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The role of morphology in subject–verb number agreement: A comparison of Mexican and Dominican Spanish

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The goal of the present study was to test the predictions of two contrasting claims about the role of morphology in subject–verb number agreement production. According to the maximalist view described by Vigliocco, Hartsuiker, Jarema, and Kolk, languages with relatively rich inflectional morphology may be more susceptible to the influence of notional number due to the penetration of meaning into the agreement process. An alternative proposed by Eberhard, Cutting, and Bock predicts the opposite: Languages with richer inflectional morphology are less susceptible to notional number because inflectional morphemes filter the effect of number meaning. In the present experiments, utterances differing in notional number properties were elicited from speakers of two varieties of Spanish that vary in morphological richness. In Experiment 1, participants formed sentences with overt subjects. In Experiment 2, they produced sentences with null subjects. Results supported

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the hypothesis that richer morphology reduces notional effects during agreement production, both within and across languages.

Keywords: Agreement production; Spanish.

Grammatical agreement is ubiquitous in the languages of the world, found in 75% or more of known languages (Mallinson & Blake, 1981, p. 184). As a psycholinguistic phenomenon, it has been examined to assess how speakers produce and understand syntactic relations in real time. In language production specifically, the issues have to do with the processes that the production system undertakes in order to implement agreement. Two key questions about these processes involve the types of information that are used when producing agreement and whether the processes differ cross-linguistically. In the present work, we assessed the predictions of two accounts of how the mechanisms of number agreement work in two varieties of Spanish (Mexican and Dominican Spanish) and in two different grammatical contexts (agreement with and without overt subjects).

The two views that we examine posit contrasting roles for meaning in the agreement process. Vigliocco and Hartsuiker (2002) dubbed the views “maximalism” and “minimalism,” and we adopt these terms for convenience. With respect to grammatical agreement, the maximalist hypothesis is that meaning permeates the process (Vigliocco & Franck, 2001). Minimalist accounts, in comparison, take a more restrictive view of the information used in agreement (e.g., Eberhard, Cutting, & Bock, 2005). Although both views predict variations in the production of agreement due to the influence of notional or conceptual information, they differ in their claims regarding the mechanisms of infiltration and, in particular, regarding the role of agreement morphology. The maximalist account as described by Vigliocco, Hartsuiker, Jarema, and Kolk (1996) predicts an increased influence of conceptual number in languages with richer inflectional systems due to the role of meaning in the selection of agreement morphology. In contrast, the Eberhard et al. account predicts that the richer the inflectional morphology of a language, the weaker the influence of conceptual or notional number due to cancellation of number-meaning effects by the grammatical specifications of inflectional morphemes. In short, the two views offer directly opposing hypotheses about the effects of morphological richness on agreement.

The goal of this work was to compare these predictions about agreement, investigating whether and how subject–verb number agreement processes vary in monolingual speakers of Mexican Spanish and Dominican Spanish (the varieties of Spanish spoken in Mexico and the Dominican Republic, respectively). Relative to English, Spanish morphology is elaborate in the extent and explicitness of its specifications of agreement features, including number features. However, Mexican and Dominican Spanish differ in how

much they capitalise on the language's resources. While Mexican Spanish has maintained the characteristics of standard Latin American Spanish, Dominican Spanish appears to be undergoing erosion in the morphology of its agreement system, making it more similar to English than are other Latin American (non-Caribbean) varieties of Spanish. The morphology of Dominican Spanish is thus somewhat sparser than that of Mexican Spanish.

To introduce the upcoming experiments, we first sketch the agreement paradigms in Mexican and Dominican Spanish. Then we review the relevant findings from the psycholinguistic literature on number agreement, including findings about the effects of meaning on agreement and the cross-linguistic variations that are correlated with morphological richness.

SPANISH AGREEMENT MORPHOLOGY

In Spanish, verbs are inflected for person, number, tense, aspect, and mood. Inflected forms are based on a stem with (usually) one or more suffixes. Table 1 makes use of the verb *comer* [to eat] in the present tense to show the person and number inflections in the Spanish verb that are of the most interest for the current study.

As illustrated in Table 1, finite verbal forms in Spanish are always inflected for number and person to agree with the subject. Subject pronouns are often unexpressed, particularly when the context makes the subject of the verb evident, as shown in (1):

- (1) ¿Dónde está Juan?
where is Juan

Fue a la tienda.
went-(he) to the store

Another characteristic of Spanish that may be related to the richness of its inflectional paradigm is its relatively flexible word order (though this

TABLE 1
The Spanish verb

<i>Person</i>	<i>Number</i>	
	<i>Singular</i>	<i>Plural</i>
First	como (I eat)	comemos (we eat)
Second	comes (you eat)	coméis (you _{pl} eat)
Third	come (he/she/it eats)	comen (they eat)

flexibility is regulated by pragmatic considerations). In Spanish, subjects appear post- as well as preverbally, as in (2):

- (2) Juan llegó.
Juan arrived

Llegó Juan.
arrived Juan

Number is morphologically expressed on the head of the subject noun phrase with *-s* or *-es*, as in English, but unlike English, determiners and adjectives modifying the noun also specify plurality reliably, as illustrated in (3):

- (3) el libro rojo
the (sing.) book (sing.) red (sing.)
“the red book”

los libros rojos
the (pl.) book (pl.) red (pl.)
“the red books”

The upshot is that in Spanish, the determiners and adjectives that modify nouns provide additional cues to number.

This elaborate number morphology characterises most varieties of Spanish, but it is only variably present in others. One of the latter varieties is the Spanish spoken in the Dominican Republic. According to a number of linguists and dialectologists, Dominican Spanish is moving in the direction of a less richly inflected system, with fewer morphological distinctions on both the noun and the verb (e.g., Henríquez Ureña, 1940; Holm, Lorenzino, & De Mello, 1999; Jiménez Sabater, 1975; Lunn, 2002; Pérez-Leroux, 1999; Toribio, 2000). The reductions include the weakening and even elision of syllable-final *-s*, which can eliminate distinctions between the second and third person singular forms in almost all tenses and moods. In addition, syllable-final *-n* can be weakened or elided, so that distinctions between third person singular and plural forms may also be lessened or even lost (though the preceding vowel is often nasalised to indicate the plural; Lunn, 2002). To illustrate, in Dominican Spanish the verb form *come* can mean “you_{sg} eat,” “he/she/it eats,” and “they eat”; in Mexican Spanish, the respective forms differ (*comes*, *come*, and *comen*). The morphological expression of number on determiners and adjectives also seems to be eroding: Syllable-final *-s* may not be produced on these words, either. This means that when the grammatical gender of the subject noun is feminine, the pronunciation of the singular and plural forms of the noun phrase may

be identical. So, what would be produced as *las flechas rojas* [the_{pl} red_{pl} arrows] in Mexican Spanish may be *la flecha roja* in Dominican Spanish, which is indistinguishable from the singular. Jiménez Sabater (1975, p. 148; cf. Colina, 2006; Holm et al., 1999, among others) notes that in the speech of some Dominicans, *-se* may be added to the end of the noun to indicate plurality, so that *flechas* is pronounced *flechase*, though plurality on the feminine noun is most often distinguished by the use of the plural verb form *-n*. When the grammatical gender of the subject noun is masculine, only the form of the article may differentiate the pronunciation of the singular from the plural in Dominican Spanish (*lo libro amarillo* [the_{pl} yellow_{pl} books] vs. *el libro amarillo* [the yellow book]), though *-se* may also be added to masculine nouns as an additional plurality marker. In Mexican Spanish, the article, noun, and adjective all carry plural specifications (*los libros amarillos* [the_{pl} yellow_{pl} books]).

Whether causing or resulting from this loss of morphology, Dominican Spanish now shows use of subject pronouns in contexts that standard Latin American Spanish (including Mexican Spanish) reserves for emphasis or pragmatic force (e.g., Camacho, 2008; Jiménez Sabater, 1975; Lipski, 1977; Lunn, 2002; Pérez-Leroux, 1999; Toribio, 2000, 2002). This is illustrated in (4), cited from Jiménez Sabater (1975, p. 165, emphasis added).

- (4) *Tú* no estudia porque *tú* no quiere.
 (cf. No estudias porque no quieres.)
 “You don’t study because you don’t want to.”

In addition, the overt expression of the expletive *ello* is now present in the language, so that expressions such as the one in (5) are found in Dominican Spanish (cited from Toribio, 2000, p. 321).

- (5) *Ello* había mucha gente en lay-a-way.
 (cf. Había mucha gente en lay-a-way.)
 “There were a lot of people on stand-by.”

Word order patterns in Dominican Spanish are also less flexible than those found in standard Latin American Spanish, with a comparatively fixed subject–verb–object order in declaratives. This subject–verb–object order appears in questions as well, as illustrated in (6) (cited from Toribio, 2000, p. 322), though standard Latin American Spanish requires subject–verb inversion in interrogatives (Jiménez Sabater, 1975; Lipski, 1977; Ordóñez & Olarra, 2006; Pérez-Leroux, 1999).

- (6) ¿Qué *yo* les voy a mandar a esos muchachos?
 (cf. ¿Qué les voy a mandar (*yo*) a esos muchachos?)
 “What am I going to send to those boys?”

Overall, then, there is less morphology expressed on the verb in Dominican Spanish than in Mexican Spanish and, specifically related to number agreement, less number morphology expressed on the noun phrase. This means that the two varieties of Spanish vary both on the overall richness of morphology and on the richness of number morphology expressed in the noun phrase. Consequently, a comparison between Dominican and Mexican Spanish speakers is ideally suited to a test of how morphological richness affects the processes of agreement.

PSYCHOLINGUISTIC MECHANISMS OF AGREEMENT PRODUCTION

In both varieties of Spanish described above, as in English, the verb of a sentence typically agrees in number (singular or plural) with its subject. Although agreement production usually follows this pattern among native speakers, there are variations in subject–verb number agreement that can be traced to at least three different mechanisms. The three mechanisms are attraction, subject inaccessibility, and notional agreement.

In attraction (Bock & Miller, 1991), the verb agrees with a nearby or *local* noun instead of the subject noun phrase, as in (7):

- (7) *The road to the mountains ARE long.

The apparent cause of attraction is that the number feature of the subject noun phrase as a whole is hijacked by the number of the local noun (Eberhard et al., 2005). This is most likely when the head is singular and the local noun is plural since the latter carries a number specification that readily occupies the null specification of the English singular. Subject inaccessibility (sometimes called subject or predicate confusion) creates variations in agreement due to a failure to keep track of (Fowler, 1937) or accurately retrieve (Badecker & Kuminiak, 2007) a sentence or clause subject. For instance, within a sentence that begins with *The king that the islands...*, speakers can be sidetracked by the relative ease of formulating a predicate for *king*, perhaps saying something along the lines of “The king that the islands ruled was benevolent” (Bock & Miller, 1991, Experiment 3; Staub, 2010). Differences in plausibility relative to a particular predicate may have similar consequences (Thornton & MacDonald, 2003).

A third source of agreement variation arises when there is a mismatch between the conventional grammatical number of a subject noun phrase and its *notional number*. Notional number has to do with the numerosity of the referent of the sentence subject in the speaker's preverbal message, in particular whether it is represented as one or more than one entity. For example, in noun phrases with distributive readings, such as *The picture on the postcards*, the noun phrase is ambiguous between a construal in which the picture is viewed as several individuals (a multiple-token or distributive reading) or as a single picture type (a single-token or nondistributive reading). Regardless of the notional construal, however, the conventional grammatical number is singular in English. The same is true for translation equivalents in Mexican and Dominican Spanish. However, there is variability in agreement that can be traced to the difference between the notional and the grammatical number: When the notional number is plural, the verb is more likely to be plural (Vigliocco, Butterworth, & Semenza, 1995).

All these variations in agreement have been examined under controlled conditions in several different languages. In most experiments, a simple sentence-fragment completion paradigm is used in which participants are presented with sentence fragments, or *preambles*, designed to serve as the subjects of sentences. The participants repeat and complete the preambles as full sentences. For example, a participant might hear a sentence fragment such as *The picture on the postcards* and then respond with "The picture on the postcards was of the Matterhorn." Responses are audio-recorded and transcribed, and verb number variations are analysed with respect to the conventional grammatical number of the sentence subject.

Using this paradigm to elicit verb agreement, variations in number due to notional differences have been found in Italian (e.g., Vigliocco et al., 1995), Spanish (e.g., Vigliocco, Butterworth, & Garrett, 1996), Dutch (e.g., Vigliocco, Hartsuiker et al., 1996), French (e.g., Vigliocco, Hartsuiker et al., 1996), Russian (e.g., Lorimor, Bock, Zalkind, Sheyman, & Beard, 2008), and English (e.g., Eberhard, 1999). The importance of these effects stems from their relevance to the overarching debate about whether and how meaning affects syntactic processes (Eberhard et al., 2005; Vigliocco & Hartsuiker, 2002). The consistency with which the effects are found makes it clear that number meaning does matter to agreement. What remains controversial is how the effects come about.

One conjecture about the origin of meaning effects comes from evidence for and explanations of cross-linguistic differences in the influence of notional number. In experiments comparing Mexican Spanish and English, Vigliocco, Butterworth et al. (1996) found larger effects of distributivity in Spanish than in English and proposed three alternative hypotheses to account for the differences. The first of the hypotheses was that speakers

of covert-subject (pro-drop) languages may be more likely to call on notional number for the verb number information that would normally be present on the expressed subject. The second hypothesis was that languages allowing postverbal subjects may exhibit more notional number agreement because the verb can be formulated prior to the subject. The third hypothesis was that languages with rich morphology are more likely to convey notional variations due to a supposed role for number meaning in the recruitment of number morphology.

Vigliocco, Hartsuiker et al. (1996) evaluated these hypotheses in experiments on French and Dutch, neither of them covert-subject languages but both rich-morphology languages. They differ, however, in the possibility of postverbal subjects: Dutch allows them and French does not. Speakers of both languages exhibited distributivity effects, thus suggesting that neither whether subjects are normally expressed nor whether they can occur postverbally matters (Vigliocco, Hartsuiker et al., 1996). Vigliocco and colleagues therefore ruled out these two hypotheses and tentatively concluded that the relative richness of a language's verbal morphology could be the determining factor in whether distributivity effects occur (while also noting that the finding of differences between English and other languages could be due to issues with the different stimuli used across studies; p. 437). This emphasis on morphology as the vehicle for notional variations in agreement implies that languages vary in the magnitude of notional effects as a function of their morphology. The mechanism behind the variations may also differ since languages with more agreement morphology may be more likely to call on meaning for deploying morphology than languages in which inflectional morphology can be driven by structural covariations, as in English. Either way, the claim is that the extent to which meaning permeates structural mechanisms in general and agreement in particular may be correlated with morphological elaboration. This is consistent with maximalist principles of sentence formulation.

Despite its plausibility, the rich-morphology hypothesis has never been directly tested. There are also indirect challenges to these proposals. A growing body of research suggests that variations in agreement, whether due to attraction or due to a mismatch in notional and grammatical number, decrease rather than increase with richer inflectional morphology. For example, Vigliocco et al. (1995) compared attraction rates with subject noun phrases in which head nouns were either ambiguously or unambiguously marked for number in Italian. They found that more errors occurred when head nouns were ambiguous than when their number was clearly marked. Vigliocco and Zilli (1999) investigated the role of morphophonological marking on gender agreement in Italian and found that more agreement errors occurred when subject nouns were not transparently

marked for gender. Vigliocco and Franck (1999, 2001) also examined gender agreement in Italian and French, with results that showed more errors in French than in Italian. Their explanation for this finding was that the presence of more morphophonological information in Italian may have reduced the occurrence of errors in comparison with French; in oral French, much of the agreement morphology is left unpronounced, while in Italian it is always phonologically present. In studies that investigated whether subject–verb number agreement is influenced by the phonological realisation of grammatical information in Dutch and German, Hartsuiker, Antón-Méndez, and Van Zee (2001) and Hartsuiker, Schriefers, Bock, and Kikstra (2003) found that morphological ambiguity led to an increased number mismatch effect (more errors) in both languages. Franck, Vigliocco, Antón-Méndez, Collina, and Frauenfelder (2008) investigated the effects of morphophonological gender marking in the noun phrase on gender agreement in Italian, Spanish, and French and replicated with all three languages the previous finding in Italian that more gender agreement errors occur when head nouns are not morphophonologically marked for gender than when they are.

With respect to the influence of notional number on agreement, the rich-morphology hypothesis is challenged by results which suggest that richer morphology does not increase but instead reduces notional effects. In a study on agreement in Russian, which is indisputably rich in agreement morphology, Lorimor et al. (2008) found surprisingly weak effects of distributivity. In fact, relative to previously observed distributivity effects on agreement in English, the Russian effects were roughly a third of the magnitude. From a meta-analysis of experiments on distributivity effects in other languages, Lorimor et al. argued that notional agreement was not promoted by morphological richness, but reduced by it.

This constitutes a minimalist hypothesis that we call morphological filtering. Morphological filtering was originally proposed in the linguistics literature by Berg (1998) and expanded upon by Acuña-Fariña (2009). According to this hypothesis, the agreement production system is more susceptible to variations in agreement, including those due to mismatches between grammatical and notional number, when there is less morphology present to filter or cancel out these variations. A specific cancellation operation is incorporated into Eberhard et al.'s (2005) marking and morphing account of agreement production, an account that explains agreement processes in terms of both conceptual and morphological influences. According to Eberhard et al., the extent to which variations in agreement occur is directly impacted by the number morphology present in the subject noun phrase, based on the combination of both positive and negative contributions from different morphemes. While positive contributions from

plural morphemes add to the likelihood that plural agreement will occur, negative contributions from singular morphemes cancel out or filter positive influences (such as plural morphemes and/or conceptual plurality) and make singular agreement more likely.

A drawback of Lorimor et al.'s (2008) test of morphological filtering is that it was based on cross-language comparisons that involved different materials in each of the languages. Obviously, with controlled materials, language differences consistent with a rich-morphology account of meaning effects could emerge that would disconfirm the morphological filtering hypothesis. Moreover, the Lorimor et al. study was not designed to test the strongest form of morphological filtering, which implies that *within*-language variations in agreement morphology should yield variations in the impact of meaning on agreement. A recent study by Antón-Méndez and Hartsuiker (2010) does, however, provide a direct test of this hypothesis. In their sentence-fragment completion experiment with speakers of Dutch, Antón-Méndez and Hartsuiker manipulated both the conceptual number of the fragment (multiple vs. single token) and the number ambiguity of the determiner in the head noun phrase (ambiguous vs. unambiguous). The results indicated that more agreement errors occur when a number-ambiguous determiner is present, providing support for the morphological filtering hypothesis.

In summary, at stake in the debate about the role of morphology in agreement is a deep question about whether there is a general mechanism of number agreement in which number morphology regulates the conceptual and grammatical components of agreement production. Such a mechanism could work in the same ways both within a language and between typologically different languages, differing chiefly or only in the scope of operation permitted by the morphology. The present work was designed to add to current research that addresses these points.

The first of the two experiments was designed to investigate whether and how the production of subject–verb number agreement differs as a function of the morphological richness of two varieties of the same language, using monolingual speakers of Mexican and Dominican Spanish. If richer morphology implies an increased role for meaning in agreement (as the maximalist view hypothesises) then speakers of Mexican Spanish should show a stronger distributivity effect than speakers of Dominican Spanish, which has less number morphology. If, on the other hand, the minimalist prediction is correct and richer morphology limits the role of meaning in agreement by decreasing the susceptibility of the system to such variations, the results should show the opposite pattern, with speakers of Dominican Spanish displaying stronger notional effects than do speakers of Mexican Spanish. A control group of English speakers was included to provide a

baseline for distributivity effects in a language with poor morphology where inconsistent effects of distributivity have been observed.

The second experiment tested how notional number affects agreement when the within-language morphological support for agreement is reduced. Specifically, the experiment assessed agreement when the pronominal subject was absent in Mexican and Dominican Spanish, so that no overt subjects (and thus no subject–number morphology) were produced. If agreement patterns within a language are set by the properties of the morphological system as a whole, the results of the second experiment should match those of the first, without changes due to the absence of agreement morphology. In contrast, if local contextual variations in agreement morphology regulate the susceptibility of the system to notional number, Mexican and Dominican Spanish speakers should both show greater conceptual effects in the second experiment than in the first.

EXPERIMENT 1: AGREEMENT IN MEXICAN AND DOMINICAN SPANISH

Experiment 1 made use of a modified version of the sentence-fragment completion task to investigate the role of morphological richness in the production of subject–verb number agreement in Mexican and Dominican Spanish. The task was designed to encourage distributive interpretations of complex subject noun phrases that were grammatically singular. Specifically, pictures were used to ensure that participants were not simply repeating and completing sentence fragments without understanding the distributive construals of the stimuli. In brief, participants saw pictures (such as those in Figure 1) on a computer screen and heard sentence fragments consisting of

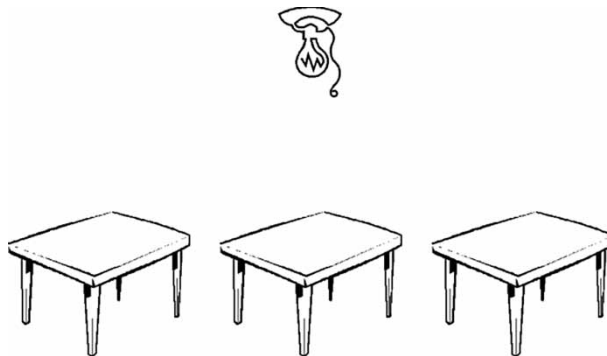


Figure 1. Example of pictorial stimulus, single referent, singular–plural fragment (note that the light was shown in blue). Fragment prompt: “The light over the tables”; expected response: “The light over the tables is blue.”

subject noun phrases that described the pictures. They repeated the fragments they heard and completed them with a form of the verb *to be* and a colour adjective that corresponded to the colour of the image depicting the head of the subject noun phrase.

Method

Participants

Three participant groups were included in Experiment 1. In the control group there were 27 native speakers of American English, all undergraduates from the University of Illinois. One participant was excluded because he spoke a language other than English at home, leaving 26 participants for the data analyses (mean age = 21 years). All English-speaking participants had taken fewer than two semesters of foreign language at the university level. The second group consisted of 37 native speakers of Mexican Spanish. These participants were all undergraduates from the Universidad Autónoma de Nuevo León in Monterrey, Mexico. Five were excluded for not completing the experiments according to the instructions given, leaving 32 participants to be included in the data analyses (mean age = 19 years). The third group of participants included 28 native speakers of Dominican Spanish, students at the Pontificia Universidad Católica Madre y Maestra in Santiago, Dominican Republic (mean age = 20 years); none were excluded. Some of the native Spanish speakers in both Mexico and the Dominican Republic had studied other languages, but none reported fluency in any language besides Spanish. All participants had normal or corrected-to-normal hearing and vision, and none were colour-blind; all participated for monetary compensation.

Materials

Two sets of 32 pairs of complex noun phrases (sentence fragments) were used as experimental items. Table 2 presents example experimental stimuli by

TABLE 2
Example experimental stimuli by condition, Experiment 1

<i>Number of head and local nouns</i>	<i>Example fragments</i>	
	<i>English</i>	<i>Spanish</i>
Single referent		
Singular–singular (control)	The road to the mountain	El camino a la montaña
Singular–plural	The road to the mountains	El camino a las montañas
Distributive referent		
Singular–singular (control)	The label on the bottle	La etiqueta en la botella
Singular–plural	The label on the bottles	La etiqueta en las botellas

condition, and Appendix 1 includes the complete list of all experimental items in English and in Spanish.

One set of fragments was in English and the other in Spanish. The Spanish fragments were translation equivalents of the English fragments, checked for grammaticality and naturalness by a native speaker of Mexican Spanish. Each noun phrase consisted of a singular head noun followed by a prepositional phrase. The two fragments in every fragment pair were identical except for the number of the local noun in the prepositional phrase: One local noun was singular and served as a control, and the other was plural. The Spanish fragments were also counterbalanced for gender, so that there were equal numbers of matching (e.g., masculine–masculine and feminine–feminine) and mismatching (e.g., masculine–feminine and feminine–masculine) head and local nouns and equal numbers of each possible gender combination. Half of the 32 pairs had distributive (notionally plural but grammatically singular) referents as head nouns, such as *The stamp on the envelopes*, and the other half had nondistributive, notionally and grammatically singular referents, as in *The key to the suitcases*.

The distributivity status of each fragment was evaluated with a norming questionnaire, administered in Spanish to 36 undergraduate students at the Universidad Autónoma de Nuevo León, Mexico, and in English to 61 undergraduate students at Michigan State University. The questionnaire included all the experimental items in their singular–plural forms listed in random order. Each participant was asked to decide for each phrase whether it referred to one thing or more than one thing. Participant ratings were coded as 0 if they answered “one thing” and 1 if they answered “more than one thing.” In one version of the questionnaire given to 36 of the English speakers, fragments were listed with accompanying picture stimuli (see below). In another version given to the other 25 English speakers and in the version given to the Spanish speakers, fragments were listed without pictures. The mean numbers of “more than one thing” ratings per item given to the single versus distributive referent fragments (shown in Table 3 as percentages) were compared using Wilcoxon signed-rank tests; the difference was

TABLE 3
Mean percentages of “more than one thing” ratings per item by
condition and group, Experiment 1

	<i>Single referent</i>	<i>Distributive referent</i>
Spanish	17.9 (7.0)	28.6 (7.4)
English (no pictures)	13.0 (9.1)	34.8 (13.1)
English (pictures)	22.7 (12.3)	44.6 (10.3)

Note: Standard deviations are indicated in parentheses.

significant whether fragments were listed with or without pictures [Spanish: $z = -3.56$, $p < .001$; English (no pictures): $z = -3.21$, $p < .01$; English (pictures): $z = -3.21$, $p < .01$]. This indicates that even though the differences in ratings were relatively small due to the biasing effect of the singular form of the head noun, distributive referent fragments were more likely to be thought of as “more than one thing” than single referent fragments.

For the agreement experiments, two sets of 64 filler fragments (noun phrases with a determiner followed by a single noun) were created. One set of fillers was in English and the other in translation-equivalent Spanish. To balance the total number of singular and plural fragments, 16 of the fillers were singular and 48 were plural.

For each language, two 96-item experimental lists were created that combined 32 of the experimental fragments (one fragment from each of the 32 pairs) and all 64 filler phrases. Within each list, eight phrases represented each of the four experimental conditions. Across the two lists for each language, every experimental phrase appeared only once. A list began with two randomly determined singular and two randomly determined plural filler phrases. Subsequent fillers and experimental items appeared randomly, with the exception that no two experimental items could appear consecutively. The same random order of presentation was used in both experimental lists and for all participants. The English fragments were recorded by a female native speaker of American English, and the Spanish by a female native speaker of Mexican Spanish. (We chose to use fragments recorded by a speaker of Mexican Spanish for both Spanish-speaking participant groups rather than use fragments spoken by a Mexican Spanish speaker for the Mexican group and a Dominican Spanish speaker for the Dominican group. This avoided the confound that would arise if less morphology were expressed in the fragments spoken by a Dominican than a Mexican speaker, leaving any observed differences between Dominican and Mexican Spanish potentially attributable to morphological reduction in comprehension rather than production.)

To accompany each of the sentence fragments, a line drawing of the referent was created. The drawings were black and white except for the referent of the head noun, which was green, blue, yellow, or red. The drawings were made from clipart files modified with a graphics software program and were displayed in the centre of the computer screen during the experiment. All drawings were approximately the same size. Figure 1 (single referent) and 2 (distributive referent) provide examples of the pictorial stimuli.

Procedure

Participants completed the experiment individually in a quiet room with only the experimenter present. They first filled out a language history



Figure 2. Example of pictorial stimulus, distributive referent, singular–plural fragment (note that the labels were shown in yellow). Fragment prompt: “The label on the bottles”; expected response: “The label on the bottles is yellow.”

questionnaire to establish their native language and to detail any experience with foreign languages; participants were excluded if they were not native speakers of English, Mexican Spanish, or Dominican Spanish or if they had any significant experience with languages besides English or Spanish. For the experimental task, participants sat in front of a computer and a microphone connected to a digital voice recorder. Instructions were displayed on the computer screen. Participants were told that they would see a picture in the centre of the screen accompanied by a sentence fragment played over the computer speakers. They were then to repeat the fragment and make it into a complete sentence as quickly and accurately as possible, naming the colour of the head noun’s referent as shown in the picture on the screen. For instance, in Figure 1 the light over the tables was blue and in Figure 2 the label on the bottles was yellow.

Participants first completed eight practice trials, which consisted of items similar to the experimental items (both complex and simple subject noun phrases); these trials were the same for all participants. During these trials, no corrections of agreement errors were made, but correction was given when the participant did not follow the instructions. Each trial’s format was identical. After the participant pressed the space bar to advance to the trial, a blank screen was presented for 1.5 s, followed by a picture appearing in the middle of the screen. When the picture appeared, the corresponding sentence fragment was played once over the computer speakers and participants repeated and completed it. If a participant did not hear the fragment, the experimenter repeated it. Each picture remained on the screen until the space bar was pressed to advance to the next trial. All responses were digitally recorded.

Scoring

Each recorded response was transcribed and assigned one of the following agreement scores: (1) correct response (exact repetition of the fragment with

TABLE 4
Example of responses in each scoring category, Experiment 1

<i>Scoring category</i>	<i>Example response</i>
Correct response	The label on the bottles is yellow
Agreement error	The label on the bottles are yellow
Repetition error	The label for the bottles is yellow
Repetition and agreement error	The label for the bottles are yellow
Miscellaneous response	Yellow

correct verb number), (2) agreement error (exact repetition of the fragment with incorrect verb number), (3) repetition error, (4) repetition and agreement error, and (5) miscellaneous response (failed to repeat the whole fragment, did not produce a verb, no response). Examples of each type of response are provided in Table 4. Gender errors were not specifically coded for these analyses, since the focus was on number and the overall rates of gender errors were low (Mexican Spanish, 0.8%; Dominican Spanish, 3.6%).

Variations in fragment pronunciation among participants were not systematically measured, since acoustic analysis of individual responses was beyond the scope of this research. However, we counted the number of audible *-s*'s pronounced in a syllable-final position in one of the filler fragments (*Los vasos son amarillos*). Based on our count, clear varietal differences were evident: Approximately 33% of the Dominican speakers did not produce an audible *-s* on the end of *amarillos*. The *-s* was inaudible for only around 12% of the Mexican speakers. In addition, we obtained phonological transcriptions for two sample responses—one from a Dominican Spanish speaker and one from a Mexican Spanish speaker—chosen as clear exemplars of varietal differences in the pronunciation of syllable-final *-s*. The transcriptions were completed by a trained phonologist who was not informed of the purpose of the study or of the Spanish varieties of the speakers. The transcriptions, given in Table 5, show the absence of the [s] on the Dominican realisations of *amarillos*, *las*, and *roja* (the plural form of red—*rojas*—was expected in this utterance based on the plural verb used by the Dominican speaker).

TABLE 5
IPA transcriptions of Example responses from Dominican and Mexican Spanish speakers, Experiment 1

<i>Fragment (expected response)</i>	<i>Dominican response</i>	<i>Mexican response</i>
Los vasos son amarillos	[lozβasosonamaɾi]	[lozbasosonamaɾeyus]
La nota de las chicas es roja	[lanotaðelatʃikasonroxa]	[lanotaðelestʃikasezroxax]

TABLE 6
Percentages of responses across scoring categories by group, Experiment 1

	<i>Correct responses</i>	<i>Agreement errors</i>	<i>Repetition errors</i>	<i>Repetition/agreement errors</i>	<i>Miscellaneous responses</i>
English	91.1 (758)	7.3 (61)	1.3 (11)	0.2 (2)	0.0 (0)
Mexican Spanish	89.8 (920)	5.5 (56)	2.8 (29)	0.1 (1)	1.8 (18)
Dominican Spanish	84.9 (761)	9.6 (86)	3.2 (29)	0.3 (3)	1.9 (17)

Note: Raw numbers of responses are indicated in parentheses.

For the experimental items, a total of 2,752 responses were scored according to these criteria. The percentages of responses in each category for each speaker group are listed in Table 6, with the raw numbers of responses indicated in parentheses.

Results

The proportions of agreement errors among all the correct and agreement error responses are presented in Table 7, broken down by speaker group and experimental condition.

As Table 7 illustrates, there were few errors in the single referent condition, and all but two of these occurred with fragments that had a singular head noun and a plural local noun, indicating that overall, errors predominantly occurred when the head and the local noun mismatched in number. These errors were much more common for distributive-referent sentence fragments. Out of the 16 fragments that were labelled as distributive, 15 showed a distributivity effect (plural agreement was elicited erroneously more often in the singular-plural condition than in the singular-singular

TABLE 7
Proportions of agreement errors by scoring category and group, Experiment 1

	<i>Single referent</i>		<i>Distributive referent</i>	
	<i>ss</i>	<i>sp</i>	<i>ss</i>	<i>sp</i>
English	0	.03	0	0.26
Mexican Spanish	0	.04	.02	0.17
Dominican Spanish	.01	.06	.01	0.31

Note: The abbreviation "ss" refers to the singular head noun, singular local noun condition, and "sp" refers to the singular head noun, plural local noun condition.

condition) in the English speaker group, 11 showed an effect in the Mexican Spanish group, and all 16 showed an effect in the Dominican Spanish group.

Figure 3 shows the net effect of distributivity for the participant groups. This was calculated as the difference in error proportions between the distributive and single referent conditions and error proportions in the respective controls for each condition. As the figure shows, English and Dominican Spanish had double the distributivity effect of Mexican Spanish; the effect in English and Dominican Spanish was close to identical.

These patterns were evaluated statistically with a model-comparison approach, using mixed logit models that allow for subjects and items as crossed random effects. This was done in order to avoid analysing categorical data in terms of mean proportions (see, e.g., Jaeger, 2008; Quené & van den Bergh, 2008, for arguments). Because three of the singular–singular conditions had zero agreement errors (see Table 6), only the singular–plural conditions were modelled.

The dependent variable for the analysis was accuracy. Referent type was a within-participant variable with two levels (single/distributed) and language group was a between-participant variable with three levels (English/Mexican Spanish/Dominican Spanish). Models with only subjects and with only items as random effects were compared with a model with both subject and item effects; the model with both subject and item effects created the best fit to the data. This model was then compared with a model with a random slope for referent type (by participant); the inclusion of the random slope did not significantly improve the original model, indicating that accuracy decreased at approximately the same rate for each participant as a function of referent type. Table 8 summarises the parameter estimates for the fixed effects of the best-fitting model.

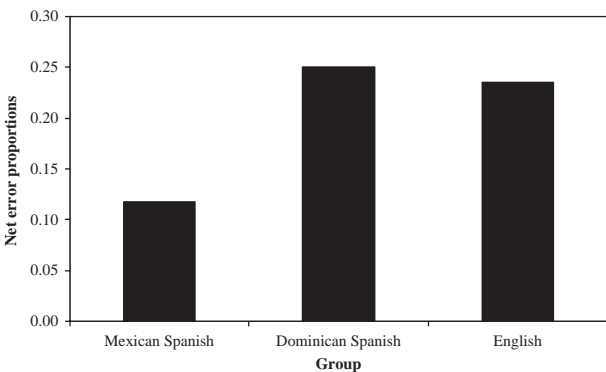


Figure 3. Distributivity effect by participant group, Experiment 1.

TABLE 8

Summary of the fixed effects on agreement in mixed logistic regression, in log odds, with associated standard errors (SEs) and probabilities, Experiment 1 ($N = 1,298$; log-likelihood = -395.6)

<i>Predictor</i>	<i>Estimate</i>	<i>SE</i>	<i>z value</i>	<i>p</i> ($> z $)
Intercept	1.53	0.38	4.28	<.001
Referent Type (single token)	3.10	0.51	6.09	<.001
Group Contrast 1: (Mexican vs. Dominican Spanish and English)	1.52	0.57	2.65	<.01
Group Contrast 2: (Dominican Spanish vs. English)	0.71	0.50	1.41	0.16
Interaction: (Group Contrast 1 \times Referent Type, single token)	-1.66	0.74	-2.24	<.05
Interaction: (Group Contrast 2 \times Referent Type, single token)	0.49	0.69	0.72	0.47

The model confirmed the major patterns revealed in the data in Table 7 and Figure 3. Multiple-token referents elicited correct responses at a rate greater than chance (the significant intercept effect) but were less likely to be correct than single-token referents (the significant effect of referent type). Dominican Spanish and English speakers did not differ significantly from each other (Group Contrast 2), but both differed significantly from Mexican speakers (Group Contrast 1). Specifically, the Dominican Spanish and English speakers appeared to rely more on notional number than the Mexican speakers did, which is reflected in the significant interaction between referent type and Group Contrast 1.

To evaluate the effects directly in terms of the values of the dependent variable, the 95% confidence interval for planned pairwise comparisons was calculated from an analysis of variance that included the singular-singular as well as the singular-plural conditions (using the error term for the interaction between referent type and language group for the calculation). The confidence interval for the differences shown in Figure 3 was $\pm .12$. Relative to Mexican Spanish, distributivity effects for English and Dominican speakers fell in or beyond the confidence interval, with differences from Mexican Spanish of .12 and .15. In comparison, the .02 difference between Dominican Spanish and English fell well within the confidence interval.

Discussion

Experiment 1 investigated cross-linguistic and cross-varietal differences in notional effects in number agreement as a function of morphological richness. For declarative sentences with overt, full subject noun phrases, results showed larger distributivity effects in English and Dominican Spanish than in Mexican Spanish, suggesting that the richer the morphology, the

weaker the effects of meaning on agreement. This finding supports the hypothesis that richer number morphology filters notional effects, rather than strengthening them.

EXPERIMENT 2: NULL SUBJECTS

The morphological filtering hypothesis predicts a reduction in the agreement production system's susceptibility to notional number as a function of morphological richness, not just between languages and language varieties but also within language as a function of the morphological context. Experiment 2 tested this prediction in Spanish. In contrast to Experiment 1, in which participants produced sentences with explicit subjects, in Experiment 2 participants produced sentences with null subjects. On each trial, speakers heard a fragment such as those in the first experiment (e.g., *la etiqueta en las botellas*) while viewing a corresponding picture. They then responded to a question about the colour of the object referred to by the head noun ("¿De qué color?"), which naturally elicited responses such as "es amarilla."

If relative morphological richness matters only at the level of the language as a whole, then the results of this experiment should pattern with those of Experiment 1. If, on the other hand, morphological richness matters at the level of specific utterances, then speakers should show greater notional effects in the current experiment, since in null subject sentences no subject–number morphology is present to filter these effects.

Method

Participants

Participants in the Mexican Spanish and the Dominican Spanish groups who completed Experiment 1 also completed Experiment 2.

Materials

The same type and number of sentence fragments were used as in Experiment 1, but with different words (due to a coding error, 17 of the 32 experimental items were fragments with distributive referents as head nouns while only 15 were fragments with single referents as head nouns). The distributivity status of each fragment was evaluated by a norming questionnaire of the same format as the questionnaire used in Experiment 1. The questionnaire was administered to 36 undergraduate students at the Universidad Autónoma de Nuevo León. The mean numbers of "more than one thing" ratings per item given to the single versus distributive referent

TABLE 9
Mean percentages of "more than one thing" ratings
per item by condition, Experiment 2

<i>Single referent</i>	<i>Distributive referent</i>
18.5 (7.2)	31.9 (8.3)

Note: Standard deviations are indicated in parentheses.

fragments (listed in Table 9 as percentages) were compared using a Wilcoxon signed-rank test; the difference was significant ($z = -3.43$, $p < .01$).

As in Experiment 1, two 96-item lists were formed by combining 32 experimental phrases, one from each pair, with all 64 filler phrases (see Appendix 2 for a complete list of all experimental items). Within one list, eight experimental phrases represented each of the four conditions, and each experimental phrase appeared only once across both lists in a set (due to the coding error described above, the number of phrases representing each condition was not always 8). All participants saw the same eight practice items (which were of the same format as the experimental items and fillers), and then each list began with two randomly determined singular and two randomly determined plural filler phrases. Subsequent fillers and experimental items appeared randomly, with the exception that no two experimental items could appear consecutively. As in Experiment 1, the same random order of presentation was used in both experimental lists and for all participants. The fragments were recorded by a female native speaker of Mexican Spanish. Pictorial stimuli were of the same format as those used in Experiment 1.

Procedure

The procedure was similar to that of Experiment 1, except that participants saw a picture in the centre of the screen accompanied by a sentence fragment played over the computer speakers and immediately followed by the question *¿De qué color?* (What colour?). They then had to answer the question as quickly as possible, using a complete sentence to name the colour of the head noun's referent according to the picture shown on the screen. They were told that they should not repeat the noun phrase subject. This elicited sentences without overt subjects, as in (8).

- (8) Es rojo.
 "[it] Is red."

The question that intervened between the fragment and the point at which participants had to answer was to prevent simple completions of the fragment heard and encourage independent sentences with no overt subjects

expressed. Corrections in response structure were provided by the experimenter to ensure production of complete sentences with no expressed subject, and if a participant did not hear the fragment, the experimenter repeated it. All responses were digitally recorded.

Scoring

Each recorded response was transcribed and assigned one of the following agreement scores: (1) correct response (correct verb number), (2) agreement error, and (5) miscellaneous response (did not produce a verb, no response). Examples of each type of response are provided in Table 10.

A total of 1,920 responses were transcribed and coded for Experiment 2. Table 11 lists the percentages of responses in each category for each speaker group. The raw numbers of responses are indicated in parentheses.

Results

Table 12 presents the proportions of agreement errors among the correct and agreement error responses, broken down by speaker group and experimental condition. The table shows that native speakers of both Mexican and Dominican Spanish made the most agreement errors for distributive referent fragments with singular head nouns and plural local nouns. However, no other category showed a noteworthy error rate. The error rate in the single referent, singular–plural condition was similar to that in the singular–singular condition, indicating that whether the head and the local noun matched or mismatched in number did not affect the incidence of errors. As in Experiment 1, both speaker groups showed a distributivity effect. In all 17 of the fragments labelled as distributive, plural agreement occurred more often in the singular–plural condition than in the singular–singular condition in both groups. Figure 4 depicts the net effect of distributivity for the two groups. Although the distributivity effect appears to be somewhat

TABLE 10
Example of responses in each scoring category, Experiment 2

<i>Scoring category</i>	<i>Fragment heard</i>	<i>Example response</i>
Correct response	La etiqueta en las botellas “The label on the bottles”	Es amarilla “[it] Is yellow”
Agreement error	La etiqueta en las botellas “The label on the bottles”	Son amarillas “[they] Are yellow”
Miscellaneous response	La etiqueta en las botellas “The label on the bottles”	Amarilla “Yellow”

TABLE 11
Percentages of responses across scoring categories by group, Experiment 2

	<i>Correct responses</i>	<i>Agreement errors</i>	<i>Miscellaneous responses</i>
Mexican Spanish	83.3 (853)	16.2 (166)	0.5 (5)
Dominican Spanish	78.9 (707)	20.3 (182)	0.8 (7)

Note: Raw numbers of responses are indicated in parentheses.

greater in Dominican Spanish than in Mexican Spanish, the statistical analyses indicated no reliable disparity.

As in Experiment 1, the data were analysed with mixed logistic regression, allowing for participants and items as crossed random effects. Only the singular-plural conditions were included in the analysis to maintain comparability with Experiment 1 results. Again, the dependent variable for the analysis was accuracy, and referent type was a within-participant variable with two levels (single/distributed), while language group was a between-participant variable with two levels (Mexican Spanish/Dominican Spanish). Models with only participants and with only items as random effects were compared with a model with both participant and item effects. The model with only participant effects did not significantly differ from the model with both participant and item effects, though the model with only item effects did. Thus, the model with only participant effects was the better fit. A model with a random slope for referent type by participant significantly improved the fit over a model with only participant effects (indicating that accuracy decreased at a different rate for different participants as a function of referent type) and was therefore taken as the final model. Table 13 provides a summary of the parameter estimates for the model's fixed effects.

The model of Experiment 2 indicates that for multiple-token referents, the overall chance of a correct response was significantly below 50% (given by the intercept). The only other significant effect in the Experiment 2 model is

TABLE 12
Proportions of agreement errors by scoring category and group, Experiment 2

	<i>Single referent</i>		<i>Distributive referent</i>	
	<i>ss</i>	<i>sp</i>	<i>ss</i>	<i>sp</i>
Mexican Spanish	.03	.02	.01	0.56
Dominican Spanish	.02	.04	.02	0.69

Note: The abbreviation "ss" refers to the singular head noun, singular local noun condition, and "sp" refers to the singular head noun, plural local noun condition.

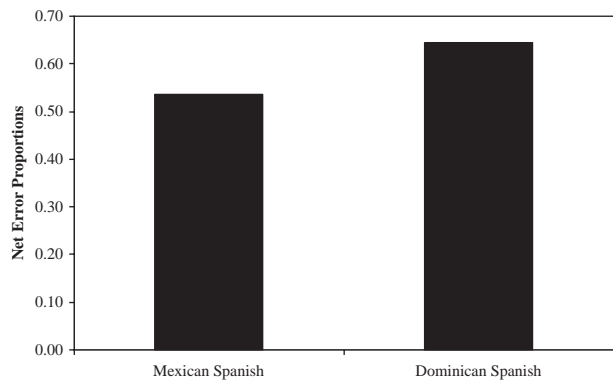


Figure 4. Distributivity effect by participant group, Experiment 2.

that of referent type, which again confirms that notional singularity improved participants’ accuracy.

As in Experiment 1, a 95% confidence interval was calculated from an analysis of variance in which the singular–singular conditions were included. The value of the confidence interval, calculated from the error term for the interaction between referent type and language group, was $\pm .16$. The difference of .08 between Mexican and Dominican Spanish in the size of the distributivity effect due to null subjects fell well within this interval.

Discussion

To sum up, notional number played a role in agreement in both Mexican and Dominican Spanish when subjects were implicit. Moreover, there was no statistically significant difference between the two varieties of Spanish in the size of the conceptual effect. So, when speakers produced subjectless utterances such as “Es amarilla,” the distributivity effect was substantial and, in contrast to Experiment 1, very similar between the groups.

TABLE 13
Parameter estimates for fixed effects on agreement in mixed logistic regression, in log odds, with associated standard errors (SEs) and probabilities, Experiment 2 ($N=954$; log-likelihood = -351.9)

Predictor	Estimate	SE	z value	p (> z)
Intercept	−1.11	0.32	−3.49	< .001
Referent Type (single token)	4.26	0.44	9.61	< .001
Group	0.73	0.43	1.69	.09
Interaction: Group × Referent Type (single token)	0.25	0.72	0.35	.73

Figure 5 gives the Spanish results for Experiments 1 and 2 together, showing clearly that the impact of notional number increased to roughly the same degree in Mexican and Dominican Spanish. The implication is that the effect of within-language variations in the expression of morphology—here the omission of the subject and its inflections—was similar in both varieties. Figure 5 also shows that the distributivity effect in Experiment 2 was more than double that of Experiment 1, reaching proportions of over .50. Evidently, when no overt subject is produced and number morphology is lacking, conceptual or notional number dominates the agreement production process.

In order to compare the distributivity patterns in the two experiments statistically, the combined data were analysed with mixed logistic regression. Only participants were included as a random effect, because the items differed across the two experiments. As in the previous analyses, only the singular–plural conditions were included in the analysis. The dependent variable was accuracy. Referent type was a within-participant variable with two levels (single/distributed), as was subject expression (expressed in Experiment 1/unexpressed in Experiment 2). Language group was a between-participant variable with two levels (Mexican Spanish/Dominican Spanish). A model with a random slope for referent type by participant was compared with a model with only participants as a random effect. The model with the random slope significantly improved the fit of the model, indicating a decrease in accuracy at a different rate for different participants as a

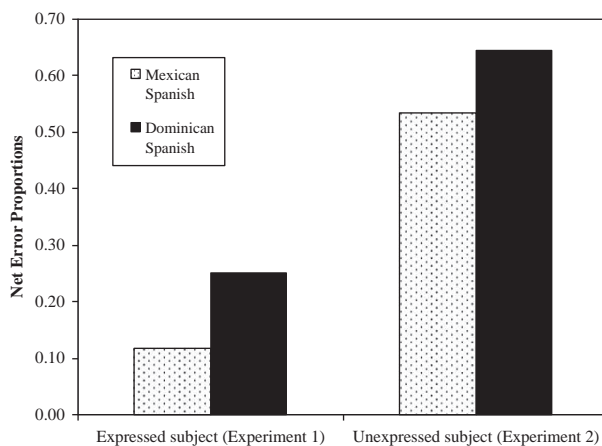


Figure 5. Distributivity effects for expressed and unexpressed subjects in Mexican and Dominican Spanish.

TABLE 14

Parameter estimates for fixed effects on agreement in mixed logistic regression, in log odds, with associated standard errors (SEs) and probabilities, comparing Experiments 1 and 2 ($N = 1,849$; log-likelihood = -664.9)

<i>Predictor</i>	<i>Estimate</i>	<i>SE</i>	<i>z value</i>	<i>p</i> ($> z $)
Intercept	0.78	0.28	2.79	<.01
Referent Type (single token)	2.19	0.39	5.60	<.001
Subject Expression (unexpressed)	-1.82	0.24	-7.53	<.001
Group	1.01	0.39	2.59	<.01
Interaction: Group \times Referent Type	-0.49	0.59	-0.84	0.40
Interaction: Group \times Subject Expression	-0.30	0.33	-0.91	0.37
Interaction: Referent Type \times Subject Expression	2.18	0.53	4.14	<.001
Interaction: Group \times Referent Type \times Subject Expression	0.74	0.86	0.86	0.39

function of referent type. Table 14 displays a summary of the parameter estimates for the fixed effects in the best-fitting model.

The significance of referent type confirms a distributivity effect across the data from both experiments, while the effect of subject expression reflects the overall decrease in accuracy when subjects were not expressed (Experiment 2) in comparison to when they were (Experiment 1). The effect of group again reflects the overall tendency towards more agreement errors in Dominican Spanish. The significant interaction between referent type and subject expression confirms an increase in the effect of notional number when subjects were not expressed, while the lack of any interactions involving group indicates that varietal differences in the effect's magnitude were negligible when no number morphology was produced.

One potential objection to Experiment 2 stems from its methodology. Because participants did not produce any overt subjects, it can be hard to tell whether what they did produce had anything to do with the sentence fragments they heard. For instance, they may have simply looked at the images on the computer screen and formed a response based on that alone. However, there is evidence that participants were making use of linguistic information from the head noun of the null subject in order to effect agreement: Many of the images contained objects that can be named with nouns that have different genders, and gender agreement with the head noun was accurate almost 100% of the time for the distributive referent singular-plural fragments, even when there were number agreement errors (Mexican Spanish speakers made two gender errors, and the Dominican Spanish speakers made none). Likewise, the results of Experiment 1 offer evidence that the referent participants had in mind when they formed their utterances matched the number of the referent in the sentence fragment they heard (e.g., "the label" rather than "the labels" in "the label on the bottles"). Participants in Experiment 1 seldom changed the number of the referent

(e.g., from “the label on the bottles” to “the labels on the bottles”), doing so just 4.8% of the time. Since Experiment 2 employed the same types of pictures as Experiment 1, it is unlikely (but of course still possible) that participants failed to use, understand, or infer the consequences of the singular/plural differences in the fragments they heard.

So, although we cannot be certain what subject the speakers had in mind when they produced their responses, it is parsimonious to conclude that they were not simply ignoring the fragments and describing the pictures without reference to what they heard. As in other work on number agreement (Eberhard, 1999), the presence of pictures probably did not change basic outcome patterns: Whether pictures are present or absent, participants make use of the information they hear in the experimental fragments to form their responses.

GENERAL DISCUSSION

The goal of the present study was to compare maximalist and minimalist accounts of agreement production by determining whether and how the production of subject–verb number agreement differs in Spanish and English as a function of relative morphological richness. Experiment 1 was a cross-language comparison, testing monolingual speakers of Mexican Spanish, Dominican Spanish, and English in order to determine whether richer morphology in a language or language variety creates stronger or weaker effects of notional number. Experiment 2 was a within-language comparison, testing whether notional number affects agreement as a function of the relative richness of the morphological context in individual utterances. Notional number was found to affect agreement in English and in both varieties of Spanish tested. Most importantly in terms of the goal of the current study, relatively richer morphology was shown to lessen notional effects in number agreement rather than increase them, supporting the hypothesised filtering role of morphology in agreement production. In Experiment 1, the magnitude of distributivity effects was larger in English and Dominican Spanish (with relatively poor morphology) than in Mexican Spanish (with relatively rich morphology). In Experiment 2, when within-utterance number morphology was reduced in both varieties of Spanish, meaning dominated the agreement process: More utterances used notional rather than grammatical number as a basis for agreement. Furthermore, the relative increase in the magnitude of distributivity effects from Experiment 1 to Experiment 2 was similar across both varieties of Spanish.

By itself, the finding that notional number dominates agreement when subjects are not expressed is consistent with the maximalist hypothesis that speakers of pro-drop languages are more likely to call upon notional number

during agreement production than do speakers of languages that express subjects overtly (Vigliocco et al., 1995). However, the results of Experiments 1 and 2, taken together, do not support this account. The minimalist claim is that the frequency of utterances that lack subject morphology in pro-drop languages predisposes speakers of these languages to obtain verb number information directly from the message during agreement production. According to the results of the present study, while it is true that speakers call on notional number when producing utterances without subjects (Experiment 2), when the same speakers produced utterances with overt subjects, they did not do so to nearly the same extent (Experiment 1). Speakers of languages that are not pro-drop (e.g., English) are as likely or even more likely to make use of notional number as speakers of languages with covert subjects (Experiment 1). All this means that there is no language-general proclivity towards the use of notional number in agreement production when subjects are not expressed. Instead, the impact of notional number is a function of morphological variation. That is, whether across or within languages, variations in the expression of agreement morphology yield variations in the impact of meaning on agreement. This supports the morphological filtering hypothesis.

As mentioned in the introduction, the mechanism of morphological filtering is built into a minimalist account of agreement production outlined by Eberhard et al. (2005). This account explains variations in notionally influenced number agreement not as a result of a pervasive influence of number meaning throughout the production system (Vigliocco & Hartsuiker, 2002), but as a matter of the functional feature marking (i.e., subject feature marking) and morphological realisation operations that occur during agreement implementation. In common with all theories of language production, Eberhard et al. (2005) posited that the production of agreement begins with a message that the speaker intends to communicate. Message processes categorise the referents that eventuate as subject noun phrases as “one thing” or “more than one thing” (notional number valuation). The number valuation is then transmitted to the syntax via the mechanism of marking, which occurs as part of functional assembly during language production.

The marking mechanism ensures that subject noun phrases carry features that reflect the conceptual singularity or plurality of their referents. Another mechanism that operates during agreement implementation selects lexical entries whose meanings capture the contents of the message. From the lexical–syntactic representations formed during functional assembly, morphing operations reconcile the marked subject–number features with the number specifications from the lexicon during a process of structural

integration. The reconciled subject features then control the number of the verb phrase.

In this framework, agreement variations related to conceptual or notional number can occur when two sources of number (the number marked on the syntax and the lexically specified number) conflict. In the reconciliation that resolves this conflict, the morphological specifications of the noun phrase can cancel out the functional features: The more number morphology the subject phrase carries, the greater the likelihood of cancelling out the functional marking. For example, the explicit singular morphology on Spanish nouns (morphology that is negatively weighted in the Eberhard et al., 2005, model) can cancel a plural marking feature bestowed from notional sources on the subject phrase. But in English, many singular noun phrases lack explicit singular morphology (e.g., *the girl* carries no privative singular specification), giving them no power to cancel functionally marked plurality.

The results of both experiments in the present study, along with the results of Lorimor et al. (2008) and Antón-Méndez and Hartsuiker (2010), align with the feature-cancelling prediction. In Experiment 1, the language and language variety with relatively poorer noun phrase morphology (English and Dominican Spanish, respectively) showed stronger conceptual effects than the language variety with relatively richer noun phrase morphology (Mexican Spanish). In Experiment 2, when no noun phrase number morphology was produced, notional number took over equally in Mexican and Dominican Spanish, so that notional number agreement occurred for more than half of the utterances produced in the two groups. Based on these findings, it seems that number agreement works similarly across different languages and language varieties, in that morphology is the regulator of the conceptual and grammatical components of agreement production. Variations in morphological richness modulate the extent to which notional number and other factors shape agreement across and within languages.

In addition to providing support for a minimalist approach to the role of morphological richness in agreement production, the present results are pertinent to linguistic theory. According to many linguists and dialectologists, Dominican Spanish seems to be moving in the direction of a less richly inflected verbal system (e.g., Henríquez Ureña, 1940; Holm et al., 1999; Jiménez Sabater, 1975; Lunn, 2002; Pérez-Leroux, 1999; Toribio, 2000, 2002). This is evident in the use of subject pronouns in situations that other varieties of Spanish (such as Mexican Spanish) reserve for emphasis, its comparatively fixed subject–verb–object word order, and other linguistic characteristics that make Dominican Spanish more similar to English than are other Spanish varieties. In support of this analysis, Dominican Spanish patterned in the present work not with another variety of the same language (Mexican

Spanish), but rather with English. This contrastive patterning provides converging evidence in support of the claim that Dominican Spanish illustrates language change in progress.

CONCLUSION

In order to compare opposing accounts of the role of morphological richness in language production, we investigated subject–verb number agreement in monolingual speakers of Mexican Spanish, Dominican Spanish, and English. Both with full, overt subjects and with null subjects, speakers tended to produce sentences in which the morphological specifications of number filtered the effects of conceptual number in subject–verb number agreement. Consequently, when less number morphology is present on a controller during the implementation of number agreement, the effects of conceptual number increase. This suggests that inflectional morphology serves to regulate the syntax of agreement.

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APPENDIX 1. AUDITORY STIMULI, EXPERIMENT 1

Type	English	Spanish
Single referent	The doll for the girls	La muñeca para las niñas
	The desk for the students	El escritorio para los estudiantes
	The note from the girls	La nota de las chicas
	The key to the suitcases	La llave de las maletas
	The train to the castles	El tren a los castillos
	The ship of the pirates	El barco de los piratas
	The bus to the schools	El camión a las escuelas
	The spoon for the babies	La cuchara para los bebés
	The bank next to the cafés	El banco al lado de los cafés
	The home of the ladies	El hogar de las mujeres
	The statue next to the tree	La estatua al lado de los árboles
	The road to the mountains	El camino a las montañas
	The light over the tables	La luz sobre las mesas
	The plate for the apples	El plato para las manzanas
	The lamp for the boys	La lámpara para los niños
Distributive referent	The box for the rings	La caja para los anillos
	The arrow on the signs	La flecha en las señales
	The name on the letters	El nombre en las cartas
	The sign on the hotels	El letrero en los hoteles
	The stamp on the envelopes	El timbre en los sobres
	The door to the houses	La puerta de las casas
	The picture on the postcards	La foto en las tarjetas postales
	The uniform of the soldiers	El uniforme de los soldados
	The flower in the vases	La flor en los floreros
	The label on the bottles	La etiqueta en las botellas
	The price of the skirts	El precio de las faldas
	The hat on the guys	El sombrero de los muchachos
	The date on the papers	La fecha en los papeles
	The number on the computers	El número en las computadoras
	The plant in the pots	La planta en los tiestos
	The design on the shirts	El dibujo en las camisas
	The flag on the buildings	La bandera en los edificios

APPENDIX 2. AUDITORY STIMULI, EXPERIMENT 2

<i>Type</i>	<i>English</i>	<i>Spanish</i>
Single referent	The bag for the towels	La bolsa para las toallas
	The drawer for the papers	El cajón para los papeles
	The shelf for the books	El estante para los libros
	The key to the doors	La llave para las puertas
	The telephone of the secretaries	El teléfono de las secretarias
	The house in the mountains	La casa en las montañas
	The gift for the daughters	El regalo para las hijas
	The trap for the rats	La trampa para las ratas
	The hotel of the travelers	El hotel de los viajeros
	The bird of the girls	El pájaro de las niñas
	The ball for the kids	La pelota para los chicos
	The chalkboard of the teachers	La pizarra de los maestros
	The pool for the swimmers	La piscina para los nadadores
	The book for the students	El libro para las estudiantes
	The television of the brothers	El televisor de los hermanos
Distributive referent	The dress of the ladies	El vestido de las mujeres
	The jacket of the guys	La chaqueta de los muchachos
	The watch of the men	El reloj de los hombres
	The chimney of the houses	La chimenea de las casas
	The skirt of the girls	La falda de las chicas
	The necklace of the actresses	El collar de las actrices
	The collar on the dogs	El collar de los perros
	The bed in the rooms	La cama en los cuartos
	The shirt on the men	La camisa de los hombres
	The tie of the clowns	La corbata de los payasos
	The uniform of the policemen	El uniforme de los policías
	The dress for the brides	El vestido para las novias
	The coat of the models	El abrigo de los modelos
	The bracelet of the ladies	La pulsera de las mujeres
	The keyboard of the computers	El teclado de las computadoras
	The bell of the cows	La campana de las vacas
	The medal for the winners	La medalla para los ganadores