SYNTACTIC PRIMING IN GREEK AND ENGLISH: ON THE REPRESENTATION OF SYNTACTIC INFORMATION IN THE BILINGUAL MENTAL LEXICON

Angeliki Salamoura UNIVERSITY OF CAMBRIDGE

Περίληψη

Τα υπάρχοντα δίγλωσσα μοντέλα (νοητικής) αναπαράστασης και παραγωγής λόγου δεν λαμβάνουν υπόψιν το ρόλο των συντακτικών ιδιοτήτων των λέξεων, όπως η δομή ορισμάτων του ρήματος, όταν αφορούν στο βαθμό της αλληλεπίδρασης μεταξύ της μητρικής (Γ1) και της δεύτερης/ ξένης γλώσσας (Γ2) στο δίγλωσσο νοητικό λεξικό. Η μελέτη αυτή ασχολείται με την αναπαράσταση των συντακτικών ιδιοτήτων ρημάτων της Γ1 και Γ2 και την ενεργοποίηση τους κατά την παραγωγή λόγου στη Γ2. Πιο συγκεκριμένα, εξετάζει τα εξής ζητήματα: α) την από κοινού ή ανεξάρτητη αναπαράσταση αντίστοιχων ρηματικών δομών στη Γ1 και Γ2, και β) το ρόλο των θεματικών και συντακτικών πληροφοριών καθώς και της σειράς των όρων της πρότασης σε αυτές τις αναπαραστάσεις. Τα ζητήματα αυτά μελετήθηκαν σε δύο πειράματα όπου φυσικοί ομιλητές της ελληνικής με άριστη γνώση της αγγλικής συμπλήρωσαν προφορικά ημιτελείς προτάσεις και στις δύο γλώσσες. Συνολικά τα αποτελέσματα δείχνουν ότι δομές αντίστοιχες στη Γ1 και Γ2 αναπαριστώνται από κοινού. Στο πείραμα 1 υπήρξε συντακτικός παραλληλισμός (syntactic priming) από τη Γ1 στη Γ2 με προτάσεις που δεν διέφεραν στη συντακτική δομή και σειρά των θεματικών ρόλων. Το πείραμα 2 έδειξε στη συνέχεια ότι το φαινόμενο επηρεάζεται από τη σειρά των όρων της πρότασης. Με βάση αυτά τα δεδομένα προτείνεται ένα μοντέλο αναπαράστασης συντακτικών ιδιοτήτων ρημάτων στο δίγλωσσο νοητικό λεξικό.

Keywords

cross-linguistic syntactic priming, representation of syntactic information, bilingual mental lexicon

1. Introduction

Bilingual models[1] of representation and production have largely ignored the role of the syntactic information of words, such as the argument structure of verbs, in the extent of L1-L2 interaction in the bilingual mental lexicon. The aim of the present paper is to investigate cross-linguistic (from L1-to-L2) processing of syntactic structures that pertain to a particular class of words, i.e. ditransitive verbs, by advanced L2 learners. By doing so, we will attempt to answer two interrelated questions that are relevant to issues of modeling bilingual production: (i) Are syntactic representations of equivalent L1 and L2 structures shared or independent? (Experiment 1), (ii) What is the role of cross-linguistic variation of constituent order and the order of thematic roles in these representations? (Experiment 2).

2. Models of lexical processing: Representation of syntactic information

Specific proposals about the representation of syntactic information in models of lexical processing have been put forward in the monolingual literature. Roelofs (1993) proposed a model of lexical access for verbs that elaborated, among other things, on the nature of the

representation of syntactic information at the lemma or syntactic level. This level contains lemma nodes that correspond roughly to the bare (uninflected) form of a word (e.g., *give*) and syntactic feature nodes that encode the syntactic category (e.g., *Verb*) and other syntactic information such as tense, person, number and mood in the case of a verb lemma.

Pickering and Branigan (1998) extended Roelof's model by adding nodes that represent 'combinatorial' information of verbs. Combinatorial information "specifies the way in which a word can combine with other linguistic units to form possible expressions of the language. A verb (e.g., *eat*) can combine with arguments (e.g., *the men*, *the food*) that correspond to the participants in the action denoted by the verb" (: 634), i.e. its subcategorisation frame. In their model combinatorial nodes are shared among different verb lemmas that have the same combinatorial potential, thus avoiding representational redundancy. Moreover, whenever a verb is used in context, in addition to the corresponding lemma node, the appropriate combinatorial node is also activated. For example, the lemmas for ditransitive verbs that dativise are linked to two combinatorial nodes: one for the Prepositional Object construction [NP, PP] (henceforth PO) and another for the Double Object construction [NP, NP] (henceforth DO). When, for example, the verb *give* is used in the utterance *She gave a tip to the waiter* the (NP, PP) node is activated; when it is used in an utterance such as *She gave the waiter a tip* the [NP, PP] node is activated. This activation decays gradually after use.

Pickering and Branigan's model can be used to frame questions about the relationship between the representation of syntactic information in the bilingual lexicon. On the one hand, the combinatorial nodes of one language (L2) may map onto those of the other (L1) at least for languages that have the same combinatorial possibilities for a particular type of verb. On the other hand there may be separate representations of the combinatorial possibilities in each language, resulting in duplicate representations. A useful tool for testing these two possibilities is a cross-language version of the syntactic or structural priming paradigm that has been used successfully in monolingual research to explore syntactic representation and processing.

3. Syntactic priming

3.1 Syntactic priming in monolinguals

Syntactic priming is the tendency to reproduce the same syntactic form in a different semantic context. The effect was first obtained by Bock (1986) in a primed sentence production task. Participants first listened and repeated a prime sentence like: *The rock star sold some cocaine to an under cover agent* (PO) or *The rock star sold an undercover agent some cocaine* (DO) and afterwards they were presented with a picture showing a *man reading a story to a boy*. Bock found that participants were more likely to describe the event in the picture using a PO structure, e.g. *The man is reading a story to the boy*, when the previous auditory prime sentence had the same structure than when it had a DO structure. Likewise, DO descriptions were more likely to occur after a DO than a PO prime. The prime sentence and the target picture were neither semantically related nor did they form a coherent discourse.

Since its first occurrence, this syntactic or structural persistence has been replicated in a number of different languages, structures, tasks, and modalities. One line of research on structural persistence has provided evidence for a syntactic account of the effect, ruling out thematic roles, metrical, lexical and discourse level similarities between the prime and target as the locus of priming (e.g., Bock and Loebell, 1990; Bock, 1989; Pickering and Branigan, 1998). For instance, Bock and Loebell (1990) showed that locative sentences such as *The wealthy widow drove an old Mercedes to the church* primed PO sentences such as *The wealthy widow gave an old Mercedes to the church*, despite the difference in thematic roles between the two sentences (PO: Agent, Theme, Recipient/Beneficiary; Locative: Agent, Theme, Locative).

Further work has demonstrated the possibility of priming finer details of syntactic structure such as constituent order. For instance, Pickering Branigan and McLean (2002) provided evidence of priming of constituent order in the absence of a functional level explanation. In their task, different word order variants of the same structure did not prime each other (e.g. *The racing driver showed the torn overall to the helpful mechanic* vs. *The racing driver showed to the helpful mechanic the torn overall*).

Another line of research, however, has cast doubt on a purely syntactic source of the effect. Hare and Goldberg (1999) argued that the priming demonstrated in Bock and Loebell (1990) between PO and locative structures could also be accounted for by thematic role similarities. Under some linguistic accounts (e.g., Jackendoff, 1987) the thematic role of *recipient/beneficiary* in *The wealthy widow gave an old Mercedes to the church* and the thematic role of *locative* in *The wealthy widow drove an old Mercedes to the church* can both be subsumed under a broader thematic role, that of *goal*. Thus, instead of locatives, Hare and Goldberg used *provide-with* primes (e.g., *His editor credited Bob with the hot story*) which share syntactic structure with POs and thematic role assignment with DOs. They found that *provide-with* primes elicited significantly more DO than PO responses and almost as many DO responses as DO primes themselves, suggesting that thematic role information does influence syntactic priming.

To sum up, one line of evidence suggests that the effect reflects purely syntactic processes and representations. This view is challenged by another line of evidence that suggests that semantic, rather than syntactic, factors, such as thematic roles, mainly drive structural repetition effects. Since the precedence of syntactic or semantic information over the other in structural repetition during sentence production gives rise to different theoretical explanations regarding the source of priming and makes an important difference for both monolingual and bilingual models of language processing and representation, further evaluation of their contribution to the effect seems necessary.

3.2 Syntactic priming in bilinguals

In an experimental setting, three studies have employed cross-language syntactic priming thus far. Although there were overlaps among the type of structures, tasks and languages employed in these studies, their results are contradictory. Heydel & Murray (2000) used a picture description task with German primes and English targets. They found that along with passive primes, topicalisation structures (e.g., *Den Manager berat ein PR-Mann* = The manager-ACC

advises a PR-man-NOM) also primed the production of passive target responses. The effect was, thus, interpreted as arising from the conceptual similarities (the order of thematic roles) between primes (German topicalisations) and targets (English passives).

Two methodological issues should be noted here though. First, in Heydel and Murray's tasks participants had to decide whether the prime sentence was related to the event depicted in the target picture prior to target picture description. Critical primes and targets were always semantically unrelated; they nonetheless both entailed an event and two participants. Thus, the conceptual organization of the prime (i.e., the arrangement of thematic roles) might have become unusually potent by virtue of the requirements of the task. Second, Heydel and Murray elicited written target responses in their tasks. Braningan, Pickering Stewart et al. (2000), however, have noted that due to its specific nature, written production may induce more conceptual processing than oral production.

Harstuiker, Pickering and Veltkamp (2002) employed a dialogue task with Spanish primes and English targets but the same prime structures as Heydel and Murray: actives, passives and 'dislocated' actives (corresponding to Heydel and Murray's German topicalisations). Unlike Heydel and Murray though, they found that only passive primes produced priming relative to a baseline. The fact that 'dislocated' actives did not produce priming supports the view that the effect resulting from the 'topicalisations' in Heydel and Murray might be due to the procedure used, although such an explanation cannot account for the absence of priming from actives in the present study.

Loebell and Bock (submitted) used a picture description task that differed methodologically from Heydel and Murray's. They tested four types of primes - actives, passives, POs and DOs - with German-English bilinguals. They obtained a priming effect for DOs only. A possible explanation for the contradictory results obtained in this and the previous two studies regarding the priming of actives and passives might be the different tasks and methodology employed. Note, however, that the picture description task and the dialogue task, used by Loebell and Bock and Hartsuiker et al respectively, have also been employed in L1 studies (e.g.,Bock & Loebell, 1990; Branigan, Pickering, & Cleland, 2000) where robust syntactic priming effects have been reported with actives and passives.

For all the reasons mentioned above and the contradictory results, the data from these cross-language studies cannot be conclusive about the nature of cross-language syntactic priming or the conditions under which it takes place.

4. Experiment 1

Experiment 1 investigated whether representations of L1 and L2 syntactic structures are shared between pairs of languages in which these structures serve the same discourse function and have an equivalent surface syntax. Examples of such equivalent structures are the PO and DO constructions in English and Greek.

Using a cross-language oral sentence completion task with L1 (Greek) primes and L2 (English) targets, we tested two alternative hypotheses. The first one, which we will term the shared language hypothesis, claims that equivalent L1 and L2 syntactic structures share representations in the bilingual mental lexicon. The second hypothesis, which we will call the language-specific hypothesis, states that even equivalent L1 and L2 syntactic structures do not have shared representations. The shared language hypothesis predicts cross-language syntactic priming with these structures. If participants produce an L1 utterance with a PO structure, they will be more likely to produce a subsequent L2 utterance with a PO rather than a DO structure and vice versa. The language-specific hypothesis predicts no such priming.

4.1 Method

Subjects. 36 Greek-speaking advanced learners of English.

Materials. The critical material consisted of English and Greek sentence fragments whose main verb was a ditransitive (e.g., *give*, *στέλνω*). These fragments were incorporated into 32 sets of items as seen in Table 1.

Table 1. Examples of prime and target fragments in Experiment 1.

FRAGMENT	PRIME CONDITION	EXAMPLE	
PRIME	Same Verb-PO:	1a.	Ο πρόεδρος έδωσε το χρυσό μετάλλιο...
	Same Verb-DO:	1b.	Ο πρόεδρος έδωσε του νικητή...
	Translated Verb-PO:	1c.	Ο πρόεδρος πρόσφερε το χρυσό μετάλλιο...
	Translated Verb-DO:	1d.	Ο πρόεδρος πρόσφερε του νικητή...
TARGET		2.	The hotel receptionist gave…

The prime fragment (1a-d) was always in Greek (L1) and the target fragment (2) always in English (L2). There was always an intransitive English filler fragment between prime and target. Every target fragment contained a subject NP followed by a ditransitive verb and it could be completed by a PO or DO construction. The prime fragments included an additional postverbal NP and varied on two dimensions. First, by introducing this additional NP it was possible to manipulate the prime fragment completion so as to induce either a DO or PO construction. In (13a), for instance, the postverbal NP is a plausible theme but an implausible recipient/ goal for the action denoted by the verb. Thus, participants were more likely to complete this fragment with a PO construction. Second, half of the prime fragments included an L1 translation of the target L2 verb (e.g., 1a&b) and the other half a different L1 verb (e.g., 1c&d). Thus, each of the 32 target fragments occurred with 4 different prime types as shown in Table 1. In addition, 128 filler and 10 practice fragments of various syntactic form were included.

Procedure. Participants were instructed to repeat aloud and complete sentence fragments in any way they like provided that the resulting sentence is grammatically correct and semantically plausible. Each experimental session lasted approximately 45 minutes.

Scoring. Branigan, Pickering, Stewart, & McLean's (2000) scoring method was followed. A completion was scored as PO if the ditransitive verb was followed by a theme or patient NP and then a recipient/ goal PP with the preposition *σε* (L1) or *to* (L2). A completion was scored as DO if the ditransitive verb was followed by a recipient/ goal NP and then by a theme or patient NP. A completion was scored as Other a) if the ditransitive verb was part of a phrasal verb construction (e.g., *show off*); b) if it occurred in the wrong prime condition; c) in the case of target fragments if its PO or DO alternative was ungrammatical; and d) in all other cases.

Data Analysis. The data analysis was based on the method outlined by Pickering et al. (2002). The dependent variable was the "PO target ratio", i.e. the proportion of PO (versus DO) target completions in each of the four conditions excluding Other completions.

Results. An ANOVA revealed a significant main effect of Prime Type ($F_1(1,35)=36.29$, $p<.01$; $F_2(1,31)=15.11$, $p<.01$). The mean PO target ratios in Table 2 show that participants produced more PO target completions following a PO prime completion than following a DO prime completion (and vice versa for the DO target completions). Neither the main effect of Verb Type nor their interaction approached significance (all Fs<.79) meaning that the syntactic priming effect was unaffected by the type of verb (translated vs. different) used in the prime fragments.

Table 2*:* Results of Experiment 1 (N = 36)

Verb Prime Type (L1):	Translated Verb		Different Verb	
Structure Prime Type (L1):	PO	DO	PO	DO
PO Target Ratio (L2):	.75	.64	.78	.62

4.2 Discussion

Experiment 1 demonstrates that structural priming can occur cross-linguistically from L1 to L2 in oral production between L1 and L2 structures that are equivalent in terms of surface syntax and discourse function. The production of PO target completions (as expressed by the PO target ratio) was 12.5% higher after PO prime completions than after DO prime completions, and vice versa. These results are in line with the shared language hypothesis that postulates a shared representation of equivalent L1 and L2 syntactic structures.

In addition, priming was unaffected by whether the L2 target verb was a translation of the L1 prime verb or a completely different verb. This finding suggests that translation links between L1 and L2 verb lemmas did not contribute to priming. If this had been the case there would have been greater priming in the translated versus different verb condition.

5. Experiment 2

Having established the existence of a syntactic priming effect across languages with PO and DO structures, the goal of Experiment 2 was to evaluate the role of constituent order and thematic roles in cross-language syntactic priming and, hence, in syntactic processing and representation

in the bilingual lexicon. This is necessary as in Experiment 1 the pairs of prime and target constructions that induced priming did not only share syntactic structure but also constituent order and order of thematic roles.

Evidence of constituent order and thematic role priming during sentence production with ditransitive verbs derives from monolingual studies (Hare & Goldberg, 1999; Hartsuiker & Kolk, 1998; Pickering et al., 2002). Pickering et al. found that Shifted-PO primes (NP V PP NP) did not prime the production of PO structures (NP V NP PP) but instead behaved like Baseline (intransitive) primes. However, it might be argued that the lack of priming from a Shifted-PO to a PO structure is due to the fact that the Shifted-PO construction is rarely used in English (when, for instance, the direct object is particularly long) and might not be fully represented or productive in native English speakers′ mental lexicon. A relatively free word order language like Greek where the Shifted-PO construction is more commonly used relative to the PO (Lascaratou, 1994) provides a better test case for evaluating the role of constituent order and thematic information during syntactic priming.

Using the same bilingual sentence completion paradigm as in Experiment 1, we also introduced, after Pickering et al. (2002), a Shifted-PO structure (Ο πρόεδρος έδωσε στο νικητή...το βραβείο = *The president gave to the winner …the prize*) and an intransitive Baseline (Ο πρόεδρος χρεωκόπησε... = *The president got bankrupt*…) in the set of L1 primes. In this way, we were able to test three alternative hypotheses regarding the variables influencing cross-language syntactic priming. The first, which we term the syntactic structure hypothesis, claims that syntactic structure alone – irrespective of constituent order variations – is the cause of cross-linguistic syntactic priming. The second, which we call the constituent order hypothesis, states that structural repetition during sentence production across languages is due to the surface constituent alignment of sentences. Finally, the third is the order of thematic roles hypothesis and says that the array of thematic roles in sentences drives cross-language syntactic priming.

In this task all three hypotheses predict the main syntactic priming effect, i.e. PO prime completions will prime PO rather than DO target completions and vice versa. They make, however, different predictions concerning the priming that will result from the ′Shifted-PO′ structure. See Table 3 for a summary of the similarities and differences of the prime types. The syntactic structure hypothesis predicts no difference in priming between PO and Shifted-PO primes. The constituent order hypothesis predicts no priming of either PO or DO target completions following Shifted-PO primes. Last, the order of thematic roles hypothesis predicts no difference in priming between DO and Shifted-PO primes.

Table 3: Similarities and differences between prime types of Experiment 2

	syntactic structure	**constituent order**	**order of thematic roles**
PO - DO	different	different	different
PO - ′Shifted PO′	same	different	different
DO - ′Shifted PO′	different	different	same

5.1 Method

Subjects. 36 Greek-speaking advanced learners of English.

Materials. The design of the experimental material was identical to that in Experiment 1 except from that of the prime items (see Table 4).

Table 4. Examples of prime fragments in Experiment 2.

FRAGMENT	PRIME CONDITION	EXAMPLE	
PRIME	PO:	3a.	Ο πρόεδρος πρόσφερε το χρυσό μετάλλιο...
	DO:	3b.	Ο πρόεδρος πρόσφερε του νικητή...
	Shifted PO:	3c.	Ο πρόεδρος πρόσφερε στο νικητή...
	Baseline:	3d.	Ο πρόεδρος εξαφανίστηκε...

The prime fragments of type a) and b) included a postverbal NP manipulated in such a way so as to elicit a PO or DO completion respectively, as described in Experiment 1. The prime fragments of type c) contained a postverbal PP using the preposition *to*. This PP was always a plausible recipient/ goal and an implausible theme for the action denoted by the ditransitive verb so a Shifted PO completion was very likely in this case. Finally, the prime fragments of type d) consisted only of a subject NP and an intransitive verb so as to elicit an intransitive structure. L1 prime and L2 target fragments always contained different – never translated – verbs in this task.

Scoring. A completion was scored as Shifted PO if the ditransitive verb was followed by a recipient/ goal PP with the preposition *σε* (L1) or *to* (L2). Every grammatically correct completion in the Baseline prime fragments was scored as Baseline. Otherwise, the scoring method was the same with that of Experiment 1.

Procedure & Data Analysis. They were identical to that of Experiment 1.

Results. Table 5 shows the PO target ratio in the four prime conditions. An ANOVA revealed a significant effect of Prime Type ($F_1(3,105)=8.05$, $p<.01$; $F_2(3,93)=5.12$, $p<.01$). Planned comparisons showed that the PO target ratio differed significantly between the 'Shifted PO' and PO prime conditions in the subject analysis and approached significance in the item analysis ($F_1(1,35)=5.64$, $p<.05$; $F_2(1,31)=3.56$, $p<.075$). It also differed significantly between the 'Shifted PO' and DO conditions ($F_1(1,35)=6.14$, $p<.05$; $F_2(1,31)=5.06$, $p<.05$). However, it did not differ significantly after the 'Shifted PO' and 'Baseline' prime conditions (both Fs<.41).

Table 5. Results of Experiment 2 (N = 36)

Prime Type (L1):	PO	DO	Shifted PO	Baseline
PO Target Ratio (L2):	.81	.58	.70	.67

5.2 Discussion

The results replicate the main cross-linguistic syntactic priming effect between PO and DO, also present in Experiment 1. The production of PO target completions (as expressed by the PO target ratio) was 23% higher after PO prime completions than after DO prime completions, and vice versa. In addition, L1 Shifted PO behaved similarly to the L1 Baseline with respect to the production of PO and DO target completions. Overall, the findings were consistent with Pickering et al.'s (2002) L1 data and indicate that the lack of priming from Shifted POs cannot be attributed to the frequency of use of that structure in English.

These results lend support to the constituent order hypothesis which claims that constituent order is primed across languages during oral sentence production and appears to be a source of cross-linguistic syntactic priming. Figure 1 (see Appendix) outlines a model of representation of postverbal syntactic information in the bilingual mental lexicon that accommodates these results. In this model using a verb in a sentence context entails activation of the equivalent verb lemma along with the appropriate combinatorial node that is also specified for constituent order.

6. Conclusion

The present study demonstrated the existence of a robust cross-linguistic syntactic priming effect in L2 production. Participants tended to reuse L1 structure when generating L2 sentences. This tendency was subsequently found to be dependent on the overlap of constituent order in the postverbal arguments of the utterance structures. These findings provide strong evidence for a model of the lemma level in the bilingual mental lexicon where verb lemmas are linked to combinatorial nodes which encode the syntactic and constituent order properties of postverbal argument phrases and are shared among verb lemmas across languages whenever possible (see Fig. 1). Finally, the present results are in line with previous abundant evidence from cross-linguistic studies that both languages of a bilingual appear to be active and influence performance during processing – particularly L1 during L2 processing – even in fluent bilinguals at both the word form and conceptual level. What the present results add to this picture is that in addition to the lexical-conceptual features of L1 words, syntactic information of L1 words is also active during the production of utterances in L2.

References

Bock, J. Kathryn. 1986. "Syntactic Persistence in Language Production". *Cognitive Psychology* 18:355-387.

Bock, Kathryn. 1989. "Closed-Class Immanence in Sentence Production". *Cognition* 31:163-186.

Bock, Kathryn, & Loebell, Helga. 1990. "Framing Sentences". *Cognition* 35:1-39.

Branigan, Holly P., Pickering, Martin J., & Cleland, Alexandra A. 1999. "Syntactic priming in written production: Evidence for rapid decay". *Psychonomic Bulletin & Review* 6:635-640.

Branigan, Holly P., Pickering, Martin J., & Cleland, Alexandra A. 2000. "Syntactic co-ordination in dialogue". *Cognitio*, 75:B13-B25.

Branigan, Holly P., Pickering, Martin J., Stewart, Andrew J., & McLean, Janet F. 2000. "Syntactic priming in spoken production: Linguistic and temporal interference". *Memory & Cognition* 28:1297-1302.

Hare, Mary L., & Goldberg, Adele E. 1999. "Structural priming: Purely syntactic?" *Proceedings of the twenty first annual conference of the Cognitive Science Society*, ed. by M. Hahn and S. C. Stoness, 208-211. Mahwah, NJ: Lawrence Erlbaum Associates.

Hartsuiker, Robert J., Pickering, Martin J., & Veltkamp, Eline. 2002. "Cross-linguistic syntactic priming in Spanish/ English bilinguals: Evidence for shared syntax". Poster presented at AMLaP 2002, Tenerife, Spain.

Heydel, Maren, & Murray, Wayne S. 2000. "Conceptual effects in sentence priming: A cross-linguistic perspective". *Cross-linguistic perspectives on language processing*, ed. by M. De Vincenzi and V. Lombardo, 227-254. Dordrecht, London: Kluwer Academic.

Jackendoff, Ray. 1987. "The Status of Thematic Relations in Linguistic Theory". *Linguistic Inquiry* 18:369-411.

Lascaratou, Chryssoula. 1994. *Performace principles in word order variation*. Parousia Journal Monograph Series. Athens: University of Athens.

Loebell, Helga, & Bock, J. Kathryn. submitted. "Structural priming across languages". *Linguistics*.

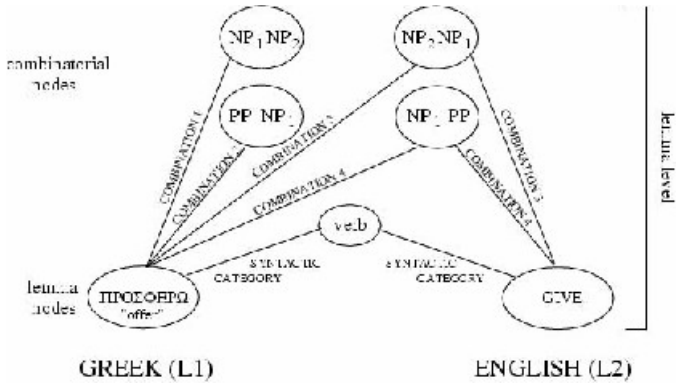
Pickering, Martin J., & Branigan, Holly P. 1998. "The representation of verbs: Evidence from syntactic priming in language production". *Journal of Memory and Language* 39:633-651.

Pickering, Martin J., Branigan, Holly P., & McLean, Janet F. 2002. "Constituent structure is formulated in one stage". *Journal of Memory and Language* 46:586-605.

Roelofs, Ardi. 1993. "Testing a Non-Decompositional Theory of Lemma Retrieval in Speaking - Retrieval of Verbs". *Cognition* 47:59-87.

Appendix

Figure 1: Model of shared representations of some of the syntactic information associated with verbs at the lemma level in the bilingual mental lexicon (based on Pickering & Branigan, 1998). In addition to syntactic structure, combinatorial nodes in this model also encode constituent order information.



Author Note

I would like to thank John Williams for his helpful guidance during this study and Kiki Nikiforidou, Chryssoula Laskaratou and Ourania Hatzidaki for making it possible for me to run these experiments at the Dept. of English Studies, University of Athens. This research was funded by the Greek State Scholarship Foundation.

Notes

[1] The term *bilingual* is used here in its most broadest sense to refer to speakers who know and use more than one language.