# The representation of grammatical gender in the bilingual mental lexicon: the case of cognate and noncognate nouns

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## Abstract

The present paper investigates the shared or independent nature of grammatical gender representations in the bilingual mental lexicon[1] and the role word form similarity (as in the case of cognates) plays in these representations. In a translation task from Greek (L1) to German (L2), L1-L2 nouns with the same gender (*gender-congruent*) were translated faster than L1-L2 nouns with a different gender (*gender-incongruent*) when the L2 target utterance required computation of gender agreement (adjective + noun). This tendency held for both cognates and noncognates. Unlike noncognates, however, gender-incongruent cognates yielded more errors than gender-congruent cognates. These results are interpreted as evidence for an L1-L2 shared gender system with L2 cognates relying more heavily on the L1 gender value.

**Keywords:** bilingual lexicon, grammatical gender, language representation, language production, gender-congruency effect, cognates

## 1. Introduction

Bilingual models of representation and production (e.g. de Bot 1992; Kroll & de Groot 1997) have, up to now, focused – almost exclusively – on the extent of the L1 and L2 interaction at the conceptual, lexical-semantic and phonological/orthographic levels. However, this picture of the bilingual processing system, which is based mainly on single word, out-of-context tasks and takes into account only the interrelation of word meaning and word form, is definitely not complete (Salamoura 2004). Apart from meaning and form, words are also associated with lexical-syntactic information such as syntactic category, gender, number, tense and argument structure. And it is precisely their lexical-syntactic information that determines – to a large extent – the way words combine with each other in naturally occurring speech.

The present study aims to examine the nature of the representation of lexical-syntactic information of words, and more specifically of grammatical gender, in the bilingual mental lexicon. It investigates cross-linguistic processing of grammatical gender (from L1 to L2) in order to provide evidence about two theoretical questions that are relevant to modelling the bilingual lexicon:

(i) Do L1 and L2 nouns of the same gender share representations of their gender feature (and hence of their inherent syntactic properties)?

(ii) Is formal similarity of L1 and L2 nouns – as in the case of cognates – a prerequisite for a shared representation of gender features?

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[1] In this paper the term *bilingual* is used in its wider sense to denote a person who possesses and regularly uses two languages in any degree.

The issue of how grammatical gender information is represented (and processed) in the mental lexicon has, thus far, been addressed only within the framework of L1 models of lexical processing. In Roelofs' (1992) and subsequently in Levelt, Roelofs & Meyer's (1999) model, grammatical gender is represented at the lemma level by means of syntactic nodes. Each gender value (masculine, feminine and neuter for Greek and German) is represented by a different node shared by all noun lemmas that have this gender. Thus, all masculine noun lemmas are connected to the masculine gender node, all feminine noun lemmas to the feminine gender node and so on (see Figure 1). Activation or selection of a noun's gender depends upon activation or selection respectively of its noun lemma. However, selection of a noun lemma does not automatically entail selection of its gender node in all contexts. A gender node is selected only when gender agreement needs to be computed during NP production as in gender-marked phrases. By contrast, a gender node is simply activated but not selected when no gender information is required for NP production as is the case in bare noun phrases (Roelofs et al. 1998). Caramazza's (1997) Independent Network model also assumes that gender features (masculine, feminine, neuter) are represented by a separate node each and are shared by nouns (lexemes) of the same gender, although it makes different assumptions with respect to gender processing.

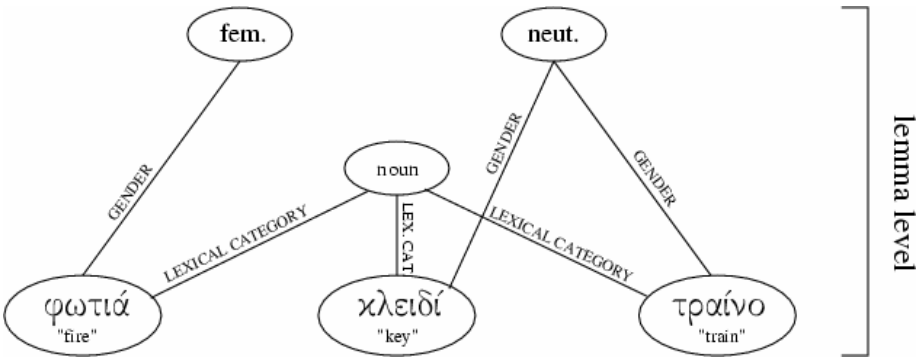


**Figure 1.** Part of Levelt et al.'s (1999) model depicting the representation of gender information associated with nouns at the lemma level in the monolingual lexicon

To answer the first research question about the shared or independent nature of L1 and L2 gender representations, I tested for a *gender-congruency* effect across languages. The first experimental evidence for the gender congruency effect was obtained by Schriefers (1993) in L1 Dutch. He employed the picture-word interference paradigm, in which pictures are typically named by a single word or a short phrase and are accompanied by a visually or aurally presented *distractor word* that participants must ignore during naming. Schriefers manipulated the gender information between distractor and target name. Distractor and target names either had the same gender (*gender-congruent*) or a different gender (*gender-incongruent*). In two experiments, native Dutch speakers named pictures using a gender-marked NP in Dutch consisting of either a (gender-marked) definite determiner + adjective + noun (e.g. ***de***.COM *groene stoel*.COM 'the green chair', ***het***.NEUT *groene bed*.NEUT 'the green bed'), or a (gender-marked) adjective + noun (e.g. *groene*.COM stoel.COM 'green chair', *groen*.NEUT *bed*.NEUT 'green bed'). The visually presented distractor words were bare nouns that were not overtly marked for gender. The gender manipulation resulted in a *gender-congruency* effect:

naming latencies were significantly faster following a gender-congruent distractor than following a gender-incongruent distractor.

Schriefers (1993) interpreted these findings within the framework of Roelofs' (1992) model (subsequently incorporated in Levelt et al.'s (1999) model). The target noun lemma activates its corresponding gender feature, necessary for the choice of the appropriate agreement targets such as definite determiners and adjective inflections. In parallel, the distractor noun lemma automatically activates its gender feature too, although the distractor is not accompanied by any overt marking of its gender. The selection of the target gender feature, and consequently that of the agreement items, is delayed if it faces competition from a simultaneously activated, different gender feature. This is what actually happens in the gender-incongruent condition where target and distractor noun have different gender, as opposed to the gender-congruent condition where both of them lead to activation of the same gender information.

The gender-congruency effect has since been replicated and explored further in a number of monolingual studies (van Berkum 1997; La Heij et al. 1998; Schriefers & Teruel 2000). La Heij et al. (1998), for instance, found that the effect is obtained only when gender has to be selected for the production of the target utterance (e.g. an utterance that involves gender agreement) but not when gender information is not required (e.g. production of bare nouns). In addition to the picture-word interference task, a gender-congruency effect has been obtained with a translation task (from English to Dutch, Vigliocco et al. 2002). The current study employed a translation task, based on Vigliocco et al. (2002), as it provides greater flexibility with the choice of material. The translation was from L1 (Greek) to L2 (German); single L1 nouns were translated in L2 using either an NP that does not involve gender agreement (single N) or an NP that requires gender agreement (Adj + N).

Two hypotheses were formulated and put to test. The *gender-shared* hypothesis states that gender specifications, and hence inherent syntactic properties of words, are shared across languages and predicts a cross-linguistic gender-congruency effect. If L1 and L2 gender features are shared, then the activated L1 gender information will affect the retrieval and selection of the L2 gender: it will facilitate retrieval if it coincides with L2 gender or inhibit/not facilitate retrieval if it is different from the L2 gender (cf. Figure 2). This is true only when the target utterance requires computation of gender agreement (La Heij et al. 1998; Roelofs et al. 1998; Levelt et al. 1999). The *gender-independent* hypothesis, on the other hand, claims that gender features are language-specific and predicts no gender-congruency effect across languages. If L1 and L2 gender features are independently represented, L1 gender information may be activated but will not influence gender retrieval and selection in L2, even when the target utterance requires computation of gender information (cf. Figure 3).

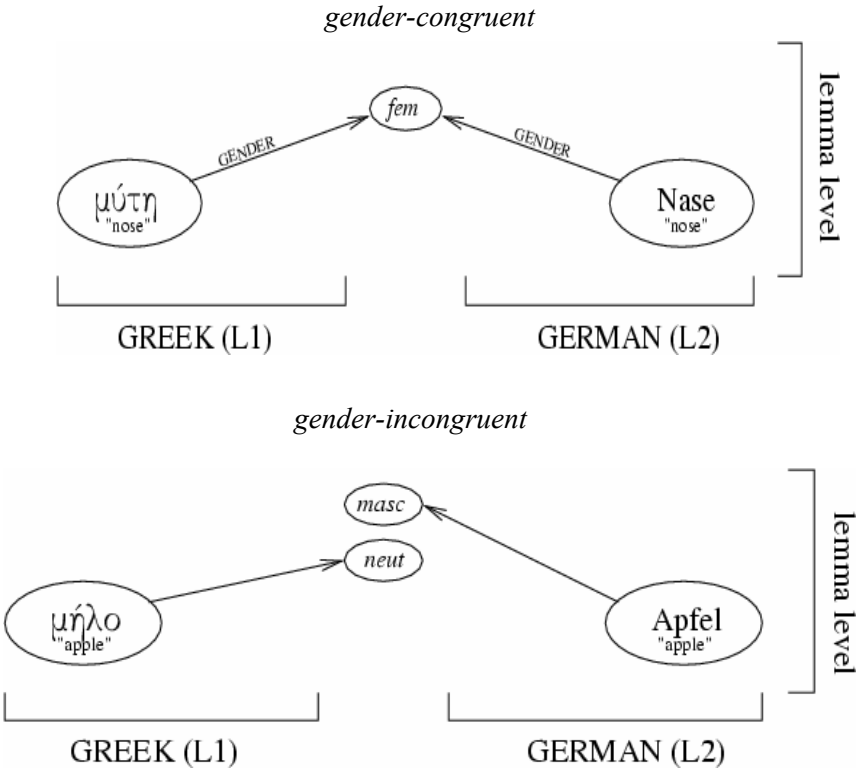


**Figure 2.** Model of language-shared representations of gender information associated with nouns at the lemma level in the bilingual lexicon (based on Levelt et al. 1999)

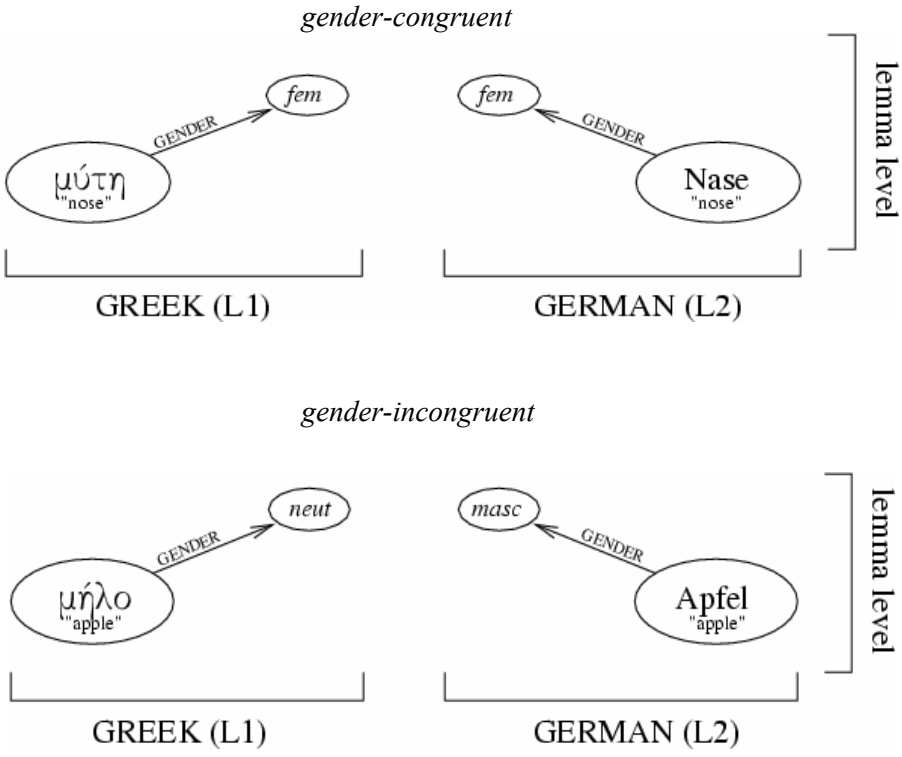


**Figure 3.** Model of language-independent representations of gender information associated with nouns at the lemma level in the bilingual lexicon (based on Levelt et al. 1999)

To tackle the second research question, the role of word type in the interaction of gender information across languages, I employed both noncognate and cognate material. If word form similarity of the L1 and L2 nouns is the key for a shared gender representation, then a gender-congruency effect is predicted only with cognate nouns. Since the lexical entries of cognates overlap more than those of noncognates (de Groot 1992b; van Hell & de Groot 1998; Dijkstra, Grainger & van Heuven 1999), cognate translation pairs are more likely candidates for activating the gender information of the non-target (L1) noun than noncognate pairs. If learning of L2 cognates draws more heavily on L1 resources and consists mainly of relating the new word to existing L1 information (Carroll 1992; de Groot 1992a; Lotto & de Groot 1998), then L2 cognates might tend to utilise the L1 lemma-to-gender link to activate gender information, developing only a weak direct link from L2 lemma to gender node. Such a strategy would have obvious advantages in the case of L1-L2 gender-congruent cognates, leading to easy access of the gender node with minimal processing load and to faster learning and processing. In the case of gender-incongruent cognates, however, this strategy would lead to less efficient access of the gender node and to slower learning and processing as well as errors. Moreover, in accordance with previous findings (de Groot 1992b; Sánchez-Casas et al. 1992; de Groot et al. 1994; Kroll & Stewart 1994;) a cognate effect is expected: cognates will be processed (here translated) faster than noncongates due to their formal similarity.

## 2. The experiment

### *2.1 Method*

#### *2.1.1 Participants*

Eighteen Greek-speaking advanced learners of German (11 females and 7 males), students at the German department of the University of Athens, participated. On average, they started learning German at the age of 10 (SD = 4.8), had received 11 (SD = 3.1) years of formal instruction and had lived in a German-speaking country for 2.35 (SD = 4.25) years.

#### *2.1.2 Material & procedure*

The task employed L1-to-L2 translation and comprised two blocks: a NonCognate (NonCOG) block including 30 L1 nouns with a noncognate L2 translation (i.e. with an equivalent meaning but no similarity in phonological/orthographic form); and a Cognate (COG) block including 30 L1 nouns with a cognate L2 translation (i.e. with an equivalent meaning *and* similar phonology/orthography). In each block half of the L1 nouns were gender-congruent (CON) in L2, i.e. their L2 translation had the same grammatical gender, and half were gender-incongruent (INC) in L2, i.e. their L2 translation had a different grammatical gender. L1-L2 CON and INC nouns were matched in terms of frequency of occurrence, syllable and letter length as much as possible. An example set of the material can be viewed in Table 1. For all participants the presentation of the NonCOG block preceded that of the COG block to avoid any transfer of effects from COG to NonCOG material, given the processing advantage of cognates (e.g. de Groot 1992b).

**Table 1.** Example set of critical material

| *Translation Task* | *L1 Noun Type* | *Example* | *g* | *Designated L2 translation* | *g* |
|---|---|---|---|---|---|
| Single Noun | NonCOG CON | μύτη /:miti/ 'nose' | f | Nase /'nɑ:zə/ | f |
| | NonCOG INC | μήλο /:milɔ/ 'apple' | n | Apfel /'apfəl/ | m |
| | COG CON | μπανάνα /ba:nana/ 'banana' | f | Banane /ba'nɑ:nə/ | f |
| | COG INC | κανόνι /ka:nɔni/ 'cannon' | n | Kanone /ka'no:nə/ | f |
| Adjective+Noun | NonCOG CON | μύτη / **μύτη** | f | kleine / große Nase | f |
| | NonCOG INC | μήλο / **μήλο** | n | kleiner/ großer Apfel | m |
| | COG CON | μπανάνα / **μπανάνα** | f | kleine / große Banane | f |
| | COG INC | κανόνι / **κανόνι** | n | kleine / große Kanone | f |

g = gender, COG = cognate, CON = Gender-Congruent, INC = Gender-Incongruent.

Each block included two parts: a Single Noun Translation part followed by an Adjective + Noun Translation part. In the Single Noun Translation parts, participants were instructed to translate the Greek bare nouns presented on the screen in German using a single N as quickly and as accurately as possible. The purpose of the Single Noun Translation parts was to assess whether there is any difference in terms of RT between the L1-L2 gender-congruent nouns and the L1-L2 gender-incongruent nouns when no grammatical gender information needs to be accessed for the target utterance, as in a single word translation task. In the Single Noun parts, all critical nouns were presented and translated three times.

In the Adjective + Noun Translation parts, participants were again presented with the Greek bare nouns of the Single Noun part. This time, however, some of the nouns appeared in a small font and others in a large font. Participants were asked to translate them into German using either the adjective *klein* ('small') for those in the small font, or the adjective *groß* ('big') for those in the large font before the appropriate noun. L2 adjective and noun had to agree in terms of grammatical gender and this agreement was reflected by the inflectional suffix of the adjective (*klein**er**/groß**er*** for masculine, *klein**e**/groß**e*** for feminine and *klein**es**/groß**es*** for neuter gender). Participants were further instructed to reply as quickly and as accurately as possible but to avoid starting a NP with the adjective without knowing what they would say next. In these parts all critical words were presented and translated twice – once in the small font requiring the adjective *klein* and the second time in the large font requiring the adjective *groß*. A practice section consisting of 15 trials preceded both the Single Noun and the Adjective + Noun Translation part. The L1 word was displayed until the participant's response (ISI: 600ms).

### *2.2 Results*

#### *2.2.1 Single Noun block*

For the response latencies, a 2 (CON *vs* INC) × 2 (NonCOG *vs* COG) ANOVA revealed a significant main effect of Noun ($F_1$ (1, 17) = 54.82, MSe = 2464.6, $p < .001$; $F_2$ (1, 56) = 26.34, MSe = 5056.9, $p < .001$). The mean RTs in Table 2 show that participants were faster at translating a cognate noun from L1 to L2 than a noncognate noun. Neither the

main effect of Gender Congruency nor their interaction reached significance (all Fs < .869), meaning that RTs were not influenced by whether the L1-L2 translation pair of nouns had the same or a different gender.

**Table 2.** Results for the Single Noun trials (n = 18)

| | *NONCOGNATES* | *COGNATES* | *Difference* |
|---|---|---|---|
| Gender Congruent | | | |
| RT | **852** | **761** | *91* |
| SD | 85 | 109 | |
| %Error [a] | 4.3 | 2 | |
| %Long [b] | 6.5 | 4.6 | |
| Gender Incongruent | | | |
| RT | **854** | **772** | *82* |
| SD | 101 | 98 | |
| %Error [a] | 4.1 | 3.5 | |
| %Long [b] | 6.1 | 5.2 | |
| *Difference* | *2* | *11* | |

RT = mean Response Time (in ms), SD = Standard Deviation

[a] Mean percentage of data lost due to error

[b] Mean percentage of long responses (outliers and responses over the 2.5sec cut-off collapsed)

For the error and long responses rates, the main effect of Noun was significant by-participants but not by-items (errors: $F_1$ (1, 17) = 8.43, MSe = .008, p = .01; $F_2$ (1, 56) = .929, p > .3; long responses: $F_1$ (1, 17) = 4.88, MSe = .007, p < .05; $F_2$ (1, 56) = .546, p > .4). Inspection of Table 2 indicates that errors and long responses were more numerous with the noncognate than cognate nouns.

*2.2.2 Adjective + Noun*

For the response latencies, a 2 × 2 ANOVA revealed a significant main effect of Gender Congruency ($F_1$ (1, 17) = 44.94, MSe = 4206.1, p < .001; $F_2$ (1, 56) = 10.79, MSe = 13420.3, p < .01) and a significant main effect of Noun in the participant analysis ($F_1$ (1, 17) = 4.8, MSe = 14798.7, p < .05) but not in the item analysis ($F_2$ (1, 56) = 2.36, p > .13). Their interaction did not reach significance (both Fs < 2.97, p > .1). However, inspection of the INC-CON numerical difference in Table 3 reveals that the gender-congruency effect in the noncognate conditions (80ms) is almost two-thirds the size of the effect in the cognate conditions (125ms). Simple effects confirmed the existence of a significant difference between both the COG-INC and -CON conditions ($F_1$ (1, 17) = 36.12, MSe = 3885.5, p < .001; $F_2$ (1, 28)= 10.89, MSe = 10777.1, p < .01) and between the NonCOG-INC and -CON conditions in the participant analysis ($F_1$ (1, 17) = 17.15, MSe = 3362.3, p =.001) but not in the item analysis ($F_2$ (1, 28) = 2.38, MSe = 16063.5, p =.13). The mean RTs in Table 3 show that participants were faster at translating a target NP from L1 to L2 when L1 and L2 nouns had the same gender than when they had a different gender. In addition, the cognate nouns were translated faster than the noncognate nouns in the participant but not in the item analysis.

For the error rates, there was a significant main effect of Gender Congruency ($F_1$ (1, 17) = 7.09, MSe = .023, p < .05; $F_2$ (1, 56) = 5.98, MSe = .031, p < .05). The interaction of Gender Congruency and Noun was significant in the participant analysis ($F_1$ (1, 17) = 20.68, Mse = .007, p < .001) and approached significance in the item analysis ($F_2$ (1, 56) = 3.24, MSe = .031, p = .077). Simple contrasts showed a significant difference between

the CON and INC conditions in the COG block ($F_1$ (1, 17) = 18.30, MSe = .017, p = .001; $F_2$ (1, 28) = 11.54, MSe = .024, p =.002). The main effect of Noun was not significant (both Fs < 2.46, p > .13). For the long response rates, no significant results were obtained in either the participant or item analyses.

**Table 3.** Results for the Adjective + Noun trials (n = 18)

| | *NONCOGNATES* | *COGNATES* | *Difference* |
|---|---|---|---|
| Gender Congruent | | | |
| RT | **1219** | **1134** | *85* |
| SD | 300 | 248 | |
| %Error [a] | 13.3 | 9.6 | |
| %Long [b] | 5.6 | 4.8 | |
| Gender Incongruent | | | |
| RT | **1299** | **1259** | *40* |
| SD | 347 | 271 | |
| %Error [a] | 12.8 | 23.9 | |
| %Long [b] | 6.5 | 5.4 | |
| *Difference* | *80* | *125* | |

RT = mean Response Time (in ms), SD = Standard Deviation
[a] Mean percentage of data lost due to error
[b] Mean percentage of long responses (outliers and responses over the 2.5sec cut-off collapsed)

## 3. Discussion

The results show that the L1-to-L2 oral translation process (of gender-marked adjective + noun phrases) is susceptible to a gender-congruency effect. When participants used only a single word to translate L1 nouns into L2, no significant difference in terms of RTs or errors was obtained between the L1-L2 gender-congruent and L1-L2 gender-incongruent group of stimuli. This finding indicates that gender information is not automatically computed when it is not required during L2 production and is consistent with prior L1 data (La Heij et al. 1998) and the assumptions of Levelt et al.'s (1999) model. Furthermore, it shows that the sets of gender-congruent and –incongruent nouns employed were comparable in terms of translation difficulty. However, when participants were asked to use a gender-marked phrase (adjective + noun) while translating into L2, L1-L2 gender-congruent words were translated 103ms faster than L1-L2 gender-incongruent ones. This priming was observed both with noncognate and cognate L1-L2 pairs of nouns. L1-L2 noncognate pairs were translated 80 ms faster when they were gender-congruent than when they were gender-incongruent. In L1-L2 cognate pairs this tendency was 125ms. This numerical difference between noncognate and cognate noun conditions did not reach significance. In addition, as expected, L1-L2 cognate nouns were 63ms faster to translate than noncognate ones. This finding is consistent with evidence from previous translation studies that reported a clear advantage of cognates (de Groot 1992b; Sánchez-Casas et al. 1992; de Groot et al. 1994; Kroll & Stewart 1994). Altogether, these results lend support to a shared representation of gender features between L1 and L2 (cf. Figure 2) that explains why the gender of an L1 phrase influences the production of the translation equivalent (gender-marked) phrase in L2.

Although the numerical difference in the gender-congruent effect between cognates and noncognates did not reach significance, their difference with respect to error rates did. The interaction of Gender Congruency × Noun Type reached significance in the error rates, the majority of which were cases where the wrong gender (i.e. wrong gender

agreement between Adj+N) was generated. Unlike L2 noncognate responses, L2 cognate responses led to significantly more errors when their L1 translation was of a different gender (INC condition) than when it had the same gender (CON condition). Taken together, the findings from RTs and error rates suggest that cognateness plays a role. L2 cognates are affected more by the gender congruency or incongruency of their L1 translation than L2 noncognates. A possible explanation might lie in the role of cognates in cross-language transfer during L2 learning. If grammatical gender is an existing category in L1, then the challenge in learning an L2 gender language is not to familiarise oneself with the workings of gender as a language feature but to learn new mappings between the existing gender values and L2 words. During the early stages of this process the resemblance of form and meaning between cognates might lead not only to a language-shared semantic, phonological and orthographic representation but also to a correspondence between L1 and L2 cognates in terms of gender, particularly since grammatical gender is arbitrary, minimally predictable information of a lexical item. The formal similarity of cognates may prompt learners to link the new L2 word onto the gender value of its L1 translation until evidence to the contrary is provided[2]. On the other hand, the formal dissimilarity of noncognates may make learners more cautious about equating L2 with L1 gender, forcing them to develop a strong, L1-independent link between the L2 lemma and its gender feature.

In the representational model of gender information presented in Figure 2, the difference between cognates and noncognates suggests that only a weak link is formed between the L2 lemma and the appropriate gender node in cognates (cf. Figure 4). This weak link poses no problem in the case of gender-congruent cognates. Because of the heavy reliance of L2 cognates on the representations of their L1 counterparts, activation of the gender node can be achieved using the existing and strong L1 lemma-to-gender link. In the case of gender-incongruent cognates the situation is reversed. The target gender node receives only a small amount of activation by the weak L2 gender-to-lemma link and it will take longer to surpass (if at all) the higher level of activation of the non-target gender node activated by the strong L1 lemma-to-gender link. As a result, the gender of the L2 word would be readily accessible for gender-congruent cognates, and it may even be comparatively inaccessible for gender-incongruent cognates, thus explaining the larger gender-congruency effect in cognates. What is important for the present purposes is that the larger effect in cognates is obtained precisely because of the existence of a language-shared set of gender nodes (i.e. the target of the mappings from the L1 and L2 lemmas is the same).

[2] In fact, Kirsner et al. (1993) have proposed that L2 cognates are represented and stored as variants of their L1 translations, with morphology being the only distinctive feature between L1 and L2 cognate items.

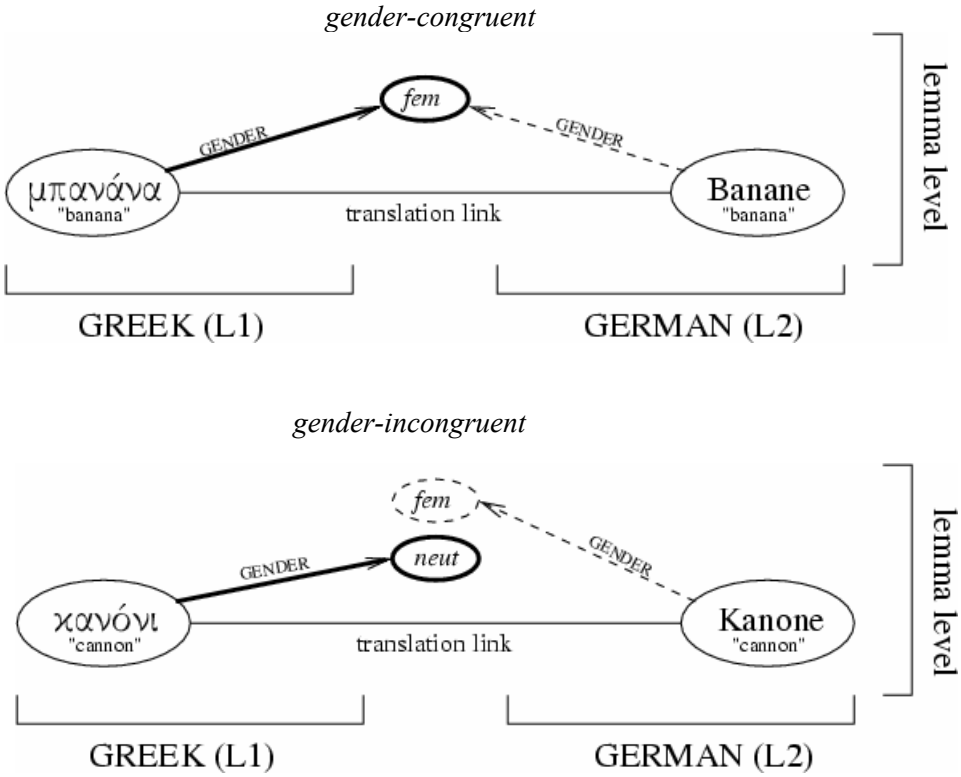


**Figure 4.** Model of language-shared representations of gender information associated with nouns at the lemma level in the bilingual lexicon (based on Levelt et al. 1999). The thickness of lines distinguish level (degree) of activation of the lemma-to-gender links and the gender nodes

It is nonetheless interesting that this effect is observed even with advanced L2 learners. Namely, the strong connections that are assumed to develop between L1 and L2 cognates during the early stages of L2 learning seem to be long-lasting. However, this finding is not theoretically unmotivated. Paradis' (1985, 1987) Subset Hypothesis outlines a rather static developmental pattern for cognates. Although with increasing L2 proficiency the intralingual connections of lexical items strengthen and the interlingual ones become looser, and consequently the two language subsystems gradually become increasingly independent, cognate lexical items are thought to preserve their strong interrelations.

Overall, the pattern of results suggests that the L1 and L2 gender systems are not separate but interact in the bilingual mental lexicon during language production. Nouns with the same gender have a common representation of their gender feature within but also across languages – at least for pairs of languages that have symmetrical gender systems, i.e. share number and type of gender values (cf. Figure 2). This L1-L2 interaction in terms of gender information pertains to both cognate and noncognate nouns. However, the greater the semantic and formal overlap between L1 and L2 nouns (cf. cognates), the stronger the interaction of the L1 and L2 gender systems.

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