Competition in the bilingual lexicon and cross-language priming asymmetries: A morphological connection?

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Morphological processing and the variables influencing it have been studied through several experimental protocols, among which the masked priming technique has a special status. Although the technique is quite sensitive to orthographic factors (Forster, Mohan & Hector, 2003), which is normal in the extent that it examines visual processing, it has a great potential, with the adequate design, to explore the various kinds of relations between morphologically simple or complex lexical units (LU henceforth). Given that LU share several of their characteristics (orthographic, phonological, semantic, morphological) in both dimensions, syntagmatic and paradigmatic, a model of the bilingual lexicon has to take into account not only the processes but also the way in which these intertwining characteristics influence representation and processing.

Early studies on morphological processing with the masked priming technique, for ex. Grainger, Colé & Segui (1991) demonstrated that orthographic similarity of the prime inhibits lexical access of morphologically complex targets, despite (or because of) the absence of any morphological relation between them, e.g. the prime *mûrir* 'ripen' inhibits the target mural 'wall'. This inhibition reaches 27ms when LU share their initial letters and is accounted for in terms of "preactivation of lexical representations during the processing of the prime, which interferes with the processing of the target" (p. 380). The complex flow of activation/inhibition taking place in the lexicon during processing is central for Interactive Activation models (McClelland & Rumelhart, 1981) and the above observation has led to models such as the supra-lexical model of morphology (Giraudo & Grainger, 2001).

Other variables related to interference and competition have been documented in the literature, for instance Coltheart's N (Coltheart, Davelaar, Jonasson, & Besner, 1977), which refers to the number and relative frequency of neighbours, i.e., words differing by a single letter (e.g., banish and vanish). For a model such as the SOLAR model (Self-Organizing Lexical Acquisition and Recognition, Davis, 1999), lexical competition orientates the acquisition. As noticed by Bowers, Davis & Hanley (2005), it is important to have a psychologically accurate definition of what is a neighbour and considering as such only words of the same length that differ by one letter (Coltheart's N) is based on simplicity rather than perceptual similarity.

As far as monolingual morphological processing is concerned, the role and the influence of competition is illustrated in several experiments, for instance, Voga & Giraudo (2017) report evidence in favor of the variable called 'pseudo-family size' in French. This variable reflects the number of words that function as antagonists during processing, e.g. the prime *portons* 'we carry', will potentially activate (at least) all words that share its initial letters (i.e. the letters of the stem) at the lexical level. These 'pseudo-relatives' (e.g., *portail* 'portal', *porte* 'door', *port* 'harbour', *portier* 'porter', *portion* 'portion', *portique* 'porch', *portrait* 'portrait', *portière* 'door', *postons* 'we mail') interfere with the representation of the target, delaying thus its recognition. The above variable which is, in a certain way, the opposite of the MFS (Morphological family Size, de Jong, Schreuder & Baayen, 2000) highlights the fact the complex flow of activation and inhibition giving rise (or not) to morphological priming effects, does not exclusively depend on what happens inside the word (its morphemes), but also beyond the-word-to-be

identified, in its lexical environment, i.e., other LUs exhibiting different kinds of similarities with the word under study.

The aim of this presentation is to highlight the fact that lexical interference and competition (Hoffmann & Jacobs, 2014) also take place in the bilingual lexicon, influencing the pattern of morphological effects. To put it in terms of language co-activation, the lexicon is shown to be sensitive to the 'larger chain of morphological relations' (Mulder, Dijkstra, Schreuder & Baayen, 2014), and this influence may be positive (inducing facilitation effects) or negative (inducing inhibition effects and/or preventing the occurrence of positive effects).

Two sets of bilingual evidence will be presented, both using cross-language cross-script priming (in both directions, L1 to L2 and L2 to L1) with Greek - French bilinguals who had Greek as L1, had formal education on French and had lived at least 6 months in France. In the first experiment, four categories of materials were tested in a lexical decision task (108 words and 108 pseudowords), in which the duration of the prime (48ms SOA) prevented the participant from consciously perceiving the prime. These categories were the following:

a) 27 pairs of cognates such as κατακλυσμός /kataklysmós/ 'cataclysm' - *cataclysme* 'cataclysm', known to induce robust cross-language cross-script effects;

b) 27 prefixed non-cognate pairs such as συνέπεια /sinépia/ 'consequence' - *conséquence* 'consequence'. They had the same meaning as LUs but did not overlap on form, and their base wasn't a word in both languages. In this category of stimuli, the segmentation into morphemes was difficult, given that the 'base' of (at least) one member of the non-cognate pair does not mean anything, e.g. the segment -έπεια /épia/ in συνέπεια /sinépia/ 'consequence'. These words shared nevertheless a prefix with a common meaning, ex. συν- /syn/ - *con/com*, από- /apó/ - *ex*, υπό- /ypó/ - *sous/sup*;

c) 27 prefixed non-cognate pairs, sharing the same meaning at the level of the whole unit. These pairs had synonymic prefixes (as in b), as well as the same proportion of formal saliency of the prefix as in (b). In this category, the base corresponds to a word in both languages, ex. διάθεση /diáthesi/ 'disposition' – *disposition*, in which the base θέση /thesi/ 'position' is an existing LU. Morphological segmentation was thus possible here;

d) 27 non-cognate pairs without prefix, such as λογαριασμός /logariasmós/ 'bill' - *facture* 'bill'. This group corresponds to the classic category of non-cognates, tested in several studies (e.g., Dimitropoulou, Duñabetia & Carreiras, 2011).

The above stimuli were primed by three conditions of priming: translation in the other language (i.e., if the prime was in Greek the target was in French); morphological (mostly adjectives and adverbs) and the unrelated condition. They were tested in both directions of priming, L1 to L2 priming direction and the opposite. Results (RTs) for the L1-to-L2 direction, show that translation priming occurs for all three categories, excepted for non-cognate with word-base (c). This first result suggests that stimuli of category (c) triggered competition, probably related to the big morphological families they activate in the other language, e.g., θέση /thesi/ 'position' and θέτω /theto/ 'to posit' belong to very broad morphological families, not necessarily transparent. Moreover, the first two types of materials (a and b) induce translation (57 and 29ms respectively) and morphological effects (50 and 34ms) which are concomitant and of equivalent amplitude. In other words, no difference is found between cognates overlapping in form and non-cognates, which do not have similar form, but share a common morphological structure and a non-word base. This result is interpreted in the direction of shared prefix units (synonymic prefixes such as δια- /dia/ and *trans-*) which manage, despite the lack of any formal overlap, to activate each-other cross-linguistically, from the L1 to the L2 of the participant. This type of organisation corroborates Bybee's (1988; 2010) position following which the languages of the bilingual are organised morphologically,

in terms of morphological clusters. In such an organisation, there is no reason why not supposing connections between synonymic prefixes such as those considered here. Note however, that the positive influence of shared meaning (at the level of the prefix or of the whole LU) manages to emerge as long as there is no competition from other LUs, such as the one exerted on the stimuli of category (c) seen above. The results of the L2 to L1 direction of this first set of experiments, also show evidence in favour of competition. The statistical analysis shows significant inhibition (-23ms) for categories (c) and (d) taken as a group, versus cat. (a) and (b), which is clear evidence in favour of competition in the L2 to L1 direction of priming.

This last result is especially important because it relates to the well-documented and hotly debated, especially for cross-script bilinguals, asymmetry between the two priming directions, an asymmetry which is nevertheless not always found. While it is found in some studies (e.g., for Chinese-English: Jiang & Forster 2001; Chen, Zhou, Gao & Dunlap 2014; Allen, Conklin & van Heuven 2015, with Japanese-English cognates) it is not found in others (e.g., Duyck & Warlop, 2009, for Dutch-French non-cognates).

In some other studies (Voga, 2014), an asymmetry is found for one type of stimuli but not for the other. The second set of experiments compares (in the same experiment and with the same participants), two types of Greek - French cognates: etymologically French (Latin), e.g., ρόλος /rólos/ 'role' - *rôle* or κουζίνα /kuzína/ 'kitchen' - *cuisine*, and etymologically Greek ones, e.g., ιδέα /idea/ 'idea'- *idée*. The etym. French cognates, while they manage to prime in the L1 to L2 direction (34ms for cognate and 28ms for morphological priming), fail to induce any significant effect in the opposite direction. This pattern is quite different to that of etym. Greek cognates, which manage to induce robust translation and morphological priming in both directions (e.g. translation priming effect: 24ms in the L2 to L1 direction and 56ms in the 'easier' direction, i.e., L1 to L2). To sum up, the etymologically L2 cognates, contrary to their L1 counterparts, confirm the asymmetrical pattern between the two priming directions and behave similarly to non-cognates (Dimitropoulou et al., 2011, with Greek learners of Spanish).

The asymmetry-between-the-languages-of-the-bilingual issue is to be put in relation to competition between LU. Moreover, as the above data clearly show, competition between LUs contained in the 'unified lexico-semantic architecture' (Schoonbaert, Duyck, Brysbaert & Hartsuiker, 2009) that forms the bilingual lexicon, depends on several intertwining factors, springing from different parts of words: a) the influence of the base, e.g., the role of 'base-word lexicality' (Exp. 1); b) the influence of the morphological family of the base, e.g., the 'secondary morphological family size' (Mulder et al., 2014). This type of variable also relates to etymology, whose influence was demonstrated in Exp. 2; c) the influence of the prefix, both as a structural and perceptual unit (denoting morphological complexity, at least when it is salient) and as a meaning unit, given that prefixes' salience is related to the multiplicity of their different senses (Voga, Nikolaou & Anastassiadis-Symeonidis, 2018, for Greek L2 data). The prefix's semantic instruction can be obscured by various factors, e.g., by the application of metaphoric or metonymic semantic rules on the base-word before that of Word Construction Rules (Corbin, 1987/1991).

The above results and suggestions highlight the fact that morphological processing does not exclusively depend on what happens inside the word, but also beyond the-word-to-be identified, in its lexical and morphological environment. This environment corresponds to a dynamic network based on the 'larger chain of morphological relations', compatible with facts such as productivity, lexical interference and competition, as well as facts related to discrimination (Milin, Feldman, Ramscar, Hendrix & Baayen, 2017) and categorisation

(Bybee, 2010) processes. This lexical environment does not only exert positive influence but can also lead to inhibition. Visualising the complex sum of activation/inhibition in terms of a unique, purely bottom-up linear process whose function would consist of decomposing the word-to-be-identified into pieces independently of words' characteristics seems insufficient.

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