

THE RELATION BETWEEN GENDER AND NUMBER AGREEMENT PROCESSING

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Abstract. We report an experiment in which we test the relationship between gender and number in subject-predicate agreement. We also test the link between two different number-agreement relations—subject-verb and subject–predicative adjective. Participants saw first an unmarked adjective and then a sentence fragment consisting of a complex subject with a head noun and a modifier containing a second noun and were asked to make a whole sentence using the adjective with the proper gender and number markings. The gender of the subject head and the gender and number of the attractor noun were manipulated. Number errors in the verb and number and gender errors in the predicative adjective were measured. The results suggest gender agreement is computed independently of number agreement. In contrast, subject-verb number agreement and subject–predicative adjective number agreement are a unitary process. The implications for psycholinguistic and linguistic theories of gender and number are discussed.

1. Introduction

There is a fair amount of psycholinguistic literature on agreement processing. The research has focused mainly on number agreement in different languages: English (Bock & Miller 1991; Bock & Cutting 1992; Bock & Eberhard 1993; Vigliocco, Butterworth & Garrett 1996; Vigliocco & Nicol 1998), Spanish (Vigliocco, Butterworth & Garrett 1996; Antón-Méndez 1996), Italian (Vigliocco, Butterworth & Semenza 1995), French (Vigliocco, Hartsuiker, Jarema & Kolk 1996), and Dutch (Vigliocco et al. 1996; Hartsuiker, Antón-Méndez & Van Zee 2001). Another type of agreement that has come recently to the forefront is gender agreement. Because English lacks grammatical gender specification on nouns, the research has been carried out in Italian (Vigliocco & Franck 1999), French (Vigliocco & Franck 1999), and Spanish (Vigliocco, Antón-Méndez, Franck & Collina 1999).

The purpose of the experiment reported here is to explore the relationship between several forms of agreement. On the one hand, we investigate the relationship between gender and number—whether gender and number features associated with a given noun behave independently of each other. And, on the other hand, we study the relationship between different agreement relations concerning a single feature—whether number agreement with different elements in the sentence is a single or multiple process, that is, whether number agreement of the subject head with the verb occurs separately from number agreement of the head noun with a predicative adjective.

1.1 *Agreement in Spanish*

The language chosen to study these relationships between different forms of agreement is Spanish. In Spanish, all nouns are either masculine or feminine. There are also two levels of gender specification: grammatical and semantic. Nouns referring to objects and concepts have grammatical gender that is arbitrary, has no semantic import, and is not a property that differentiates between linguistic opposites:

- (1) molino
mill.MASC
- (2) venta
inn.FEM

On the other hand, the gender of nouns referring to animate beings is mostly semantically meaningful:

- (3) dueño
owner.MASC (refers to a male)
- (4) dueña
owner.FEM (refers to a female)

But there are some exceptions—there are some nouns whose referents are humans or animals but whose gender is independent of their biological sex:

- (5) Don Quijote fue la víctima de una imaginación
Don.MASC Quixote was the.FEM victim.FEM of a.FEM imagination.FEM
exaltada.
exalted.FEM

As can be seen in the previous examples, many of the masculine nouns end in *-o* and many of the feminine nouns end in *-a*. They are the morphologically regular nouns and constitute the majority of the nouns (68.15%). There are also other nouns that end in other vowels or in a consonant, or that end in *-o* and are feminine or in *-a* and are masculine. We will not be concerned with these morphologically irregular nouns.

Gender and number agreement is required between nouns and their adjectives, determiners, and quantifiers. But number agreement also holds between nouns and verbs. For the purposes of this experiment, we are interested in the gender agreement between the subject noun and a predicative adjective, and in number agreement between the subject noun and both the verb and the predicative adjective.

1.2 Psycholinguistics of Number and Gender Agreement

Most of the psycholinguistic literature on number agreement is based on the relation between the subject noun and the verb in a sentence. The experimental results have shown that, when sentence beginnings (or “preambles”) containing two nouns—a subject head noun, and a second “attractor” noun in a phrasal or clausal modifier of the subject head—had to be completed, more verb-number errors occurred for preambles where the two nouns in the subject phrase mismatched in number. Furthermore, this mismatch effect (which we refer to as the “congruency effect”) was significantly greater when the head noun was singular and the attractor was plural (Bock & Miller 1991, Bock & Cutting 1992, Bock & Eberhard 1993). This asymmetrical pattern of results has been found to hold for languages other than English, like Dutch and Spanish (Vigliocco et al. 1996; Vigliocco, Butterworth & Garrett 1996; Antón-Méndez 1996). It has been interpreted as a reflection of an underlying asymmetry in the way number is specified: there is a default or unmarked number—singular, and a marked one—plural (Eberhard 1993). Speakers are more likely to make an error when the attractor’s number is a marked plural and thus more salient than the singular unmarked head noun.

The experimental research on gender agreement is less copious. It has largely been concerned with the relation between the subject noun and a predicative adjective. Results indicate that there is no default gender for subject-predicate agreement in languages such as Italian (Vigliocco & Franck 1999) and Spanish (Antón-Méndez 1999, Vigliocco et al. 1999). The congruency effect, on the other hand, has also been a consistent finding in all the gender-agreement experiments, which suggests that a similar mechanism is responsible for both types of agreement or, at least, for both types of errors. The question of interest here is whether the same mechanism processes both types of agreement simultaneously and over all the sentential elements that require agreement.

It is pertinent to note that the rates of number and gender agreement errors within a language could differ considerably, which could be interpreted as evidence for different agreement mechanisms. For example, the proportion of number agreement errors in Spanish has been reported at 8.4% by Antón-Méndez (1996), whereas the proportion of gender agreement errors (found in experiment 1 in Antón-Méndez 1999) is only 3.0%. Nicol and O’Donnell (1999) found the same difference between gender and number errors in English. In their experiment, participants had to repeat and add tag questions to sentences with a complex subject (e.g., *The girl behind the headmaster got punished, didn’t she?*), in which the number and gender of the two nouns inside the subject were manipulated. They looked at the error rates for the tag pronouns. They found that tag-pronoun errors involving number were far greater (7.4%) than those involving gender (4%). However, it is also true that the proportion of number agreement errors also varies across experiments

(e.g., the error proportion in Vigliocco, Butterworth & Garrett's [1996] Spanish experiment is only 5.2%), and, although some of the differences could be due to different presentation procedures, the instructions received by the participants, or their overall level of education (Bock, Eberhard, Cutting & Meyer 2001), this makes it difficult to draw definitive conclusions from comparisons of error rates.

There is other psycholinguistic evidence that gender and number are independent. Igoa, García-Albea, and Sánchez-Casas (1999) compared gender and number both with respect to how they are represented and with respect to how they are processed in the course of language production. In their view, which they call the Dissociation Hypothesis, grammatical gender, one of the two levels of gender, is part of the lemma (the part of a word's representation that contains the syntactic and semantic information; Kempen & Hoenkamp 1987), whereas number is determined independently of the lemma. They looked at speech-error data to determine whether there was a difference in the way the two features behaved. They hypothesized that if gender is more tightly linked to the word stem than number is, it should be stranded less often; that is, whenever there is an error involving an exchange between two words in a sentence, gender would be more likely to appear with the stem in the erroneous position, whereas number would be more likely to be stranded, accompanying the wrong stem. This is indeed what they found—gender is more likely to be moved with the nouns in word exchanges, as in the following error taken from the Spanish corpus of Del Viso, Igoa, and García-Albea (1987):

- (6) Estos son los coches de la llave.
 these.MASC.PL are the.MASC.PL cars.MASC.PL of the.FEM.SG key.FEM.SG
 cf. Estas son las llaves del coche.
 these.FEM.PL are the.FEM.PL keys.FEM.PL of-the.MASC.SG car.MASC.SG

Also, gender morphemes are unlikely to be part of an exchange (see also García-Albea, Del Viso & Igoa 1989) probably because a nonword would be created, as in the error in (7) (from Igoa, García-Albea & Sánchez-Casas 1999), where the two words affected by the gender exchange turn into nonwords:

- (7) He cantado líneo y binga.
 I-have cried line.MASC and bingo.FEM
 cf. He cantado línea y bingoo.
 I-have cried line.FEM and bingo.MASC

In addition to the analysis of speech errors, Igoa, García-Albea, and Sánchez-Casas (1999) also report the results of an experiment in which they elicited morpheme exchanges by giving participants complex NPs with two nouns (*unos gatos de la niña*, 'some.MASC.PL cats.MASC.PL of the.FEM.SG girl.FEM.SG') and asking them to exchange the two nouns in their response (*una niña de los*

gatos, ‘a.FEM.SG girl.FEM.SG of the.MASC.PL cats-MASC.PL’). If there is a stronger relationship between the noun stem and the gender affix than between the noun stem and the number affix, number would be more likely stranded and gender would be more likely to move with the noun stem. As expected, they found that number stranding was far more likely than gender stranding. They also found differences between the levels of gender, with gender stranding being more common for nouns carrying semantic gender (*el niño/la niña*, ‘the boy/the girl’) and less common for nouns carrying purely grammatical gender (*el libro/la libra*, ‘the book/the pound’). These results are evidence of the independence of the two types of features with respect to how they are specified on the noun—that is, the link between the noun stem and the two features. The question of how agreement implementation proceeds from here is a different one.

An interesting report in this regard is that of Centeno and Obler (1994), who studied number and gender impairment in a Spanish-speaking agrammatic subject. The patient and a matched control had to describe pictures using an article, a noun, and an adjective. The agrammatic patient showed equal preservation of number on nouns, adjectives, and articles, but her preservation of gender was significantly higher for adjectives than articles. The authors concluded that the patient was economizing on effort because of limited resources and that, given that an adjective conveys more information than an article in this task, she chose to focus on adjectives.

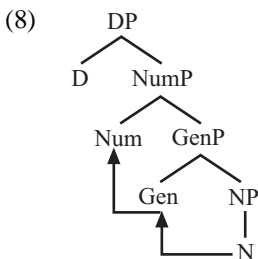
What is also interesting about these results is the fact that number and gender behaved differently. Their overall preservation was similar, but whereas the preservation of number was not limited to any one particular syntactic class, gender was differentially preserved on the two different agreement targets. The difference in preservation patterns for the two may mean that gender agreement is carried out separately from number agreement. Alternatively, the difference may be due to differences in the way the two noun properties are specified and their susceptibility to decay in memory during processing. The gender-preservation pattern also indicates that agreement with different targets is not a single process; that is, the process that determines article-noun agreement seems to be independent of the one that determines adjective-noun agreement, instead of there being one single process determining article-noun-adjective agreement.

With respect to how agreement errors arise, it could be that features from the wrong noun are transferred to the verb (e.g., Eberhard 1993, Vigliocco & Nicol 1998, Bock et al. 2001) via feature “percolation.” Another possibility is that the wrong noun is misselected as the subject head, which is the implication of models of language production where no syntactic hierarchical organization is assumed (Bates & McWhinney 1989; Fayol, Largy & Lemaire 1994). Most of the experimental results support the former hypothesis. For example, if the errors were due to head misselection, the closer to the verb an attractor noun is, the more active it would be in short-term memory at the time of producing the verb and the more agreement errors

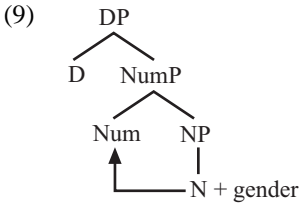
it would be expected to induce. But Vigliocco and Nicol (1998) found that what most influenced error rates on the verb was not how linearly close the attractor and the verb were but, rather, how syntactically close they were. When they asked participants to produce questions (e.g., *Is the helicopter for the flights safe?*), the verb-number error rate was similar to when participants had to produce simple sentences (e.g., *The helicopter for the flight is safe*) even though in the first case the attractor is not close to the verb. Furthermore, if what mattered for error rate was the distance between the attractor and the verb, the syntactic function of the former would not have any impact on errors when the surface distance is not altered. Bock and Cutting (1992), however, found more errors for sentence preambles such as *The report of the destructive fires* than for preambles such as *The report that they controlled the fires*, where the attractor's distance to the verb is the same. Another strong piece of evidence against the head-misselection hypothesis is the finding that the suitability of the attractor as subject of the verb does not affect errors. Bock and Eberhard (1993) found that manipulating the animacy of the nouns did not influence error rate, even though animate nouns are more likely to be subject heads than inanimate nouns. Our experiment would distinguish between the two possibilities: Head misselection would predict no independence of gender and number agreement errors in predicative adjectives because, given that it is a theory that postulates the misremembering of the subject head, it implies that the wrong noun is taken as the head with all its features; whereas an account of errors based on feature percolation would be more compatible with gender and number features being independent of each other.

1.3 Linguistic Theories of Number and Gender

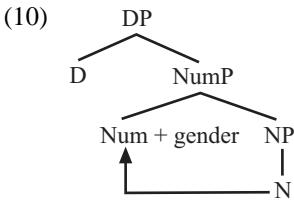
In the linguistics literature, there are basically two different proposals about how gender and number are represented syntactically within a generativist framework. Picallo (1991), for example, argues for each feature heading its own projection in the syntactic tree, on the basis of evidence from Catalan. (Arrows indicate the movement of the noun to acquire the appropriate features.)



In contrast, Ritter (1993) proposes that number heads its own projection but that gender appears either attached to the number phrase or as part of the lexical entry of the noun, depending on the language. For languages such as Hebrew, where gender can be considered a derivational suffix, it will be considered part of the lexical entry:



For languages in which gender is not a derivational suffix, such as Spanish or Italian (for nouns with grammatical gender), gender will be part of the number phrase:



Di Domenico (1995) offers a similar structural analysis, with only a number phrase headed by the number features, and no gender phrase. The difference between her proposal and Ritter's is that for Di Domenico, whether gender is attached to the number phrase or is part of the lexical entry depends on the level of gender, grammatical gender would be part of the lexical entry and would, therefore, accompany the noun (as in (9)), and semantic gender would be projected under the number phrase (as in (10)). The reason that Di Domenico does not postulate a gender phrase for the syntactic projection of semantic gender is that this would mean that the speaker would need to choose a different phrasal structure for nouns that have grammatical or semantic gender. She finds this solution undesirable and appeals to the strong connection between gender and number (Greenberg 1966) to justify her hypothesis that semantic gender is projected together with number under the number phrase. But her analysis is based on evidence from Italian, in which semantic gender is not morphologically independent from number, which makes it more plausible that both of them share a projection. What is attractive about this proposal is that it supports a different treatment of the two levels of gender nouns at a structural level, which makes it compatible with empirical results in this respect in Italian (Vigliocco & Franck 1999) and

Spanish (Igoa, García-Albea & Sánchez-Casas 1999; experiment 1 in Antón-Méndez 1999).

Picallo's proposal is also postulated to apply to Spanish, which has a similar structure to Catalan with respect to gender and number morphology, and would predict complete independence of the two features for the purpose of agreement. The alternative analysis by Ritter for Romance languages would, on the other hand, predict dependence of the two in Spanish. Finally, Di Domenico's account would predict a difference between the two levels of gender, with grammatical—but not semantic—gender being independent of number.

In the experiment reported here, we address this question of the relation between the two types of features—gender and number—with respect to agreement, and the relation between different types of agreement. We are assessing primarily (1) whether an error derived from the mismatched gender of an attractor will be accompanied by an error from the mismatched number in the same attractor, and (2) whether a number error in the verb is always accompanied by a number error in the predicative adjective. We also analyze the effects of gender congruency and number congruency on the different response categories as a control to ensure that the errors found are indeed the expected attraction errors (those found after preambles with two mismatched nouns as compared with the matched counterparts, which provide a baseline for error occurrence). Finally, and mainly for comparison with previous experiments reported in the literature, we also study the effect of gender.

2. Method

2.1 Participants

Thirty-two native Spanish speakers participated in this experiment. Most of them were students at the Instituto Tecnológico de Nogales, in Mexico; some were from the University of Arizona. The ages of the participants ranged from 18 to 42, with a mean age of 23.1. Of the 31 participants for which there are language questionnaire data (one of the language questionnaires was missing), 14 were also relatively fluent in English; the rest were monolingual Spanish speakers.

2.2 Materials

There were 64 experimental quadruplets. Items consisted of a complex sentence subject with a head noun and a prepositional modifier of the head. These sentence preambles were preceded by an adjective stem, without the morphemes specifying either gender or number. Half of the items were formed with two nouns with grammatical gender (*gr*-nouns), and half were formed with two nouns with semantic gender (*se*-nouns); all the heads were singular, but half were masculine, and half feminine. The attractors and head nouns were either matched or mismatched for gender (*G/MA* and *G/MS*,

Table 1: Example of two gr-items; one quadruplet with masculine nouns and another with feminine nouns

Condition	Adjective	Preamble
Masc-G/MA-N/MA	<i>alejad-remote</i>	<i>el terreno del establo</i> the.MASC.SG lot.MASC.SG of-the.MASC.SG stable.MASC.SG
Masc-G/MA-N/MS		<i>el terreno de los establos</i> the.MASC.SG lot.MASC.SG of-the.MASC.PL stables.MASC.PL
Masc-G/MS-N/MA		<i>el terreno de la cuadra</i> the.MASC.SG lot.MASC.SG of the.FEM.SG stable.FEM.SG
Masc-G/MS-N/MS		<i>el terreno de las cuadras</i> the.MASC.SG lot.MASC.SG of the.FEM.PL stables.FEM.PL
Fem-G/MA-N/MA	<i>bonit-pretty</i>	<i>la vista de la playa</i> the.FEM.SG view.FEM.SG of the.FEM.SG beach.FEM.SG
Fem-G/MA-N/MS		<i>la vista de las playas</i> the.FEM.SG view.FEM.SG of the.FEM.PL beaches.FEM.PL
Fem-G/MS-N/MA		<i>la vista del puerto</i> the.FEM.SG view.FEM.SG of-the.MASC.SG port.MASC.SG
Fem-G/MS-N/MS		<i>la vista de los puertos</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL

respectively) or number (N/MA means matched for number, and N/MS means mismatched for number) or both gender and number. All the nouns were morphologically regular.

An example of an item quadruplet with gr-nouns and a masculine head, followed by a quadruplet with a feminine head can be seen in Table 1. An example with se-nouns appears in Table 2.

Items were counterbalanced across four presentation lists.

There was also a set of 64 filler items with the same structure as the experimental items. All the head nouns in the fillers were plural; half of them had a plural attractor, and half had a singular attractor. They were also equally divided into preambles with gr-nouns or se-nouns, feminine or masculine heads, and matched or mismatched for gender.

2.3 Procedure

Participants were seated in front of a computer screen. They first went through six practice items with the experimenter still in the room. For the main part of the experiment, participants were left alone.

The presentation of the items was carried out on a computer-controlled video display using the DMAstr system developed by K. I. Forster and J. C. Forster at the University of Arizona.

Table 2: Example of two se-items; one quadruplet with masculine nouns and another with feminine nouns

Condition	Adjective	Preamble
Masc-G/MA-N/MA	<i>enfados-</i> tiring	<i>el suegro del molinero</i> the.MASC.SG father-in-law.MASC.SG of-the.MASC.SG miller.MASC.SG
Masc-G/MA-N/MS		<i>el suegro de los molineros</i> the.MASC.SG father-in-law.MASC.SG of-the.MASC.PL millers.MASC.PL
Masc-G/MS-N/MA		<i>el suegro de la molinera</i> the.MASC.SG father-in-law.MASC.SG of the.FEM.SG miller.FEM.SG
Masc-G/MS-N/MS		<i>el suegro de las molineras</i> the.MASC.SG father-in-law.MASC.SG of the.FEM.PL millers.FEM.PL
Fem-G/MA-N/MA	<i>aburrid-</i> boring	<i>la prima del pastelero</i> the.FEM.SG cousin.FEM.SG of the.FEM.SG pastry-cook.FEM.SG
Fem-G/MA-N/MS		<i>la prima de las pasteleras</i> the.FEM.SG cousin.FEM.SG of the.FEM.PL pastry-cooks.FEM.PL
Fem-G/MS-N/MA		<i>la prima del pastelero</i> the.FEM.SG cousin.FEM.SG of-the.MASC.SG pastry-cook.MASC.SG
Fem-G/MS-N/MS		<i>la prima de los pasteleros</i> the.FEM.SG cousin.FEM.SG of the.MASC.PL pastry-cooks.MASC.PL

For each item, participants first saw an adjective (stripped of its gender and number morphemes) for approximately 600 ms on the center of the screen. The adjective stem then disappeared. Participants had been instructed not to read the adjectives aloud but to hold them in memory in order to use them in the completion of the subsequent sentence. After a brief pause of 400 ms, a sentence preamble appeared in the center of the screen. Participants had to repeat the preamble aloud and complete the sentence by using the adjective stem they had previously seen, properly inflected. Sentence preambles remained on the screen until the participant was ready for a new item, at which point he or she was to press the spacebar. Items were presented in a different random order for each participant. All responses were tape-recorded.

A summary of the method is given in Table 3.

Table 3: Method overview

	Item display	Second	Subject response
Spanish	First <i>alejad-</i>	<i>el terreno del establo</i>	<i>el terreno del establo está alejado</i>
English gloss	remote	the.MASC.SG lot.MASC.SG of-the.MASC.SG stable.MASC.SG	the.MASC.SG lot.MASC.SG of-the.MASC.SG stable.MASC.SG is remote.MASC.SG

2.4 Predictions

There are two results of primary interest. First, if gender and number are not independent of each other for the purposes of agreement between noun and adjective, all errors involving one would also involve the other, which means that errors elicited in conditions where the attractor mismatches the head in both gender and number should be double errors—gender and number errors—and this would be evidence in favor of a head-misselection mechanism of agreement errors. Second, if number agreement with different targets is a single process, all number agreement errors in one target should be accompanied by number agreement errors in the other target—that is, verb and predicative adjective should always have the same number, whether it is the correct one or not.

2.5 Results

The responses were all transcribed and coded in the following manner:

CO = Correct responses—utterances in which the preamble and the adjective were acceptably uttered, that is, they had been read correctly or, if any word was misread, the resulting word was a grammatically acceptable substitute with the same gender and number as the target (e.g., *enfermera*, ‘nurse’, instead of *enferma*, ‘sick-woman’), and the agreement was carried out correctly

GenAdj = Gender agreement errors in adjective—utterances in which the preamble and the adjective were acceptably uttered (as defined above for correct responses), but the adjective had the wrong gender marking

Gen&NumAdj = Gender and number agreement errors in adjective—utterances in which the preamble and the adjective were acceptably uttered, and the adjective was incorrectly inflected for both gender and number

Gen&NumAdj&Verb = Gender and number agreement errors in adjective and verb—utterances in which the preamble and the adjective were acceptably uttered, and where there was both gender disagreement with the adjective and number disagreement with adjective and verb

NumAdj&Verb = Number agreement errors in adjective and verb—utterances in which the preamble and the adjective were acceptably uttered, and where both the adjective and the verb were incorrectly inflected for number

NumAdj = Number agreement errors in adjective—utterances in which the preamble and the adjective were acceptably uttered, and the adjective had the wrong number marking

NumVerb = Number agreement errors in verb—utterances in which the preamble and the adjective were acceptably uttered, and the verb was incorrectly inflected for number

Table 4: Examples of possible responses for the different coding categories

Type	Example sentence
CO	<i>la vista de los puertos es bonita</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL is pretty.FEM.SG
GenAdj	<i>la vista de los puertos es bonito</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL is.SG pretty. MASC.SG
Gen&NumAdj	<i>la vista de los puertos es bonitos</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL is.SG pretty. MASC.PL
Gen&NumAdj&Verb	<i>la vista de los puertos son bonitos</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL are.PL pretty.MASC.PL
NumAdj&Verb	<i>la vista de los puertos son bonitas</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL are.PL pretty.FEM.PL
NumAdj	<i>la vista de los puertos es bonitas</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL is.SG pretty. FEM.PL
NumVerb	<i>la vista de los puertos son bonita</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL are.PL pretty.FEM.SG
Mix	<i>la vista de los puertos encanta</i> the.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL charms.SG

Mix = Miscellaneous responses—missed items, or utterances in which some other sort of unclassifiable response was given

Examples of possible responses in the different categories are given in Table 4. The distribution of responses in the different categories for preambles with gr-nouns is given in Table 5, and for preambles with se-nouns in Table 6.

Given that the pattern of results for the two levels of gender are very similar and none of the other factors (gender, gender congruency, and number congruency) interacted with level of gender (all p 's > .05), all the results for gr- and se-nouns were pooled to simplify the analyses and to enhance the statistical power.

Of the total of 2048 responses, there were 1676 (81.8%) correct responses, 88 (4.3%) gender agreement errors, 34 (1.6%) number agreement errors in adjective and verb, 240 (11.7%) miscellaneous responses, and 9 (0.4%) responses in the other categories combined.

Multiple-factor analyses of variance were performed for all the response categories except those where most of the cells contained no responses at all—NumAdj, NumVerb, Gen&NumAdj, and Gen&NumAdj&Verb.

2.5.1 Analyses of Correct Responses

A main effect of gender was found ($F(1, 31) = 22.0, p < .01$; $F(1, 61) = 13.4, p < .01$), due to conditions with feminine head nouns containing fewer

Table 5: Gr-nouns: All response categories. Number of responses and percentages per condition in each response category. Total number of responses: 1024. Number of responses per condition: 128.

Condition	CO	Gen Adj	Gen&Num Adj	Gen& Num Adj&Verb	NumAdj&Verb	Num Adj	NumVerb	Mix
Masc-G/MA-N/MA	116 90.6%	1 0.8%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	11 8.6%
Masc-G/MA-N/MS	109 85.2%	0 0.0%	0 0.0%	1 0.8%	4 3.1%	0 0.0%	0 0.0%	14 10.9%
Masc-G/MS-N/MA	111 86.7%	14 10.1%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	3 2.3%
Masc-G/MS-N/MS	112 87.5%	7 5.5%	0 0.0%	0 0.0%	1 0.8%	0 0.0%	0 0.0%	8 6.3%
Fem-G/MA-N/MA	112 87.5%	1 0.8%	0 0.0%	0 0.0%	2 1.6%	0 0.0%	0 0.0%	13 10.2%
Fem-G/MA-N/MS	98 76.6%	3 2.3%	0 0.0%	0 0.0%	8 6.3%	2 1.6%	0 0.0%	17 13.4%
Fem-G/MS-N/MA	90 70.3%	21 16.4%	0 0.0%	0 0.0%	1 0.8%	0 0.0%	0 0.0%	16 12.5%
Fem-G/MS-N/MS	103 80.5%	5 3.9%	0 0.0%	3 2.3%	4 3.1%	0 0.0%	0 0.0%	12 9.4%
Totals	851 83.1%	52 5.1%	0 0.0%	4 0.4%	20 2.0%	2 0.2%	0 0.0%	94 9.2%

Table 6: Se-nouns: All response categories. Number of responses and percentages per condition in each response category. Total number of responses: 1024. Number of responses per condition: 128.

Condition	CO	Gen Adj	Gen&Num Adj	Gen& Num Adj&Verb	NumAdj&Verb	Num Adj	NumVerb	Mix
Masc-G/MA-N/MA	116 90.6%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	12 9.4%
Masc-G/MA-N/MS	103 80.5%	0 0.0%	0 0.0%	0 0.0%	2 1.6%	0 0.0%	0 0.0%	23 18.0%
Masc-G/MS-N/MA	100 78.1%	12 9.4%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	16 12.5%
Masc-G/MS-N/MS	107 83.6%	2 1.6%	0 0.0%	2 1.6%	4 3.1%	0 0.0%	0 0.0%	13 10.2%
Fem-G/MA-N/MA	109 85.2%	1 0.8%	0 0.0%	0 0.0%	1 0.8%	0 0.0%	0 0.0%	17 13.3%
Fem-G/MA-N/MS	99 77.3%	2 1.6%	0 0.0%	0 0.0%	6 4.7%	0 0.0%	0 0.0%	21 16.4%
Fem-G/MS-N/MA	93 92.7%	13 10.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	22 17.1%
Fem-G/MS-N/MS	98 76.6%	6 4.7%	0 0.0%	1 0.8%	1 0.8%	0 0.0%	0 0.0%	22 17.2%
Totals	825 80.6%	36 3.5%	0 0.0%	3 0.3%	14 1.4%	0 0.0%	0 0.0%	146 14.3%

correct responses; gender congruency was significant as well ($F(1, 31) = 7.1, p < .05$; $F(1, 61) = 8.4, p < .01$); and there was also a significant interaction between gender congruency and number congruency ($F(1, 31) = 16.2, p < .01$; $F(1, 61) = 12.4, p < .01$) since number mismatch has opposite effects on correct responses, depending on whether there is also a gender mismatch.

2.5.2 Analyses of Gender Agreement Errors in Adjective (GenAdj)

There was a main effect of gender congruency ($F(1, 31) = 28.1, p < .01$; $F(1, 61) = 53.4, p < .01$), where the mismatched conditions elicited the most errors; and there was also an effect of number congruency ($F(1, 31) = 22.8, p < .01$; $F(1, 61) = 13.5, p < .01$), where the mismatched conditions elicited fewer errors; the interaction was also significant ($F(1, 31) = 19.4, p < .01$; $F(1, 61) = 14.6, p < .01$) because for gender matched conditions the ones with number mismatch generated the most errors, whereas the opposite was true for gender-mismatched conditions.

2.5.3 Analyses of Number Agreement Errors in Adjective and Verb (NumAdj&Verb)

There was a main effect of number congruency ($F(1, 31) = 13.0, p < .01$; $F(1, 61) = 13.9, p < .01$), since the mismatched conditions contained the most errors; there was also an effect of gender in the subjects analysis ($F(1, 31) = 7.7, p < .01$; $F(1, 61) = 2.4, p = .13$), with more errors for feminine items.

2.5.4 Analyses of Miscellaneous Responses (Mix)

A main effect of gender was found ($F(1, 31) = 19.0, p < .01$; $F(1, 61) = 4.1, p < .05$) with more cases for items with feminine heads.

The comparison of gender-matched and gender-mismatched sentences with gr-nouns is carried out across sentences containing different nouns. Given the nature of grammatical gender, this could not be avoided. The comparisons of items with feminine and masculine heads were also across items containing different nouns. This was also unavoidable for items with gr-nouns and not avoided for items with se-nouns in order to make the two sets of items more comparable and also to minimize the number of lists and the amount or repetition within lists (otherwise participants would have encountered two instances of all the head se-nouns but only one instance of each gr-noun head). Because some contrasts involved thus preambles containing different sets of words, we compared item sets on the frequency of occurrence of the words within them, on the assumption that preambles containing infrequent words might give rise to more errors. In line with studies that have shown frequency to have little effect on error occurrence (Barker 2001), we found no

Table 7: All nouns pooled: All response categories. Number of responses and percentages per condition in each response category. Total number of responses: 2048. Number of responses per condition: 256.

Condition	CO	Gen Adj	Gen&Num Adj	Gen& Num Adj&Verb	NumAdj&Verb	Num Adj	NumVerb	Mix
Masc-G/MA-N/MA	232 90.6%	1 0.4%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	23 9.0%
Masc-G/MA-N/MS	212 82.8%	0 0.0%	0 0.0%	1 0.4%	6 2.3%	0 0.0%	0 0.0%	37 14.5%
Masc-G/MS-N/MA	211 82.4%	26 10.2%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	19 7.4%
Masc-G/MS-N/MS	219 85.5%	9 3.5%	0 0.0%	2 0.8%	5 2.0%	0 0.0%	0 0.0%	21 8.2%
Fem-G/MA-N/MA	221 86.3%	2 0.8%	0 0.0%	0 0.0%	3 1.2%	0 0.0%	0 0.0%	30 11.7%
Fem-G/MA-N/MS	197 77.0%	5 2.0%	0 0.0%	0 0.0%	14 5.6%	2 0.8%	0 0.0%	38 14.8%
Fem-G/MS-N/MA	183 71.5%	34 13.3%	0 0.0%	0 0.0%	1 0.4%	0 0.0%	0 0.0%	38 14.8%
Fem-G/MS-N/MS	201 78.5%	11 4.3%	0 0.0%	4 1.6%	5 2.0%	0 0.0%	0 0.0%	34 13.3%
Totals	1676 81.8%	88 4.3%	0 0.0%	7 0.3%	34 1.6%	2 0.1%	0 0.0%	240 11.7%

Table 8: Response categories pooled according to error features, with the three columns of interest shaded. Number of responses and percentages per condition in each response category. Total number of responses: 2048. Number of responses per condition: 256.

Condition	CO	GenAdj	Gen&Num	Num	Mix
Masc-G/MA-N/MA	232 90.6%	1 0.4%	0 0.0%	0 0.0%	23 9.0%
Masc-G/MA-N/MS	212 82.8%	0 0.0%	1 0.4%	6 1.6%	37 14.5%
Masc-G/MS-N/MA	211 82.4%	26 10.2%	0 0.0%	0 0.0%	19 7.4%
Masc-G/MS-N/MS	219 85.5%	9 3.5%	2 0.8%	5 2.7%	21 8.2%
Fem-G/MA-N/MA	221 86.3%	2 0.8%	0 0.0%	3 0.4%	30 11.7%
Fem-G/MA-N/MS	197 77.0%	5 2.0%	0 0.0%	16 6.6%	38 14.9%
Fem-G/MS-N/MA	183 71.5%	34 13.3%	0 0.0%	1 1.2%	38 14.9%
Fem-G/MS-N/MS	201 78.5%	11 4.3%	4 1.6%	5 1.6%	34 13.3%
Totals	1676 81.8%	88 4.3%	7 0.3%	36 1.7%	240 11.7%

significant differences between the masculine and feminine attractors in items with gr-nouns, between feminine and masculine heads, or between masculine and feminine forms of the adjectives: all p 's > 0.23.

To focus on the two main questions, we will pool some pertinent response categories that show no statistical differences. With respect to the first question—whether gender and number are processed independently—we are interested in total number of gender errors alone, total number of number errors alone, and total number of double errors. Table 8 shows the distribution of responses, disregarding whether the number errors were detected on the adjective or the verb. That is, the columns labeled Gen&NumAdj and Gen&NumAdj&Verb in Table 7 are now a single column labeled Gen and the columns labeled NumAdj&Verb, NumAdj, and NumVerb in Table 7 form now the column labeled Num. The statistical analyses of the new response categories is given below.

2.5.5 Analysis of Gender and Number Agreement Errors (Gen&Num)

The analysis of gender and number agreement errors showed a reliable effect of number congruency ($F(1, 31) = 7.7, p < .01; F(1, 61) = 6.9, p < .05$) with more errors in the number-mismatched conditions. Other two effects were significant in the subjects analysis but only marginally so in the items analysis: gender congruency ($F(1, 31) = 4.2, p < .05; F(1, 61) = 3.8, p =$

.06) due to more errors for gender-mismatched conditions, and the interaction of gender congruency and number congruency ($F(1, 31) = 4.2, p < .05$; $F(1, 61) = 3.8, p < .06$) due to the fact that there were considerably more errors in the conditions where both gender and number mismatched.

2.5.6 Analysis of Number Agreement Errors (Num)

For number agreement errors, there was a significant main effect of number congruency ($F(1, 31) = 13.8, p < .01$; $F(1, 61) = 14.3, p < .01$), given that number-mismatched conditions elicited more errors. Two of the effects were only partially significant: gender in the subjects analysis ($F(1, 31) = 9.1, p < .01$; $F(1, 61) = 2.8, p = .10$) reflecting the higher number of errors for items with feminine heads, and gender congruency in the items analysis ($F(1, 31) = 2.8, p = .11$; $F(1, 61) = 4.7, p < .05$) because more errors are present for the gender-matched conditions.

To see whether the combined gender and number errors were the result of the independent occurrence of a gender error and a number error, a chi-square test was done comparing the observed combined errors with the number of combined errors for each condition that would have been expected if the gender and number features were independent. This was calculated by multiplying the probability of occurrence of the two independent errors (the

Table 9: Response categories pooled according to target of number agreement errors, with the three columns of interest shaded. Number of responses and percentages per condition in each response category. Total number of responses: 2048. Number of responses per condition: 256.

Condition	CO	Gen Adj	Num Adj	Num Adj & Verb	Num Verb	Mix
Masc-G/MA-N/MA	232 90.6%	1 0.4%	0 0.0%	0 0.0%	0 0.0%	23 9.0%
Masc-G/MA-N/MS	212 82.8%	0 0.0%	0 0.0%	7 2.7%	0 0.0%	37 14.5%
Masc-G/MS-N/MA	211 82.4%	26 10.1%	0 0.0%	0 0.0%	0 0.0%	19 7.4%
Masc-G/MS-N/MS	219 85.5%	9 3.5%	0 0.0%	7 2.7%	0 0.0%	21 8.2%
Fem-G/MA-N/MA	221 86.3%	2 0.8%	0 0.0%	3 1.2%	0 0.0%	30 11.7%
Fem-G/MA-N/MS	197 77.0%	5 2.0%	2 0.8%	14 5.5%	0 0.0%	38 14.9%
Fem-G/MS-N/MA	183 71.5%	34 13.3%	0 0.0%	1 0.4%	0 0.0%	38 14.9%
Fem-G/MS-N/MS	201 78.5%	11 4.3%	0 0.0%	9 3.5%	0 0.0%	34 13.3%
Totals	1676 81.8%	88 4.3%	2 0.1%	41 2.0%	0 0.0%	240 11.7%

product of the error probabilities for gender errors alone and for number errors alone) by the total of responses per condition. The analysis shows that the expected number of combined errors is not significantly different from the observed number of combined errors; that is, it shows that the two features behave independently in relation to error elicitation ($\chi^2=2.43, p > .5$).

With respect to the second question—whether number agreement with verb and predicative adjective is a single process—we are interested in whether the number errors are present in the adjective alone, in the verb alone, or in both. Table 9 shows the distribution of number errors disregarding whether gender errors were or not present in the same responses. In this table, the column labeled NumAdj is the sum of the columns labeled Gen&NumAdj and NumAdj (Table 7); and the column labeled NumAdj&Verb is the sum of the columns previously labeled Gen&NumAdj&Verb and NumAdj&Verb (Table 7). The statistical analyses of the new response categories follow.

2.5.7 Analysis of Number Agreement Errors in Adjective (NumAdj)

For number agreement errors in adjective, no analysis was performed because there were too few errors.

2.5.8 Analysis of Number Agreement Errors in Adjective and Verb (NumAdj&Verb)

Analyses of number agreement errors in adjective and verb showed a strong effect of number congruency ($F1(1, 31) = 19.7, p < .01$; $F2(1, 61) = 16.4, p < .01$) due to more errors for number-mismatched conditions. The effect of gender was significant only in the items analysis ($F1(1, 31) = 2.5, p = .12$; $F2(1, 61) = 5.7, p < .05$); this significant effect reflects the greater number of errors for items with a feminine head.

To address the second question directly by means of a statistical test is hardly possible, given that two of the three columns of interest consist almost entirely of empty cells. But it could be argued that this lack of number errors in either the adjective alone or the verb alone, and the fact that all the number errors affect both targets simultaneously obviates the need for any further statistical analysis.

3. Discussion

The results of principal interest are as follows:

- The number of combined gender and number errors is as expected if the two features were processed independently.

- The number of combined number errors in adjective and verb is much greater than would be expected if the errors in both targets occurred independently.
- Gender agreement errors (in the adjective) are sensitive to gender congruency and to number congruency, whereas number agreement errors are most clearly sensitive to number congruency but also marginally to gender congruency.
- Lastly, the correct responses show a consistent effect of gender, with more correct responses when the gender of the head noun is masculine.

Before proceeding with the discussion, let us address here a possible objection to the interpretation of the results. The design of the experiment necessarily required the comparison of sentences containing different nouns for the study of grammatical gender, given that gr-nouns do not have an opposite gender counterpart (*el establo*, ‘the stable’; *la establa* is a nonword). This raises the question of whether the results obtained are due to differences in plausibility between the different sentences in the different conditions instead of to the variable manipulated (i.e., gender). Although this is a possibility in this and all experiments with sentences as stimuli (and even when the independent variable only alters the sentence minimally), there are two reasons why we consider this factor an unlikely confound. First, if plausibility differences were responsible for the effects found in the critical error categories, they would be also expected to reproduce the pattern of results in the miscellaneous responses. For both types of items (with gr- and se-nouns), the miscellaneous responses only showed a gender effect, with more miscellaneous responses for items with feminine heads. But the most critical effect of gender congruency was not significant in this category. Second, previous studies have failed to find any relation between preamble plausibility and error induction. For example, a post hoc plausibility test for another experiment of similar characteristics (Antón-Méndez 1999, experiment 1—an study of attraction errors comparing grammatical and semantic gender) clearly showed no effect of plausibility (see also Franck, Vigliocco & Nicol, in press).

With respect to the two main questions addressed in this experiment, the answers are clear. As to whether gender and number are linked or independent of each other for the purposes of agreement, the results show that they are independent. If they were linked, the adjective would have been expected to show a combined number and gender error whenever both properties mismatched in the attractor and the head nouns, but actually there were only as many combined errors as would have been expected if the two noun features, gender and number, were being processed independently. An alternative explanation is that the reduced number of combined errors is due to differential detection during a postproduction monitoring phase (Levelt 1989). This would imply that double errors are easier to detect and correct than single errors, thus the gender error in *la vista de los puertos es bonito*

(‘The.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL is.SG pretty.MASC.SG’) would be more difficult to detect than the gender and number error in *la vista de los puertos son bonitos* (‘The.FEM.SG view.FEM.SG of the.MASC.PL ports.MASC.PL are.PL pretty.MASC.PL’). This is, however, quite counterintuitive to any native speaker in the sense that, given those two sentences, a hearer would be more likely to detect the first error than the second (and presumably, monitoring one’s own speech is akin to monitoring the speech of others). Further, the fact that the distribution of combined errors so closely matches that of expected independent double errors supports the claim that this reduced number of observed double errors is indeed due to the lower probability of occurrence of two independent events.

The independence of gender and number demonstrated by these results is more compatible with the theory of agreement that postulates features to be the source of the errors (Eberhard 1993, Vigliocco & Nicol 1998) as opposed to head misselection (Bates & McWhinney 1989; Fayol, Largy & Lemaire 1994). The results are also in accordance with previous studies (Igoa, García-Albea & Sánchez-Casas 1999; Centeno & Obler, 1994), and they are compatible with theoretical accounts that consider this independence, such as Picallo’s (1991).

As to whether agreement between one source (subject head) and several targets (verb and predicative adjective) is carried out separately, the answer seems to be that it is not. If it were, there would have been number agreement errors in the adjective independently of number agreement errors in the verb (see columns NumAdj and NumVerb in Table 9), but almost no errors of this sort were found. The overwhelming majority of number errors affected both the adjective and the verb in the same sentence (see column NumAdj&Verb in Table 9). The conclusion is that the same agreement mechanism is responsible for specifying the number features in both targets.

Alternatively, it could be postulated that the number in one of the two targets is specified directly from the subject head, whereas the number on the other target is determined from the number in the former one. In this case, it is most natural to think that the number agreement in the verb would be determined by the subject head and that the number in the predicative adjective would be determined by the verb, given that all sentences have a verb agreeing with the subject in number but only a subset of sentences contain a predicative adjective. Although this is a viable alternative hypothesis, it seems unnecessarily complicated, given that we know from linguistic analysis that the source or controller of the number agreement is the noun (see, for example, Corbett 1991), and it would imply that the verb is transformed from target of the agreement relation to source.

Number agreement errors showed the usual sensitivity to number mismatch, and the gender agreement errors showed the expected sensitivity to gender mismatch. However, the pattern of results for the single gender or number agreement errors was not altogether as expected. Given that gender and number appear to be processed independently (as discussed earlier), it seems strange that the pattern of gender errors showed a clear sensitivity to

number mismatch and that number errors appeared to be somewhat sensitive to gender mismatch at least in the items analysis. Gender agreement errors in the adjective (GenAdj) are more common when the numbers of the two nouns in the preamble are matched—that is, when both nouns are singular. Number agreement errors (Num in Table 8) are also more common when the genders of the two nouns match.

This apparent paradox—that gender and number are processed independently but are also mutually sensitive to each other—can be easily resolved. The independence result applies to the way the two features are processed in order to establish agreement with a target that needs to agree in both gender and number with the head (predicative adjective, in this case), whether they are treated as a package, or whether the predicative adjective gets each of the features apart from the other one. This question needs to be answered by comparing the probabilities of combined errors with the probabilities of single errors, and this comparison shows that the two features are independently transferred or applied to the adjective. A different issue is whether the features present in the source of the agreement—subject head noun—affect the number of single errors in the target; that is, whether the presence of an agreement feature makes the erroneous transfer of another one more difficult. Here, the answer seems to be affirmative—errors of one type increase if the source of the agreement and the element introducing confusion (the attractor) are more similar in other respects. This result conforms well with the theory of head misselection, which would predict that the greater the similarity of attractor and head, the greater the likelihood of causing confusion. This conclusion contrasts with the conclusion extracted from the result of feature independence stated earlier, which supports a theory of feature percolation. However, the pattern for single errors being sensitive to the other feature in the source can also be explained by the performance of a monitoring system (Levelt 1989), for which the same prediction holds—the greater the similarity between the two nouns, the greater the likelihood that the error would pass unnoticed.

The fact that both levels of gender behave similarly, not interacting with any of the other factors in the experiment, might seem surprising in light of previous empirical studies (Igoa, García-Albea & Sánchez-Casas 1999; Elías-Cintrón 1995) and theoretical proposals (Di Domenico 1995, Elías-Cintrón 1995) in support of the differences between grammatical and semantic gender. But a possible difference between the two levels of gender would not necessarily imply that they have a different relation with number, and the results of this experiment indicate that, indeed, both grammatical gender agreement and semantic gender agreement are equally independent from number agreement.

The gender of *se*-nouns is more similar to number, and it might have been expected to be linked to number, as reflected in some linguistic theories, like that of Di Domenico (1995). Recall that she postulates that the semantic gender and number are very strongly associated and even share a position in the syntactic tree. In contrast, Picallo (1991) considers the two types of

features to be independent. The empirical results reported here offer support for the latter rather than the former analysis.

A point to bear in mind, however, is that the analysis of Di Domenico is based mainly on Italian, whereas the one of Picallo is based mainly on Catalan, although both are claimed to apply to Spanish. Given that Italian, on the one hand, and Spanish and Catalan, on the other, differ morphologically in the sense that gender and number share a morpheme in Italian but are realized by different morphemes in Spanish, it is possible that the degree of independence of the two is indeed different in the two languages. It would be interesting in this respect to conduct the same experiment in Italian.

A gender effect—a difference between masculine and feminine genders—was found for the correct response category. Although masculine gender has been considered the default gender in theoretical accounts (Harris 1991), a difference between the genders was not necessarily expected from a psycholinguistic perspective, because both genders can be thought to be specified (as opposed to having one gender left unspecified—the default—and the other marked, as is the case with number). In fact, no asymmetry in gender marking was found in most empirical studies on gender (in Italian [Vigliocco and Franck 1999]; in Spanish [Igoa, García-Albea & Sánchez-Casas 1999; Antón-Méndez 1999, experiment 1]), nor in the analysis of spontaneous speech errors in Spanish (Igoa, García-Albea & Sánchez-Casas 1999). But an effect of gender has been reported for French (Vigliocco & Franck 1999).

The gender result is puzzling because the direction of the asymmetry is opposite to that found in studies of number agreement with respect to the default number. This may be because the default number is unmarked, but the default gender does not seem to be unmarked. Masculine gender is considered the default because it is applied to new nouns, it is more common than feminine agreement, and, furthermore, it is the agreement choice in unclear cases—that is, when the subject is not specific and is left unmentioned, as in *fue azaroso* ('it was hazardous.MASC', where 'it' can be the adventure, the day, etc.), or mixed cases, such as when there are two conjoined heads with different genders, as in *el barbero y su mujer parecían enojados* ('the.MASC barber.MASC and his wife.FEM looked angry.MASC.PL'). Therefore, what may be happening in these cases where a gender effect was found is not so much the result of having asymmetrically marked genders, as of speakers' tendency to impose masculine agreement whenever in doubt. Another possibility, given that the item sets with masculine and feminine nouns were different, is that the sentences with feminine heads were more difficult in some way that we have not been able to detect, which would be consistent with the fact that the miscellaneous responses also showed a gender effect.

But why is this effect so variable, being found in some response categories and not others? And why was it not found in Italian? One possibility is that the effect is a small one and will only be found when the number of responses in a given category is large enough; it is possible that, in some experiments, the effect was not found because of a floor effect. This explanation is supported by

the fact that a trend can be found in the results from the experiments or response categories where the effect is not statistically significant.

In sum, the results in this experiment show that gender and number agreement are carried out independently, but number agreement with one target—the verb—is related to number agreement with another target—the predicate adjective. Furthermore, it has been found that single gender or number errors are sensitive to the other feature's congruency, which could be the result of postproduction error correction.

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