, 22)$ 3.53,$p<.06$. For etymologically French MFS– cognates the morphological effect (10 ms) was not significant, $F1(1, 41) = 1.24$, $F2<1$.

The difference between translation and morphological conditions was not significant for MFS+ cognates, neither for those of Greek etymology, $F1(1, 41) = 1.79$, $F2(1, 23) = 1.30$, nor for those of French etymology (both $Fs<1$), but it was for MFS– cognates, of Greek etymology, $F1(1, 41) = 10.96$, $p<.01$, $F2(1, 22) = 7.06$, $p<.05$, as well as of French etymology, $F1(1, 41) = 8.54$, $p<.01$, $F2(1, 23) = 5.30$, $p<.05$.

Appendix 1b: Results and statistical analysis for the L2 to L1 priming direction

Table 3 (exp. 1b): Reaction Times (RTs, in milliseconds) and percentages of errors for lexical decisions in the 12 experimental conditions, translation (T), morphological (M) and unrelated (Unr.) for the four types of target, in the L2 to L1 direction. Net priming effects are accessed relative to the unrelated condition. The asterisk means that the effect is statistically significant.

Words	Translation (T)		Morphological (M)		Unrelated (Unr)		Net priming effect	
	RT	Error	RT	Error	RT	Error	Unr– T	Unr – M
Cognates of Greek etym. MFS+	587	0,005	601	0,005	615	0,01	28*	14

Table 3 (exp. 1b) (continued)

Words	Translation (T)		Morphological (M)		Unrelated (Unr)		Net priming effect	
	RT	Error	RT	Error	RT	Error	Unr– T	Unr – M
Cognates of Greek etym. MFS–	607	0,01	630	0,01	633	0,01	26*	3
Cognates of French etym. MFS+	617	0,005	612	0,01	635	0,002	18*	23*
Cognates of French etym. MFS–	609	0,002	630	0,008	635	0,03	26*	5

Main effects: the effect of prime condition is significant, $F1(2, 82) = 16.73$, $p<.001$, $F2(2, 178) = 18.34$, $p<.001$; the main effect of etymology is significant only in the analysis by subjects, $F1(1, 41) = 13.83$, $p<.0001$, $F2(1, 89) = 2.16$, as well as the effect of the MFS factor, significant only by subjects, $F1(2, 41) = 11.92$, $p<.001$, but close to significance in the analysis by items, $F2(1, 89) = 3.37$ [$\alpha<.05$, $F(1, 89) \leq 3.94$]. The interaction between etymology and MFS is significant by subjects, $F1(1, 41) = 11.99$, $p<.001$, $F2<1$.

Planned comparisons: all types of cognates induce significant translation effects, etymologically Greek MFS+ cognates (28 ms), $F1(1, 41) = 13.83$, $p<.001$, $F2(1, 23) = 16.27$, $p<.001$; etymologically Greek MFS- cognates (26 ms), $F1(1, 41) = 9.45$, $p<.01$, $F2(1, 23) = 6.55$, $p<.05$; etymologically French MFS+ cognates (18 ms), $F1(1, 41) = 4.33$, $p<.05$, $F2(1, 21) = 5.38$, $p<.05$, as well as etymologically French MFS– cognates (26 ms), $F1(1, 41) = 11.33$, $p<.001$, $F2(1, 23) = 30.49$, $p<.001$.

The only significant difference (23 ms) between the morphological and the unrelated conditions is found for French MFS+ cognates, $F1(1, 41) = 5.63$, $p<.05$, $F2(1, 21) = 6.30$, $p<.05$. For the other types of cognates, the morphological conditions do not induce any facilitation, for Greek MFS+ cognates, $F1(1, 41) = 2.80$, $F2(1, 23) = 2.80$, for Greek as well as French MFS- cognates both $Fs<1$.

Translation prime conditions statistically differ from morphological ones, except for those of etymologically French MFS+ cognates (both $Fs<1$). For the other types of cognates, facilitation induced from translation primes differs from the morphological effect: for Greek MFS+ cognates (14 ms of difference), $F1(1, 41) = 5.02$, $p<.05$, $F2(1, 23) = 8.75$, $p<.01$; for Greek MFS– cognates (23 ms of difference), $F1(1, 41) = 5.29$, $p<.05$, $F2(1, 22) = 4.05$, $p<.06$; for French MFS– cognates (21 ms difference), $F1(1, 41) = 6.58$, $p<.05$, $F2(1, 23) = 6.99$, $p<.05$.