

# Gender congruency effects in Russian–Spanish and Italian–Spanish bilinguals: The role of language proximity and concreteness of words\*

DANIELA PAOLIERI

*Mind, Brain and Behavior Research Center (CIMCYC); Department of Experimental Psychology; University of Granada, Spain*

FRANCISCA PADILLA

*Mind, Brain and Behavior Research Center (CIMCYC); Department of Experimental Psychology; University of Granada, Spain*

OLGA KORENEVA

*Department of Translation and Interpreting; University of Granada, Spain*

LUIS MORALES

*Universidad Loyola Andalucía, Department of Psychology, Seville, Spain*

PEDRO MACIZO

*Mind, Brain and Behavior Research Center (CIMCYC); Department of Experimental Psychology; University of Granada, Spain*

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*Previous studies have shown that bilinguals perform a production task faster when the item is gender-congruent across their two languages than when it is not. The current study aimed to explore three factors that might modulate this effect: the similarity of the gender systems, the need to retrieve grammatical gender to perform the task, and the role of a semantic variable (concreteness) in the processing of gender information. In Experiment 1, Russian–Spanish bilinguals showed gender-congruency effects whether they translated concrete nouns in isolation or in noun-phrases. In contrast, the effect was restricted to noun phrases when they translated abstract words. In Experiment 2, Italian–Spanish bilinguals showed the gender-congruency effect regardless of the translation task. However, the effect was larger with concrete nouns in comparison with abstract nouns. These results are discussed in terms of the proximity of bilingual gender systems and the relationship between semantics and gender.*

**Keywords:** Gender congruency, gender processing in bilinguals, language proximity, word concreteness

Grammatical gender is one of the more puzzling of the grammatical categories (Corbett, 1991). It plays an important role in the processing of languages with two (e.g., Italian and Spanish), three (e.g., German, Czech, and Russian) or more grammatical genders (e.g., Nigerian Fula, with around twenty gender categories depending on the dialect; Arnott, 1967; Corbett, 2011); while grammatical gender is completely absent in others languages (e.g., Hungarian, Finnish).

Grammatical gender is an inherent lexical feature of nouns (Corbett, 1991; Ritter 1993; Picallo, 2008; Bernstein, 2015). In classical models of monolingual

language processing, it is widely assumed that grammatical gender is stored as a property of nouns whose representation differs from that of semantic and phonological information (Caramazza, 1997; Cubelli, Lotto, Paolieri, Girelli & Job, 2005; Levelt, Roelofs & Meyer, 1999). Differences among authors emerge, however, in terms of understanding how grammatical gender is retrieved when individuals perform linguistic tasks. Some authors argue that grammatical gender is automatically retrieved whenever participants perform a production task: when a noun is produced as part of a noun phrase and when it is produced in isolation as well (Cubelli et al., 2005; Paolieri, Lotto, Leoncini, Cubelli & Job, 2011). Other authors assert that grammatical gender is only retrieved when needed to perform a specific production task where nouns are integrated within a sentential context (Caramazza & Miozzo, 1997; Levelt et al., 1999). Thus, grammatical gender is retrieved when

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Address for correspondence:

Daniela Paolieri, Mind, Brain and Behavior Research Center, Department of Experimental Psychology, C/ Professor Clavera s/n, University of Granada 18071, Granada, Spain

[dpaolieri@ugr.es](mailto:dpaolieri@ugr.es)

participants produce a noun phrase in which agreement between the noun and the definite article is needed, but gender is not accessed when individuals produce a noun in isolation. Although this issue is unresolved, there are several studies reporting grammatical gender effects during the production of both noun phrases and bare nouns, thus supporting the notion of automatic retrieval of grammatical gender in language production, at least in languages with a complex morphological structure (Cubelli et al., 2005; Paolieri et al., 2011).

When we focus on the field of bilingualism, a great number of studies have shown interactions between the grammatical gender of the bilinguals' two languages when they perform both comprehension and production tasks (Bordag & Pechmann, 2007, 2008; Lemhöfer, Spalek & Schriefers, 2008; Morales, Paolieri, Dussias, Kroff, Gerfen & Bajo, 2016; Paolieri, Cubelli, Macizo, Bajo, Lotto & Job, 2010; Salamoura & Williams, 2007). This observation supports the notion that in the bilingual mind, the first language (L1) influences the processing of the second one (L2) at the level of grammatical gender even when only the L2 is used. For instance, Paolieri et al. (2010) asked Italian–Spanish speakers to name a series of pictures in L2, or translate words from L1 to L2, by producing either the bare noun or the definite article (*el*<sub>MAS</sub> or *la*<sub>FEM</sub>) correctly marked for grammatical gender. The results showed faster naming latencies for words that were gender-congruent between the bilinguals' languages (e.g., *farfalla*<sub>FEM</sub>, *mariposa*<sub>FEM</sub>, *–butterfly–* in Italian and Spanish, respectively) relative to gender-incongruent words (e.g., *forchetta*<sub>FEM</sub>, *tenedor*<sub>MAS</sub>, *–fork–* in Italian and Spanish, respectively), irrespective of the task (bare noun or article + noun). Moreover, Bordag and Pechmann (2007) with Czech–German bilinguals and a similar L2 naming paradigm, found the same grammatical gender congruency effect in producing both bare nouns and noun phrases (adjective + noun). Salamoura and Williams (2007) extend the evidence of gender congruency effects in bilinguals using languages with a symmetric gender system (i.e., languages that share number and type of gender values) but a different script, such as Greek and German. They found that nouns with the same gender in Greek (L1) and German (L2), were translated faster than nouns with different genders, although the gender congruency effect was observed only when the L2 target production required the adjective + noun.

Therefore, some inconsistent findings appear to emerge using tasks with different demands of syntactic activation, like bare noun or noun phrase (article or adjective + noun) production tasks, at least in languages such as German and Greek (Salamoura & Williams, 2007). However, similar effects have been observed for both bare noun and noun phrase production tasks in Italian–Spanish or Czech–German bilinguals (Cubelli et al., 2005; Paolieri et al., 2011).

Overall, the presence of gender congruency effects between the two languages of bilingual speakers suggests that both languages are simultaneously active in the bilingual mind and that grammatical gender is available when gender is needed to process agreement between the adjective and the noun in noun phrases, and even when the agreement is not relevant for performing the task, such as during the comprehension and production of nouns presented in isolation. This pattern of results supports the notion that grammatical gender is an intrinsic lexical feature that is available even in production tasks outside of agreement operations. Given that the L1 is activated and spreads activation to the lexical representations of L2, if the nouns of the two languages belong to the same gender class, the target noun elicits a higher level of activation and its selection is facilitated (Cubelli & Paolieri, 2008).

The grammatical gender effect is quite easily observed in languages with symmetrical gender systems (i.e., gender systems with an equal number of gender categories), but less consistent results have been found in language systems with an asymmetrical structure. For example, Costa, Kovacic, Franck, and Caramazza (2003) investigated the production of L2 noun phrases with different groups of highly proficient bilinguals and found no effect of gender congruency in Croatian–Italian participants. In order to keep symmetry between the gender values of Croatian and Italian, Costa et al. (2003) did not include neuter Croatian nouns in their study; however, the underlying asymmetrical structure of the Croatian and Italian gender systems could account for the lack of gender effects: Italian has two gender values (feminine and masculine), while Croatian has three genders (masculine, feminine, and neuter). Recently, Klassen (2016) has also examined the effect of two asymmetric gender systems with Spanish–German bilinguals. In this study, a gender congruency effect was found, with shorter naming latencies for nouns that were gender-congruent across languages relative to gender-incongruent nouns in both bare noun and determiner phrase production, which is consistent with a significant body of previous research in bilinguals with symmetric gender systems (e.g., Bordag & Pechmann, 2007; Lemhöfer et al., 2008; Paolieri et al., 2010).

In sum, it is possible that the interactions between two grammatical gender systems can be modulated by the demands of syntactic activation during production and by specific properties of languages spoken by the bilinguals. To be more precise, the occurrence of gender congruency effects would indicate that gender is integrated at the lexical level (gender congruency effects in bare noun and noun phrase production) or is integrated at the syntactic level (gender congruency effect in the noun phrase production but not with nouns produced in isolation) (see also Paolieri et al., 2010, for similar assumptions). Finally, the distance between the two languages of a bilingual

could modulate the degree of between-language gender activation. The distance between languages seems to be a plausible modulator of the amount of activation between them. Thus, the proximity of the bilingual's two languages is an important issue that merits further analysis in the study of grammatical gender processing, as has been investigated in the case of lexico-semantic processing (e.g., cognate facilitation effects, see, Guo & Peng, 2006; Hoshino & Kroll, 2008; for languages that utilize different scripts).

Thus, these are the first two objectives of our study: we aimed to evaluate the influence of the syntactic demands of the task using bare noun and noun phrase translation tasks, and to consider the similarity between languages in terms of the symmetry of gender categories and the similarity of language scripts used by Italian–Spanish and Russian–Spanish bilinguals.

A further issue that we aimed to explore is the influence of semantic mediation on the occurrence of grammatical gender effects in bilinguals. Grammatical gender appears to be a meaningful category for distinguishing between male and female groups according to biological sex (Arias Barredo, 1990). For example, children associate the name of human referents with different genders, after which they extend this distinction to other biological entities such as animals (e.g., Vigliocco, Vinson, Paganelli & Dworzynski, 2005). Many studies have suggested that male–female differentiation extends to arbitrary words (e.g., Boroditsky, Schmidt & Phillips, 2003; Koch, Zimmermann & Garcia-Retamero, 2007; Konishi, 1993; Martinez & Shatz, 1996; Sera, Berge & del Castillo Pintado, 1994; but see Mickan, Schiefke & Stefanowitsch, 2014, for different results). Overall, these studies show that native speakers of a language with grammatical gender attribute feminine characteristics to grammatically feminine nouns and masculine characteristics to grammatically masculine nouns, leading to the conclusion that the grammatical gender property appears to have some effects at the semantic/conceptual level, with more robust effects in Romance languages (see Basseti & Nicoladis, 2016, for a review). In addition, evidence for the influence of grammatical gender on semantic processing has been observed even when the retrieval of gender is not explicitly required by the task. For example, Boutonnet, Athanasopoulos, and Thierry (2012) showed that the grammatical gender of Spanish-L1 was retrieved when participants performed a semantic categorization task in English-L2 (where they had to decide if three pictures belonged to the same semantic category or not). ERP results from a study by Friederici and Jacobsen (1999) revealed a LAN modulation effect (Left Anterior Negativity; an ERP marker considered to reflect detection of grammatical violations) when the objects to be categorized did not match each other in L1 grammatical

gender. Their results indicate that grammatical gender of nouns in the native language influences comprehension even in a second language that lacks such a grammatical property or in a context that does not require access to such information (see also, Cubelli, Paolieri, Lotto & Job, 2011; Ganushchak, Verdonschot & Schiller, 2011; Sabourin, Stowe & de Haan, 2006).

Moreover, some authors suggest that gender systems are based on semantics and the only differences between them across languages are morphological cues (e.g., number of gender classes, gender markers, gender agreements; see Corbett, 1991). For instance, Mirkovic, MacDonald, and Seidenberg (2005) found that the association between semantic and morphological information increases the probability of predicting the grammatical gender of words. Therefore, semantic information appears to modulate the processing of grammatical gender. Taken together, these studies suggest a bidirectional influence in which semantics modulate grammatical processing and vice versa.

In the case of bilinguals, this connection between semantic and grammatical representations suggests the possibility that when L1 and L2 nouns share grammatical gender, the corresponding concepts also share more semantic features relative to concepts corresponding to nouns with different gender (Boroditsky et al., 2003). Previous studies suggest that translation task from L1 to L2 (forward translation, De Groot et al., 1994), involves two routes of processing: one via the connection between L1 and L2 lexical representations and a second semantic route by which L1 words connect to the semantic system before L2 words are retrieved (Kroll & Stewart, 1994). These two routes work in parallel when bilinguals perform forward translation from L1 to L2 (Duyck & Brysbaert, 2004). According to this view, semantic mediation cannot be excluded in forward translation (Duyck & Brysbaert, 2004; Sunderman & Kroll, 2006), and it can be predicted that the degree of lexical and semantic similarity across L1 and L2 words would facilitate the translation process. Hence, in our study, we manipulated semantic strength by considering whether concreteness (Brysbaert, Warriner & Kuperman, 2014) might modulate the grammatical gender effect in bilinguals.

Concrete and abstract words are represented differently in memory (e.g., Barber, Otten, Kousta & Vigliocco, 2013; Bajo, Cañas, Navarro, Padilla & Puerta-Melguizo, 1994). These differences could be linked to the ease with which concrete words are learned in a second language compared with the learning of abstract words in L2 (de Groot, Dannenburg & Van Hell, 1994; Kaushanskaya & Rechtzigel, 2012; Van Hell & de Groot, 1998). Bilingual memory representations may differ for concrete and abstract words. For example, abstract words may have fewer semantic features than concrete words (e.g., de Groot, 1989; Plaut & Shallice,

1993), and hence have fewer semantic elements to share with their translations (Van Hell & de Groot, 1998). Therefore, if we consider that grammatical gender and semantic information interact, it is reasonable to predict that concreteness might modulate the processing of grammatical gender in bilingual speakers.

Two alternatives are possible with regard to the processing of concrete and abstract nouns when we consider the gender congruency effect in bilingual speakers. If this effect were limited to the activation of L1 and L2 grammatical representations only, the same effect would be found regardless of the concreteness of nouns. In contrast, if differences emerge between concrete and abstract nouns in the magnitude of the congruency effect, this would suggest that the congruency effect is partially influenced by the semantic processing of words. Specifically, in the case of bilinguals, concrete nouns have more semantic elements in common between translations (Van Hell & de Groot, 1998) and same gender noun concepts are hypothesised to also share more semantic features in comparison with concepts corresponding to nouns with different gender (Boroditsky et al., 2003). This suggests the possibility that a stronger gender congruency effect is observed in the case of concrete nouns with respect to abstract nouns. The evaluation of these predictions was the third goal of the present work.

### The current study

There are several factors that could modulate the presence of grammatical gender effects in bilinguals. The aim of this study was to explore three of these factors in unbalanced bilinguals translating words from L1 to L2.

Firstly, we examined the need to retrieve grammatical gender directly. To evaluate this issue, we compared the translation of bare nouns vs. the translation of articles + nouns in L2. Secondly, we analysed the possible influence of proximity of the gender systems in the languages spoken by bilingual individuals. To address this point, we compared bilinguals with different gender systems: Russian–Spanish bilinguals (Russian with three-gender classes, Spanish with two-gender classes), and bilinguals with the same gender system, Italian–Spanish bilinguals (both languages with two-gender classes). Thirdly, we investigated the interaction between the semantic and the grammatical systems. To this end, we evaluated if the gender congruency effect differed between the processing of concrete versus abstract nouns. The manipulation of concreteness allows the opportunity to observe a modulation of gender congruency effect with words which, at a conceptual level, differ in the degree of semantic overlap (such as concrete and abstract words) but that do not differ at the grammatical gender level. In addition, the observation of a modulation of the gender effect by concreteness would indicate that bilinguals

accessed the semantic system at the time of retrieving the grammatical information in the translation task.

In Experiment 1, we explored whether the grammatical gender congruency effect observed previously in bilingual speakers (Paolieri et al., 2010) would be obtained for bilinguals whose two languages differ in a number of aspects (script, number of gender categories, presence / absence of determiners), asking whether the grammatical gender of the native language (Russian) affected production in a second language (Spanish). Russian and Spanish are Slavic and Romance languages respectively, with very different gender systems in terms of gender values and gender agreement. Russian has three gender values (masculine, feminine, and neuter) whilst Spanish has only two<sup>1</sup> (masculine, feminine) and, unlike Spanish, Russian has no determiners. Unlike masculine and feminine gender categories, neuter is a gender category that is only present in the bilinguals' L1 (Russian), with no correspondence in the L2 gender system (Spanish). Thus, different outcomes could emerge during forward translation of nouns with neuter gender in L1. On the one hand, neutral nouns could behave as an intermediate level of incongruence between gender-congruent nouns (same masculine or feminine gender in both languages) and gender-incongruent nouns (masculine or feminine in one language but the opposite gender, feminine and masculine, in the other language). On the other hand, neutral nouns could behave as gender-incongruent nouns. This was the reason for including the neutral-incongruent condition in our study. To our knowledge, only Klassen (2016) has examined this type of incongruence with neutral nouns, in a study that used Spanish–German bilinguals where the L2 of participants did not have a neutral equivalent in their L1, Spanish. In Klassen's (2016) experiment both shorter naming latencies and lower error rates for neuter-incongruent nouns were found with respect to gender-incongruent nouns, showing a decrement in the amount of interference produced by neuter-incongruent nouns with respect to gender-incongruent nouns. In Russian–Spanish bilinguals, the direction of the asymmetry is reversed, and so L1 nouns with neutral gender do not have a neutral equivalent in L2. This characteristic could ensure that the neutral incongruence condition would simply generate the same pattern of results as the incongruent condition.

In Experiment 2, we investigated the gender congruency effect in two Romance languages with very similar gender systems in terms of gender values and gender agreement (Italian and Spanish) in order to replicate and extend the results of Paolieri et al. (2010).

In both experiments, gender congruency and word concreteness were manipulated and bilinguals performed a word translation task from L1 to L2 using bare nouns and

<sup>1</sup> Spanish has neuter gender in very restricted contexts: pronouns (*esto, eso, aquello, ello*) and for the article with nominalized adjectives (*lo malo es que no tenemos agua - the bad [thing] is we don't have water*).



Table 1. *Characteristics of Participants in the Study*

	Experiment 1: Russian-Spanish		Experiment 2: Italian-Spanish	
	Bare Noun	Article + Noun	Bare Noun	Article + Noun
Age (years)	30.98 (7.4)	34.4 (9.1)	29.8 (6.2)	27.6 (6.1)
L2 AoA (years)	20.8 (6.7)	23.3 (10.0)	20.1 (4.1)	20.2 (6.1)
L2 Immersion (years)	7.7 (4.7)	10.0 (4.9)	8.7 (6.9)	6.1 (5.8)
<i>Language Proficiency Questionnaire</i>				
L1 Speech fluency	10 (0)	10 (0)	9.8 (0.4)	9.7 (0.4)
L1 Speech comprehension	10 (0.2)	10 (0)	9.8 (0.3)	9.7 (0.6)
L1 Writing proficiency	9.9 (0.6)	10 (0)	9.6 (0.6)	9.6 (0.4)
L1 Reading proficiency	9.9 (0.4)	10 (0)	6.9 (0.3)	9.7 (0.6)
L2 Speech fluency	8.8 (1.4)	8.4 (2.1)	8.7 (1.2)	8.2 (1.1)
L2 Speech comprehension	9.2 (1.1)	9.2 (1.4)	8.6 (0.8)	8.2 (1.0)
L2 Writing proficiency	9.1 (1.2)	8.4 (2.2)	8.5 (0.9)	7.7 (1.1)
L2 Reading proficiency	9.2 (1.2)	8.8 (1.8)	6.4 (0.7)	8.2 (1.0)

*Note.* Bare noun: L1-L2 noun translation task, Article + Noun: L1-L2 article + noun translation task. The self-report ratings in L1 and L2 ranged from 1 to 10 where 1 was not fluent and 10 was very fluent. Standard deviations are reported in brackets.

noun phrases (article + noun). Similar gender congruency effects in Italian–Spanish bilinguals have been observed with picture-naming tasks and word translation tasks (e.g., Paolieri et al., 2010). In the current study, the word translation task was chosen because it allows the manipulation of concreteness, including abstract words as stimuli in our experimental materials to evaluate the relationship between semantic and grammatical gender processing. Furthermore, we selected the L1 to L2 direction of translation based on the revised hierarchical model (Kroll & Stewart, 1994). L2 to L1 translation can be conducted by lexical connections between the bilingual’s two languages, and therefore this translation direction would be less sensitive to concreteness effects. In contrast, semantic and lexical processing are both functional when bilinguals conduct L1 to L2 translation, and so this task would be better suited to capture the semantic effects in our study.

### Experiment 1: Russian–Spanish bilinguals

In Experiment 1, we explored whether the grammatical gender of the native language (Russian) affected naming in a second language (Spanish). In this experiment, Russian–Spanish bilinguals (L1-L2, respectively) were required to translate nouns from Russian into Spanish, by producing either the bare noun (Experiment 1a) or the noun phrase (Experiment 1b), for both concrete and abstract nouns. The presence of grammatical gender congruency effects would suggest that the gender systems of the two languages, Russian and Spanish, are integrated at the lexical level (gender congruency effects in bare noun and noun phrase production) or only at the syntactic level

(the congruency effect would be limited to the noun phrase condition, with no gender effect in bare noun production). In addition, if the semantic and gender systems interact, the congruency effect would be modulated by the concreteness of the words to be translated.

### Method

#### Participants

Participants were 54 Russian–Spanish advanced bilinguals (L1-L2, respectively). All of the participants were paid for taking part in the study. The experimental data were collected at the University of Granada. The bilinguals were randomly assigned to Experiments 1a and 1b (27 participants in each experiment). In Experiment 1a, participants performed a bare noun translation task from L1 to L2 (e.g., *звезда* (*zvezda*)/*estrella*, –*star*–), whilst in Experiment 1b they performed an article + noun translation task from L1 to L2 (e.g., *звезда* (*zvezda*)/ *la estrella*, –*the star*–). Although a within-participants experimental manipulation is a better choice for this kind of study, we preferred a between-participants manipulation in order to avoid the risk of the influence of task order in the within-subject design.

Before performing the experiment, all participants completed a language history questionnaire in which they rated their speech fluency, speech comprehension, writing, and reading skills in both L1 and L2 (see Table 1). The questionnaire was also designed to obtain information about their experience using each language. Participants across the two experiments did not differ in their L1 and L2 proficiency (all *p* values > .05).

Table 2. Experiment 1. Design and Examples

Condition	Gender (L1/L2)	Russian (L1)	Spanish (L2)	English Translation
<b>Abstract Words</b>				
Congruent	m/m	<i>поцелуй</i>	<i>beso</i>	kiss
Congruent	f/f	<i>надежда</i>	<i>esperanza</i>	hope
Incongruent	m/f	<i>выход</i>	<i>salida</i>	departure
Incongruent	f/m	<i>поддержка</i>	<i>apoyo</i>	support
Incongruent-Neuter	n/m	<i>начало</i>	<i>comienzo</i>	start
Incongruent-Neuter	n/f	<i>известие</i>	<i>noticia</i>	news
<b>Concrete Words</b>				
Congruent	m/m	<i>глаз</i>	<i>ojo</i>	eye
Congruent	f/f	<i>голова</i>	<i>cabeza</i>	head
Incongruent	m/f	<i>остров</i>	<i>isla</i>	island
Incongruent	f/m	<i>пустыня</i>	<i>desierto</i>	desert
Incongruent-Neuter	n/m	<i>платье</i>	<i>vestido</i>	dress
Incongruent-Neuter	n/f	<i>мясо</i>	<i>carne</i>	meat

Note. The gender congruency conditions (congruent, incongruent, incongruent-neuter) and word concreteness conditions (abstract, concrete) were used in the two translation tasks (bare noun translation and article + noun translation). f = feminine; m = masculine; n = neuter.

### Design and materials

A  $3 \times 2 \times 2$  mixed design was used. Gender congruency (congruent, incongruent, incongruent-neuter) and word concreteness (abstract vs. concrete) were manipulated within-participants whilst the factor of task (bare noun vs. article + noun) was manipulated between-subjects.

Sixty concrete nouns were selected: 20 nouns had the same gender in Russian and Spanish the gender-congruent condition (e.g., *звезда* (*zvezda*) /*estrella*, –*star*–, both feminine), 40 nouns had different gender in the two languages: 20 nouns in the gender-incongruent condition (e.g., *нос* (*nos*) /*naríz*, –*nose*–, masculine in Russian and feminine in Spanish) and 20 nouns in the gender-incongruent-neuter condition (e.g., *окно* (*okno*) /*ventana*, –*window*–, neuter in Russian and feminine in Spanish). In each set, half of the nouns were masculine and half feminine in both languages. Further, in the gender-incongruent-neuter condition, half of the nouns were masculine and half feminine in Spanish and all had neuter gender in Russian. Similarly, 60 abstract nouns were selected: 20 nouns with the same gender in Russian and Spanish, the gender-congruent condition (e.g., *ветер* (*veter*) /*viento*, –*wind*–, both masculine), 40 nouns with different gender in the two languages: 20 nouns in the gender-incongruent condition (e.g., *прогулка*-*progulka*/paseo, –*walk*–, feminine in Russian and masculine in Spanish) and 20 nouns in the gender-incongruent-neuter condition (e.g., *чувство* (*čuvstvo*) /*sentimiento*, –*feeling*–, neuter in Russian and masculine in Spanish). In each set, half of the nouns were masculine and half feminine in both languages. Further, in the

gender-incongruent-neuter condition, half of the nouns were masculine and half feminine in Spanish and all had neuter gender in Russian (see Table 2).

The two sets of concrete and abstract nouns differed in concreteness (concrete nouns,  $M = 6.12$ ,  $SD = 1.11$ ; abstract nouns,  $M = 4.05$ ,  $SD = 0.96$ ),  $t(86) = 9.42$ ,  $p < .001$ , and imageability (concrete nouns,  $M = 6.17$ ,  $SD = 0.56$ ; abstract nouns,  $M = 4.95$ ,  $SD = 0.96$ ),  $t(109) = 8.07$ ,  $p < .001$  (Spanish 7 point scale, LEXESP database; Sebastián, Martí, Carreiras & Cuetos, 2000). The gender-congruent, gender-incongruent, and gender-incongruent-neuter sets were matched for a number of lexical variables both for concrete nouns and abstract nouns in the two languages (Spanish, Alameda & Cuetos, 1995; Russian, Lyashevsky & Sharov, 2009) (see Table 3). For the concrete noun set, the Russian word length (number of letters) and frequency (log) was similar in the gender-congruent condition, the incongruent gender condition, and the incongruent-neuter condition,  $F_s < 1$ . When the Spanish translation of the Russian words was considered, word length (number of letters) and frequency (log) was also equated across the congruent condition, the incongruent condition, and the neuter condition,  $F_s < 1$ .

In addition, the number of nouns with transparent endings<sup>2</sup> in Spanish was matched as closely as possible

<sup>2</sup> Spanish nominal categorization systems have formal regularities related to the distribution of noun endings (Chini, 1995; Harris, 1991): Most masculine nouns end with –o, and most feminine nouns end with –a (transparent nouns). However, a large class of nouns end with –e, that is considered unmarked for gender (opaque nouns), and a small

Table 3. *Characteristics of Words Used in the Study*

	Concrete Nouns			Abstract Nouns		
	Congruent	Incongruent	Neuter	Congruent	Incongruent	Neuter
<i>Experiment 1: Russian (L1) – Spanish (L2)</i>						
L1 Length	5.90 (1.92)	5.75 (1.59)	6.20 (1.77)	6.10 (1.02)	5.85 (1.35)	6.45 (1.73)
L1 Frequency	2.03 (0.47)	2.10 (0.51)	2.00 (0.43)	2.04 (0.37)	2.07 (0.37)	2.02 (0.47)
L2 Length	6.35 (2.03)	5.90 (1.62)	6.30 (1.92)	6.55 (1.90)	6.00 (1.72)	6.20 (1.94)
L2 Frequency	1.68 (0.38)	1.81 (0.51)	1.66 (0.45)	1.75 (0.38)	1.89 (0.45)	1.81 (0.47)
<i>Experiment 2: Italian (L1) – Spanish (L2)</i>						
L1 Length	6.86 (1.63)	6.93 (1.96)		7.00 (0.56)	6.75 (0.57)	
L1 Frequency	1.95 (0.56)	1.96 (0.57)		2.07 (0.61)	1.85 (0.50)	
L2 Length	5.78 (1.31)	5.85 (1.51)		6.71 (1.58)	6.14 (2.47)	
L2 Frequency	1.09 (0.51)	1.31 (0.75)		1.39 (0.50)	1.39 (0.34)	

Note. Length in number of letters. Frequency (log). Standard deviations are reported in brackets.

across the congruency conditions for concrete nouns (12 nouns, 13 nouns, 14 nouns, for congruent, incongruent, and incongruent-neuter, respectively) and abstract nouns (12 nouns, 12 nouns, 15 nouns, for congruent, incongruent, and incongruent-neuter, respectively). In Russian, all the nouns were selected with transparent endings<sup>3</sup> for gender. The material only included non-cognate nouns. The complete set of materials is reported in Appendix A.

### Procedure

Participants were presented with Russian (L1) written words and were asked to translate them by providing the corresponding Spanish (L2) nouns, in isolation (Experiment 1a) or preceded by the definite determiner (Experiment 1b) as fast and accurately as possible. At the beginning of the experiment, each participant was familiarized with the set of Russian words and their Spanish translations used in the study. In this phase, the written nouns were presented on the computer screen with the corresponding Spanish noun printed below. Participants were familiarized with the L1-L2 word pairs. This procedure was adopted to ensure that participants knew the Spanish translation of the L1 Russian nouns and to exclude the unknown items from analyses. Moreover, in the production tasks, the inclusion of this phase reduces disfluencies and hesitations during the experimental phase (for a similar procedure, see also Bordag & Pechmann 2007; Costa et al., 2003; Kassel, 2016; Paolieri et al., 2010; Salamoura & Williams, 2007).

Following the familiarization phase, a practice block of 8 trials was administered, after which the experimental

blocks were presented. In addition, at the end of the experimental session, participants completed a gender decision task with the L2 nouns that they had to produce in the main experiment. This task was used to ensure that participants knew the grammatical gender of the L2 Spanish nouns and to exclude the unknown items from the experimental analyses.

The stimuli were presented in black Courier New 24 lower-case font on a white background at the centre of the screen, in random order using E-Prime 1.1 (Psychology Software Tools, Pittsburgh, PA). In the translation task, a trial consisted of the following events: a fixation cross presented at the centre of the screen for 500 ms, upon which the Russian word appeared until the participant's response or for a maximum of 3000 ms, and the next trial started 500 ms after word offset. Response latencies were measured from the onset of the stimulus presentation until the beginning of the response. The response of each participant was recorded for later analyses of accuracy.

### Results

Six types of responses were excluded from the statistical analyses of the translation latencies: (a) translation errors, (b) verbal disfluencies and failures to record the response by the voice key, (c) L1 words whose L2 translations were unknown by the participants in the familiarization task, (d) words whose L2 gender was unknown by the bilingual in the L2 gender decision task performed at the end of the session, (e) responses longer than 2000 ms and shorter than 300 ms, (f) translation latencies more than 2.5 standard deviations above or below the overall mean for a given participant. The percentage of responses eliminated from the latency analyses was 29% in the bare noun task, and 37% in the article + noun task. The mean

set of nouns end with –o for feminine and with –a for masculine (irregular nouns).

<sup>3</sup> In Russian, most feminine nouns end with –я (-â), masculine nouns end with a consonant, and neutral nouns end with –e (-e).

translation latencies, standard deviations, and error rates found in the experiment are shown in Table 3. Latencies were submitted to analyses of variance (ANOVAs) by both subjects ( $F_1$ ) and items ( $F_2$ ).

Gender congruency (congruent, incongruent, incongruent-neuter) and word concreteness (abstract vs. concrete) were analysed as within-participants factors whilst the translation task (bare noun vs. article + noun) was analysed as a between-subjects factor.

### Translation latencies

The analyses revealed a significant effect of concreteness,  $F_1(1, 52) = 54.96, p < .001, \eta_p^2 = .51; F_2(1, 38) = 11.66, p = .002, \eta_p^2 = .23$ , indicating that concrete nouns were translated faster ( $M = 977$  ms,  $SD = 138$ ) than abstract nouns ( $M = 1015$  ms,  $SD = 139$ ). In addition, the effect of gender congruency was significant in the subject analysis,  $F_1(2, 104) = 9.14, p < .001, \eta_p^2 = .15; F_2 < 1$ . Importantly, the interaction between concreteness, gender congruency, and task reached significance in the subject analysis,  $F_1(2, 104) = 5.19, p = .007, \eta_p^2 = .09$ ; but was not significant in the item analysis,  $F_2(2, 76) = 1.36, p = .26, \eta_p^2 = .26$ . The main effects of task and other interactions were not significant (all  $F_s < 1$ ). In order to understand the three-way interaction, the effects of gender congruency and concreteness were explored for each task separately.

In the bare noun task, the analyses revealed a significant effect of concreteness,  $F_1(1, 26) = 11.57, p = .002, \eta_p^2 = .31; F_2(1, 19) = 4.50, p = .05, \eta_p^2 = .19$ , and gender congruency by subjects,  $F_1(2, 52) = 5.45, p = .007, \eta_p^2 = .17; F_2 < 1$ . Importantly, the interaction between concreteness and gender congruency reached significance by subjects,  $F_1(2, 52) = 5.89, p = .005, \eta_p^2 = .18$ ; but not by items,  $F_2(2, 38) = 1.10, p = .34, \eta_p^2 = .06$ . The gender congruency effect was significant for concrete nouns,  $F_1(1, 26) = 11.12, p < .001, \eta_p^2 = .30; F_2(2, 38) = 2.92, p = .07, \eta_p^2 = .13$ : The comparison between congruent and incongruent nouns,  $t_1(26) = 4.11, p < .001; t_2(19) = 2.54, p = .02$ , congruent and incongruent-neuter by subjects,  $t_1(26) = 2.76, p = .01; t_2(19) = 1.25, p = .22$ , and between incongruent and incongruent-neuter by subjects,  $t_1(26) = 2.26, p = .03, t_2(19) = 1.09, p = .28$ , were significant. For abstract nouns, the gender congruency effect was not significant (both  $F_s < 1$ ) (see Table 4 for the magnitude of congruency effects).

In the article + noun task, the analyses revealed a significant effect of concreteness,  $F_1(1, 26) = 65.22, p < .001, \eta_p^2 = .71; F_2(1, 19) = 7.54, p = .013, \eta_p^2 = .28$ , and gender congruency by subjects,  $F_1(2, 52) = 4.27, p = .019, \eta_p^2 = .14$ ; but not by items,  $F_2 < 1$ . The interaction between Concreteness and Gender Congruency was not significant (both  $F_s < 1$ ), revealing an effect of gender congruency for both concrete nouns and abstract nouns. The comparisons between congruent

( $M = 986$  ms,  $SD = 158$ ) and incongruent nouns ( $M = 1006$  ms,  $SD = 154$ ),  $t_1(26) = 2.60, p = .015; t_2 < 1$ , and between congruent ( $M = 986$  ms,  $SD = 158$ ) and incongruent-neuter nouns ( $M = 1008$  ms,  $SD = 151$ ) were significant,  $t_1(26) = 2.56, p = .016; t_2 < 1$ , but there was no significant difference between incongruent and incongruent-neuter nouns ( $t_s < 1$ ) (see Table 4 for the magnitude of congruency effects).

### Accuracy

The accuracy analyses revealed a main effect of concreteness,  $F_1(1, 53) = 62.19, p < .001, \eta_p^2 = .54; F_2(1, 38) = 10.74, p = .01, \eta_p^2 = .22$ , indicating that concrete nouns were translated with less errors ( $M = 10\%$ ,  $SD = 8$ ) in comparison with abstract nouns ( $M = 15\%$ ,  $SD = 15$ ). The gender congruency effect was also significant, with fewer errors in the congruent condition ( $M = 11\%$ ,  $SD = 11$ ) compared with the incongruent condition ( $M = 14\%$ ,  $SD = 13$ ), and neuter condition ( $M = 13\%$ ,  $SD = 11$ ),  $F_1(1, 53) = 10.70, p < .001, \eta_p^2 = .17; F_2(1, 38) = 1.25, p = .27$ . Moreover, the main effect of the task was significant,  $F_1(2, 52) = 10.95, p < .001, \eta_p^2 = .30; F_2(1, 38) = 22.69, p < .001, \eta_p^2 = .37$ , with fewer errors found in the bare noun task ( $M = 9\%$ ,  $SD = 6$ ) compared with the article + noun task ( $M = 16\%$ ,  $SD = 9$ ). Other interactions were not significant (all  $p_s > .05$ ).

The ANOVAs conducted in this experiment revealed some inconsistencies in the analyses performed by items. In order to further strengthen the pattern of results found in the experiment, the RT data were analysed by estimating the Bayes factor using the JZS approach (Love et al., 2015; Rouder, Morey, Speckman & Province, 2012). Bayes factor allows for making statements about the alternative hypothesis, rather than just the null hypothesis, comparing the fit of the data under the null hypothesis relative to the alternative hypothesis. In addition, it specifies a clear estimate of the evidence present in the data and it has been considered to be superior to  $p$ -values for statistical evidence (Rouder et al., 2012). When task, gender congruency, and concreteness were submitted to a Bayesian ANOVA, the interaction among the three factors was more likely to occur under the alternative hypothesis ( $BF_{10}$  alternative/null = 1.039e + 12) than under the null hypothesis ( $BF_{01}$  null/alternative = 5.489e - 13). When the production of bare nouns was considered, the data were more likely to occur under a model including the concreteness by gender congruency interaction ( $BF_{10} = 4977.106$ ) than under a model that does not include the two-way interaction ( $BF_{01}$  null/alternative = 2.187e - 4). Moreover, the two-way interaction was preferred over the main effects of concreteness and gender congruency by a  $BF_{10} = 15.195$ . When the production of concrete nouns was considered, a model including gender congruency was preferred ( $BF_{10} = 230.293$ ) over a model without this factor



Table 4. Mean of Translation Latencies (RTs, in milliseconds), Standard Deviations (in brackets) and Percentage of Errors as a Function of Tasks and Experimental Conditions of Experiment 1 and magnitude of congruency effects

	Concrete Nouns		Abstract Nouns	
	RTs	E%	RTs	E%
Bare Noun Task				
Congruent	953 (122)	5.7 (3.9)	1008 (128)	10.8 (14.1)
Incongruent	998 (114)	8.1 (7.6)	998 (118)	11.4 (16.3)
Incongruent-Neuter	981 (128)	7.9 (6.3)	1012 (135)	12.4 (14.0)
<i>Congruent vs. Incongruent</i>	−45		10	
<i>Congruent vs. Incongruent-Neuter</i>	−28		−4	
<i>Incongruent vs. Incongruent-Neuter</i>	−17		−14	
Article + Noun task				
Congruent	965 (165)	10.4 (9.0)	1008 (151)	17.8 (17.1)
Incongruent	978 (150)	15.3 (11.4)	1034 (155)	21.5 (17.2)
Incongruent-Neuter	986 (149)	13.5 (11.6)	1031 (152)	18.8 (12.3)
<i>Congruent vs. Incongruent</i>	−13		−26	
<i>Congruent vs. Incongruent-Neuter</i>	−21		−23	
<i>Incongruent vs. Incongruent-Neuter</i>	−8		3	

( $BF_{01} = 0.004$ ). In contrast, when participants produced abstract nouns, a model without gender congruency was preferred ( $BF_{01} = 4.530$ ) over a model including this variable ( $BF_{10} = 0.216$ ).

When the production of noun phrases was taken into account, the main effects of concreteness and gender congruency were more likely to occur ( $BF_{10} = 6.79$ ) than the interaction between the two factors. Specifically, the data were more likely to occur under a model including the main effect of gender congruency ( $BF_{10} = 1.202$ ) than under a model without it ( $BF_{01} = 0.829$ ). Thus, Bayesian analyses confirmed the results of those conducted with classical null-hypothesis significance testing reported above.

To sum up, the results found in this experiment showed that the interaction between concreteness, gender congruency, and task was significant and appeared to be driven by the lack of gender congruency effects in the abstract bare noun condition.

In the bare noun task, grammatical gender of nouns in the non-response L1 language (Russian) affected translation in the L2 response language (Spanish). In particular, when bilinguals translated concrete nouns, faster latencies were found in the congruent condition relative to both the incongruent-neuter condition and the incongruent condition. In addition, concrete nouns were translated faster in the incongruent-neuter condition compared with the incongruent condition. For abstract nouns, a different pattern of results was observed; the gender congruency effect was not significant.

In the article + noun task, the gender congruency effect was significant, with a comparable gender effect for both concrete and abstract nouns; congruent nouns were translated faster than incongruent nouns and incongruent-neuter nouns, with no difference between incongruent and incongruent-neuter conditions. Thus, for concrete nouns, a similar pattern of results was observed for both bare noun and noun phrase production when the congruent condition was compared to the incongruent condition and when the congruent condition was compared to the incongruent-neuter condition.

To summarize, in Experiment 1 we observed a gender congruency effect when Russian–Spanish bilinguals translated words from L1 to L2. This effect replicates the findings reported in previous studies (e.g., Paolieri et al., 2010), suggesting co-activation of gender information between the two languages of bilingual speakers. Importantly, in the current study, the effect of congruency was obtained in languages that are different in many respects (script, number of gender categories, presence / absence of determiners). Therefore, the closeness between the two languages of a bilingual is not necessary for observing a gender congruency effect (see also Klassen, 2016). To the best of our knowledge, this is the first study exploring the possible influence of a semantic variable (concreteness) on the gender congruency effect. The pattern of results indicates an interaction between concreteness, gender congruency and the degree of gender activation required by the translation task (bare noun vs. noun phrase production). For abstract nouns, the

gender congruency effect was only significant in the noun phrase task, where a mandatory activation of gender is required. In contrast, for concrete nouns, comparable effects were found for bare noun and noun phrase production. Moreover, the neutral incongruent condition in this experiment appears to produce the same pattern of results as the incongruent condition.

## Experiment 2: Italian–Spanish bilinguals

In Experiment 2, we explored whether the grammatical gender of the native language (Italian) affects naming in a second language (Spanish). Italian and Spanish are Romance languages with very similar gender systems in terms of both gender values and gender agreement. In this experiment, Italian–Spanish bilinguals were required to translate nouns from Italian into Spanish by producing either the bare noun (Experiment 2a) or the noun phrase (Experiment 2b). We expected to confirm the effect of gender congruency found in Experiment 1 with Russian–Spanish bilinguals, an effect previously found in languages with a similar gender system (Bordag & Pechmann, 2007; Paolieri et al., 2010). Previous studies, however, have evaluated the gender congruency effect with concrete nouns only. Therefore, the main goal of Experiment 2 was to evaluate, for the first time, the possible interaction between concreteness, gender congruency, and the syntactic demands of the tasks in symmetrical languages such as Italian and Spanish. We expected to observe the effect of grammatical gender for both bare noun translation and noun phrase translation (Paolieri et al., 2010), suggesting that the gender systems of the two languages, Italian and Spanish, are integrated at the lexical level. Importantly, if semantic information and grammatical gender are interrelated, the concreteness by gender congruency interaction would be observed, as in Experiment 1.

## Method

### Participants

Participants were 32 Italian–Spanish advanced bilinguals (L1–L2, respectively) randomly assigned to Experiment 2a (bare noun task) and Experiment 2b, (noun phrase task) with 16 participants in each experiment. Participants in the two experiments were equated in terms of demographic characteristics and proficiency in L1 and L2 (all  $p$ s > .05): see Table 1. They were all paid for their participation. The experimental data were collected at the University of Granada.

### Design and materials

A  $2 \times 2 \times 2$  mixed design was used. Two factors were manipulated within-subjects: gender congruency (congruent vs. incongruent) and word concreteness

(abstract vs. concrete). The factor of task (bare noun vs. article + noun) was manipulated between-subjects.

Twenty-eight concrete nouns were selected: 14 nouns had the same gender in Italian and Spanish, the gender-congruent condition (e.g., *finestra/ventana*, – window–, both feminine), and 14 nouns had a different gender in the two languages, the gender-incongruent condition (e.g., *letto/cama*, – bed–, masculine in Italian and feminine in Spanish). In each set, half of the nouns were masculine and half feminine. Similarly, 28 abstract nouns were selected, 14 of which had the same gender in Italian and Spanish – the gender-congruent condition (e.g., *sviluppo/desarrollo*, –development–, both masculine), and 14 with different genders in the two languages – the gender-incongruent condition (e.g., *paura/miedo*, –fear–, feminine in Italian and masculine in Spanish). In each set, half of the nouns were masculine and half feminine in both languages (see Table 5). The group of concrete and abstract nouns differed in concreteness and imageability values (Sebastián et al., 2000). Concreteness values were  $M = 5.60$  ( $SD = 2.00$ ) for concrete nouns, and  $M = 4.41$  ( $SD = 1.49$ ) for abstract nouns,  $t(54) = 2.53$ ,  $p = .014$ . Imageability values were  $M = 5.39$  ( $SD = 1.95$ ) for concrete nouns, and  $M = 4.02$  ( $SD = 1.07$ ) for abstract nouns,  $t(54) = 3.25$ ,  $p = .002$ . The gender-congruent and gender-incongruent sets were matched for lexical variables in the two languages (Spanish, Alameda & Cuetos, 1995; Italian, Bertinetto, Burani, Laudanna, Marconi, Ratti, Rolando & Thornton, 2005). Word length (number of letters) and word frequency were similar in the two gender congruency conditions in L1 and L2 (all  $F$ s < 1) (see Table 2). Finally, the congruent and incongruent conditions were matched as closely as possible in term of nouns with transparent endings for grammatical gender. For concrete nouns, 11 Italian words and 11 Spanish words in each congruency condition were transparent. For abstract words, 13 Italian words in each congruency condition were transparent, 13 Spanish words were transparent in the congruent condition, and 14 Spanish words in the incongruent condition. No cognates were included in the lists. The complete set of materials is reported in Appendix B.

### Procedure

The procedure used in Experiment 2 was exactly the same as that described in Experiment 1, with the exception that the L1/L2 languages changed from Russian/Spanish (Experiment 1) to Italian/Spanish (Experiment 2).

### Results

We used the same criteria described in Experiment 1 to discard responses for the translation latency analysis. The percentage of responses eliminated from the latency analyses was 21% in the bare noun task and 12% in

Table 5. Experiment 2. Design and Examples

Condition	Gender (L1/L2)	Italian (L1)	Spanish (L2)	English Translation
Abstract Words				
Congruent	f/f	<i>ricerca</i>	<i>búsqueda</i>	search
Congruent	m/m	<i>sviluppo</i>	<i>desarrollo</i>	development
Incongruent	f/m	<i>rugiada</i>	<i>rocío</i>	dew
Incongruent	m/f	<i>scherzo</i>	<i>broma</i>	joke
Concrete Words				
Congruent	f/f	<i>sciarpa</i>	<i>bufanda</i>	scarf
Congruent	m/m	<i>pomodoro</i>	<i>tomate</i>	tomato
Incongruent	f/m	<i>forchetta</i>	<i>tenedor</i>	fork
Incongruent	m/f	<i>stivale</i>	<i>bota</i>	boot

Note. The gender congruency conditions (congruent, incongruent) and word concreteness conditions (abstract, concrete) were used in the two translation tasks (bare noun translation and article + noun translation). f = feminine; m = masculine.

Table 6. Mean of Translation Latencies (RTs, in milliseconds), Standard Deviations (in brackets) and Percentage of Errors as a Function of Tasks and Experimental Conditions of Experiment 2 and magnitude of congruency effects

	Concrete Nouns		Abstract Nouns	
	RTs	E%	RTs	E%
Bare Noun Task				
Congruent	831 (113)	1.7 (2.1)	898 (133)	1.6 (2.3)
Incongruent	894 (108)	1.9 (2.5)	934 (167)	1.9 (4.2)
<i>Congruent vs. Incongruent</i>	−63		−36	
Article + Noun task				
Congruent	810 (102)	1.3 (2.1)	909 (109)	1.8 (3.2)
Incongruent	911 (122)	2.1(2.4)	941 (109)	1.8 (2.9)
<i>Congruent vs. Incongruent</i>	−101		−31	

the article + noun task. The lower percentage of data discarded in Experiment 2 relative to Experiment 1 (29% and 37%, respectively) could be due to the different length of the experiments (120 trials in Experiment 1 vs. 56 trials in Experiment 2). In addition, the higher degree of orthographic-phonological similarity between the bilinguals' two languages in Experiment 2 (Italian–Spanish) might reduce the number of outlier responses relative to Experiment 1 (Russian–Spanish bilinguals). The mean translation latencies, standard deviations, and error rates are shown in Table 6.

The analyses revealed a significant effect of concreteness,  $F_1(1, 30) = 30.73, p < .001, \eta_p^2 = .51; F_2(1, 26) = 12.05, p = .002, \eta_p^2 = .32$ , indicating that concrete nouns were translated faster ( $M = 862$  ms,  $SD = 117$ ) than abstract nouns ( $M = 921$  ms,  $SD = 130$ ). The gender congruency effect was significant,  $F_1(1, 30) = 44.43,$

$p < .001, \eta_p^2 = .60; F_2(1, 26) = 7.18, p = .013, \eta_p^2 = .22$ , revealing that gender-congruent stimuli led to faster translation latencies ( $M = 862$  ms,  $SD = 120$ ) than gender-incongruent stimuli ( $M = 920$  ms,  $SD = 127$ ). Importantly, the interaction between concreteness and grammatical gender reached significance in the analysis by subjects,  $F_1(1, 30) = 7.17, p = .012, \eta_p^2 = .19$ ; but not by items,  $F_2(1, 26) = 1.71, p = .20, \eta_p^2 = .06$  (concrete congruent,  $M = 821$  ms,  $SD = 116$ ; concrete incongruent,  $M = 903$  ms,  $SD = 139$ ; abstract congruent,  $M = 904$  ms,  $SD = 120$ ; abstract incongruent,  $M = 938$  ms,  $SD = 107$ ). Planned comparisons revealed a gender congruency effect (34 ms) for abstract nouns,  $F_1(1, 31) = 4.67, p = .039, \eta_p^2 = .13; F_2(1, 27) = .59, p = .45, \eta_p^2 = .02$ , and a gender congruency effect (82 ms) for concrete words,  $F_1(1, 31) = 98.62, p < .001, \eta_p^2 = .76; F_2(1, 26) = 8.14, p = .008, \eta_p^2 = .23$ . The effect of task and other

interactions were not significant (all  $F_s < 1$ ). An error analysis was not conducted due to the low number of translation errors (see Table 4).

As in Experiment 1, Bayesian analyses were conducted in order to further evaluate the RT data found in this experiment. The concreteness by gender congruency interaction was preferred over the main effects of these two variables ( $BF_{10} = 3.508$ ). When the production of abstract words was considered, a model including the effect of gender congruency was preferred ( $BF_{10} = 76988.248$ ) over a model that did not include this variable ( $BF_{01} = 1.316e - 5$ ). Similarly, when the production of concrete nouns was taken into account, a model including gender congruency was preferred ( $BF_{10} = 9.195e + 7$ ) over a model that did not include this variable ( $BF_{01} = 1.082e - 8$ ). Moreover, even when a model with gender congruency effect was preferred in the production of concrete and abstract words, the effect of this variable was  $BF_{10} = 1194.338$  times more likely to occur with concrete words relative to abstract words. Therefore, Bayesian analyses confirmed the results of those analyses conducted with a classical frequentist approach previously described.

The results of Experiment 2 with Italian–Spanish bilinguals both strengthened and served as a control for those obtained in Experiment 1 with Russian–Spanish bilinguals. This allowed us to replicate the effect of gender with concrete words and to observe how the effect of gender in abstract words behaves in languages with a symmetric gender correspondence.

In Experiment 2, we found a significant effect of concreteness, with concrete nouns translated faster than abstract nouns. Moreover, the grammatical gender of nouns in the non-response L1 language (Italian) affected naming in the L2 response language (Spanish). The same pattern of results was observed in the bare noun and article + noun task; gender-congruent stimuli led to faster translation latencies than gender-incongruent stimuli. Critically, the magnitude of the gender congruency effect was large when bilinguals translated concrete nouns relative to the translation of abstract nouns in this experiment. In the following section, we present a more in-depth discussion of the results found in this study.

## General discussion

In the current study, we evaluated whether bilinguals co-activate their languages at the grammatical level when they produce speech in their second language. To this end, the gender congruency effect was examined. In particular, we considered three important factors that might influence the processing of gender information in bilinguals. These were the proximity of the bilinguals' two languages, the need to retrieve grammatical gender to

produce speech, and the relationship between semantics and gender processing.

The present study revealed that the grammatical gender of L1 affects the production of L2 word translation. Bilinguals translated words faster when there was congruency in the gender of these words across languages than when the words were gender-incongruent. This gender congruency effect appears to be a reliable phenomenon, since it has been observed in bilinguals of languages with a different degree of similarity such as Russian–Spanish and Italian–Spanish, and with different translation tasks, including bare noun and noun phrase translation in L2. The presence of gender congruency effects is consistent with the hypothesis that the selection of one lexical representation involves access to grammatical gender features (e.g., Cubelli et al., 2005).

To evaluate the role of the proximity of the languages spoken by the bilinguals, we compared two sets of bilinguals that varied in their L1 (Russian in Experiment 1, Italian in Experiment 2) with both having the same L2 (Spanish). It could be argued that co-activation of gender information and the subsequent gender congruency effect might differ between the two groups of bilinguals. In fact, Italian and Spanish are very closely related languages; both are Romance languages, with the same script and gender systems (two gender classes, masculine and feminine). In contrast, Russian and Spanish differ both in terms of script and gender system (three gender classes in Russian). The results found in our study indicate that, overall, gender congruency effects were observed in the two groups of bilinguals. This observation, in two languages with very different gender systems such as Russian and Spanish, is in line with the results found in languages that share the same gender system, such as Czech–German (Bordag & Pechmann, 2007) and Italian–Spanish (Paolieri et al., 2010; see also Costa et al., 2003; for an advantage when gender-congruent stimuli are processed in Catalan–Spanish, Spanish–Catalan, and Italian–French bilinguals), as well as with the results found in languages with similar gender systems such as German and Dutch (Lemhöfer et al., 2008), or asymmetric gender systems such as Spanish and German (Klassen, 2016). Thus, it appears that bilinguals co-activate their languages at the lexical level regardless of the similarities of their gender systems and scripts. In line with this conclusion, co-activation has been demonstrated at other linguistic levels (e.g., the phonological level) in bilinguals with different scripts (e.g., cognate facilitation in picture naming with Japanese–English bilinguals, Hoshino & Kroll, 2008). Taken together, these findings suggest that between-language co-activation occurs at different levels of processing (grammatical, phonological) regardless of the languages spoken by the bilinguals. However, this conclusion should be treated with caution. A close examination of the results found in Experiments



1 and 2 revealed some differences depending on the languages spoken by the bilinguals. To be more specific, a gender congruency effect was readily observed in Italian–Spanish bilinguals (it was found with both concrete and abstract nouns in the two translation tasks) while it was limited to some circumstances in Russian–Spanish bilinguals. In the latter case the effect was observed with concrete nouns in the two translation tasks (bare noun and noun phrase); but it was found with abstract nouns only when the task required the retrieval of grammatical gender in order to select the article that agreed in gender with the noun (article + noun translation in L2).

As mentioned in the introduction, it is not clear whether grammatical gender is automatically retrieved whenever participants perform production tasks (Cubelli et al., 2005; Paolieri et al., 2010) or whether it is only activated when needed to perform the task (Caramazza & Miozzo, 1997; Levelt et al., 1999). The results found in this study appear to be in favour of the first alternative, albeit with some restrictions. Gender congruency effects can be found when participants produce names in isolation (e.g., Italian–Spanish bilinguals); but, the degree of grammatical gender activation depends on the proximity of the languages (Russian–Spanish bilinguals did not show the effect when translating abstract words in isolation).

An important finding observed in the current study was the modulatory role played by the concreteness of words in producing the gender congruency effect. Russian–Spanish bilinguals showed gender congruency effects when they translated concrete nouns and noun phrases. However, for abstract nouns, a different pattern of results emerged in bare noun and noun phrase production tasks, with an influence of L1 grammatical gender only when the production of a syntactic context was directly required. This differential effect for concrete and abstract words could be due to the reduced similarity that abstract words share with their translations at the semantic level in comparison with concrete words (Van Hell & de Groot, 1998). Thus, it seems that in bare noun production, words with more similarities across languages at the semantic level (concrete words) and the grammatical level (gender-

congruent words) are more readily processed relative to less similar words (abstract words and incongruent words). This preliminary conclusion is further supported by the results found in Experiment 2. Italian–Spanish bilinguals showed gender congruency facilitation in the bare noun and noun phrase translation tasks, with a stronger gender congruency effect for concrete nouns compared with abstract nouns.

To explain the present findings, we assume that the grammatical gender effect in forward translation tasks is located at the lexical level (Cubelli et al., 2005; Paolieri et al., 2010). In bilingual speakers, the L1 lexical representation of the target noun, which is activated by the visual presentation of a written word, would spread activation to the L2 lexical representation. Thus, when there is greater similarity between the lexical representations of the two nouns across languages, there will be stronger activation of the L2 noun. This means that when two nouns share the same gender class, the L2 representation is activated more readily, thus producing a decrease in L2 translation latencies (the gender congruency facilitation observed in our study). In addition, the concreteness of the words modulates the response times in gender-congruent and incongruent conditions throughout the semantic system, where concrete words have more semantic features than abstract words (e.g., de Groot, 1989; Plaut & Shallice, 1993), and concrete nouns thus share more semantic similarities with their translations (Van Hell & de Groot, 1998). Therefore, similarities in terms of both the semantic level and the gender system favour the processing of words in translation tasks.

To conclude, the present study provides evidence for cross-language activation of grammatical gender in bilinguals. The findings reported here suggest that different written scripts, gender values, and gender systems are not sufficient to restrict cross-language activation of grammatical gender during lexical access in language production. Moreover, semantic variables modulate the gender congruency effect, suggesting a close relationship between semantics and grammatical information in bilingual language production. Future research will be needed to shed more light on this issue.

## Appendix A

### Stimuli used in Experiment 1

Abstract Words						Concrete Words					
Condition	Gender	L1	L1	L2	English	Condition	Gender	L1	L1	L2	English
		Russian (Cyrillic)	Russian (Roman)					Russian (Cyrillic)	Russian (Roman)		
Con.	m/m	поцелуй	poceluj	beso	kiss	Con.	m/m	глаз	glaz	ojo	eye
Con.	m/m	завтрак	zavtrak	desayuno	breakfast	Con.	m/m	вертолет	vertolet	helicóptero	helicopter
Con.	m/m	ветер	veter	viento	wind	Con.	m/m	грузовик	gruzovik	camión	truck
Con.	m/m	смысл	smysl	sentido	sense	Con.	m/m	палец	palec	dedo	finger
Con.	m/m	конец	konec	final	final	Con.	m/m	лес	les	bosque	forest
Con.	m/m	порядок	porádok	orden	order	Con.	m/m	самолет	samolet	avión	airplane
Con.	m/m	воздух	vozduh	aire	air	Con.	m/m	подарок	podarok	regalo	present
Con.	m/m	запах	zapah	olor	odor	Con.	m/m	шкаф	škaf	armario	closet
Con.	m/m	совет	sovet	consejo	advice	Con.	m/m	треугольник	treugol'nik	triángulo	triangle
Con.	m/m	крик	krik	grito	scream	Con.	m/m	хлеб	hleb	pan	bread
Con.	f/f	надежда	nadežda	esperanza	hope	Con.	f/f	голова	golova	cabeza	head
Con.	f/f	природа	priroda	naturaleza	nature	Con.	f/f	башня	bašnâ	torre	tower
Con.	f/f	неделя	nedelâ	semana	week	Con.	f/f	лестница	lestnica	escalera	stairs
Con.	f/f	дружба	družba	amistad	friendship	Con.	f/f	звезда	zvezda	estrella	star
Con.	f/f	выставка	vystavka	exposición	exposition	Con.	f/f	бутылка	butylka	botella	bottle
Con.	f/f	покупка	pokupka	compra	purchase	Con.	f/f	змея	zmeâ	serpiente	snake
Con.	f/f	тюрьма	tûr'ma	prisión	prison	Con.	f/f	улица	ulica	calle	street
Con.	f/f	темнота	temnota	oscuridad	darkness	Con.	f/f	спина	spina	espalda	back
Con.	f/f	продажа	prodaža	venta	sale	Con.	f/f	стена	stena	pared	wall
Con.	f/f	потеря	poterâ	pérdida	loss	Con.	f/f	улыбка	ulybka	sonrisa	smile
InCon.	m/f	вход	vhod	entrada	entry	InCon.	m/f	дом	dom	casa	home
InCon.	m/f	выход	vyhod	salida	departure	InCon.	m/f	остров	ostrov	isla	island
InCon.	m/f	возраст	vozzrast	edad	age	InCon.	m/f	галстук	galstuk	corbata	tie
InCon.	m/f	туман	tuman	niebla	fog	InCon.	m/f	нос	nos	naríz	nose
InCon.	m/f	взрыв	vzryv	explosión	explosion	InCon.	m/f	стол	stol	mesa	table
InCon.	m/f	голос	golos	voz	voice	InCon.	m/f	чемодан	čemodan	maleta	bag
InCon.	m/f	праздник	prazdnik	fiesta	party	InCon.	m/f	велосипед	velosiped	bicicleta	bicycle
InCon.	m/f	фильм	fil'm	película	movie	InCon.	m/f	снег	sneg	nieve	snow
InCon.	m/f	адрес	adres	dirección	address	InCon.	m/f	ключ	klûč	llave	key
InCon.	m/f	долг	dolg	deuda	debt	InCon.	m/f	журнал	žurnal	revista	magazine

## Appendix A

Continued

Abstract Words						Concrete Words					
Condition	Gender	L1 Russian (Cyrillic)	L1 Russian (Roman)	L2 Spanish	English	Condition	Gender	L1 Russian (Cyrillic)	L1 Russian (Roman)	L2 Spanish	English
InCon.	f/m	поддержка	podderžka	apoyo	support	InCon.	f/m	пустыня	pustynâ	desierto	desert
InCon.	f/m	тысяча	tysâča	mil	one thousand	InCon.	f/m	бумага	bumaga	papel	paper
InCon.	f/m	работа	rabota	trabajo	work	InCon.	f/m	перчатка	perčatka	guante	glove
InCon.	f/m	попытка	popytka	intento	tried	InCon.	f/m	машина	mašina	coche	car
InCon.	f/m	ошибка	ošibka	error	error	InCon.	f/m	дорога	doroga	camino	path
InCon.	f/m	сказка	skazka	cuento	story	InCon.	f/m	газета	gazeta	periódico	newspaper
InCon.	f/m	прогулка	progulka	paseo	walk	InCon.	f/m	шляпа	šlâpa	sombrero	hat
InCon.	f/m	точка	točka	punto	point	InCon.	f/m	книга	kniga	libro	book
InCon.	f/m	тишина	tišina	silencio	silence	InCon.	f/m	страна	strana	país	country
InCon.	f/m	шутка	šutka	chiste	joke	InCon.	f/m	деревня	derevnâ	pueblo	town
InCon.-N.	n/m	начало	načalo	comienzo	start	InCon.-N.	n/m	платье	plat'e	vestido	dress
InCon.-N.	n/m	число	čislo	número	number	InCon.-N.	n/m	кладбище	kladbiše	cementerio	cemetery
InCon.-N.	n/m	чувство	čuvstvo	sentimiento	feeling	InCon.-N.	n/m	небо	nebo	cielo	heaven
InCon.-N.	n/m	желание	želanie	deseo	wish	InCon.-N.	n/m	дерево	derevo	árbol	tree
InCon.-N.	n/m	будущее	budušee	futuro	future	InCon.-N.	n/m	мороженое	moroženoie	helado	frozen
InCon.-N.	n/m	прошлое	prošloe	pasado	past	InCon.-N.	n/m	сердце	serdce	corazón	heart
InCon.-N.	n/m	уважение	uvaženie	respeto	respect	InCon.-N.	n/m	плечо	plečo	hombro	shoulder
InCon.-N.	n/m	лето	leto	verano	summer	InCon.-N.	n/m	животное	životnoe	animal	animal
InCon.-N.	n/m	эхо	èho	eco	echo	InCon.-N.	n/m	солнце	solnce	sol	sun
InCon.-N.	n/m	зло	zlo	mal	evil	InCon.-N.	n/m	здание	zdanie	edificio	building
InCon.-N.	n/f	пятно	pâtno	mancha	stain	InCon.-N.	n/f	окно	okno	ventana	window
InCon.-N.	n/f	слово	slovo	palabra	word	InCon.-N.	n/f	колени	koleno	rodilla	knee
InCon.-N.	n/f	свидание	svidanie	cita	appointment	InCon.-N.	n/f	посольство	posol'stvo	embajada	embassy
InCon.-N.	n/f	мнение	mnenie	opinión	opinion	InCon.-N.	n/f	лицо	lico	cara	expensive
InCon.-N.	n/f	здоровье	zdorov'e	salud	health	InCon.-N.	n/f	полотенце	polotence	toalla	towel
InCon.-N.	n/f	сомнение	somnenie	duda	doubt	InCon.-N.	n/f	письмо	pis'mo	carta	letter
InCon.-N.	n/f	качество	kačestvo	calidad	quality	InCon.-N.	n/f	молоко	moloko	leche	milk
InCon.-N.	n/f	прощание	prošanie	despedida	farewell	InCon.-N.	n/f	одеяло	odeâlo	manta	blanket
InCon.-N.	n/f	обещание	obešanie	promesa	promise	InCon.-N.	n/f	масло	maslo	mantequilla	butter
InCon.-N.	n/f	известие	izvestie	noticia	news	InCon.-N.	n/f	мясо	mâso	carne	meat

Note. Con = Congruent; InCon. = Incongruent; InCon.-N. = Incongruent-Neuter; f = feminine; m = masculine; n = neuter.

## Appendix B

### Stimuli used in Experiment 2

Abstract Words					Concrete Words				
Condition	Gender	L1 Italian	L2 Spanish	English	Condition	Gender	L1 Italian	L2 Spanish	English
Con.	f/f	ricerca	búsqueda	search	Con.	f/f	sciarpa	bufanda	scarf
Con.	f/f	fretta	prisa	hurry	Con.	f/f	padella	sartén	skillet
Con.	f/f	sconfitta	derrota	defeat	Con.	f/f	farfalla	mariposa	butterfly
Con.	f/f	vicinanza	cercanía	closeness	Con.	f/f	finestra	ventana	window
Con.	f/f	scommessa	apuesta	bet	Con.	f/f	gonna	falda	skirt
Con.	f/f	fermata	parada	stop	Con.	f/f	valigia	maleta	bag
Con.	f/f	bugia	mentira	lie	Con.	f/f	ape	abeja	bee
Con.	m/m	aiuto	socorro	help	Con.	m/m	cane	perro	dog
Con.	m/m	pranzo	almuerzo	lunch	Con.	m/m	sgabello	taburete	stool
Con.	m/m	lavoro	trabajo	work	Con.	m/m	bicchiere	vaso	glass
Con.	m/m	rumore	ruido	noise	Con.	m/m	sedano	apio	celery
Con.	m/m	sorso	buche	maw	Con.	m/m	orologio	reloj	clock
Con.	m/m	sviluppo	desarrollo	development	Con.	m/m	pomodoro	tomate	tomato
Con.	m/m	schifo	asco	disgust	Con.	m/m	formaggio	queso	cheese
InCon.	f/m	gelosia	celo	zeal	InCon.	f/m	scimmia	mono	monkey
InCon.	f/m	noia	aburrimento	boredom	InCon.	f/m	spazzola	cepillo	brush
InCon.	f/m	rugia	rocío	dew	InCon.	f/m	forchetta	tenedor	fork
InCon.	f/m	stanchezza	cansancio	fatigue	InCon.	f/m	spina	enchufe	plug
InCon.	f/m	colazione	desayuno	breakfast	InCon.	f/m	scarpa	zapato	shoe
InCon.	f/m	cura	cuidado	watch out	InCon.	f/m	macchina	coche	car
InCon.	f/m	paura	miedo	fear	InCon.	f/m	busta	sobre	envelope
InCon.	m/f	allevamento	cría	breeding	InCon.	m/f	letto	cama	bed
InCon.	m/f	appuntamento	cita	appointment	InCon.	m/f	cuscino	almohada	pillow
InCon.	m/f	scherzo	broma	joke	InCon.	m/f	stivale	bota	boot
InCon.	m/f	incubo	pesadilla	nightmare	InCon.	m/f	zaino	mochila	backpack
InCon.	m/f	compito	tarea	homework	InCon.	m/f	piccione	paloma	dove
InCon.	m/f	aspetto	pinta	appearance	InCon.	m/f	fucile	escopeta	shotgun
InCon.	m/f	strato	capa	cap	InCon.	m/f	tavolo	mesa	table

Note. Con = Congruent; InCon. = Incongruent; InCon-N. = Incongruent-Neuter; f = feminine; m = masculine.



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