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The influence of conversational context and the developing lexicon on the calculation of scalar implicatures

Insights from Spanish-English bilingual children

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Although monolingual children do not generally calculate the upper-bounded scalar implicature (SI) associated with ‘some’ without additional support, monolingual Spanish-speaking children have been reported to do so with *algunos* (‘some’), and further distinguish *algunos* from *unos*. Given documented cross-linguistic influence in interface phenomena in bilinguals, we asked whether young Spanish-English bilinguals calculate SIs with *algunos*, or if there is an effect of acquiring languages with overlapping but diverging lexical entries. Two experiments reveal that not only do bilinguals inconsistently calculate SIs, Spanish monolinguals do not always either. In Experiment 1, bilinguals did not calculate the SI associated with *algunos*. However, in Experiment 2, which calls upon their awareness of speaker-hearer dynamics, they did. This research highlights the challenges arising from interpreting linguistic phenomena where lexical, semantic, and pragmatic information intersect, and is a call for further investigation with bilinguals in a rapidly growing area where bilingual research is lacking.

Keywords: Pragmatics, scalar implicatures, cross-linguistic influence

1. Introduction

When a TV corporation apologizes for *some viewers* missing key moments of their favorite show because of a failure in the system (as happened during the 2014 Grammys), how do we know that there were still *other* viewers who were able to

witness this moment in entertainment history? What does the word *some* signal to us, and how do we somehow instinctively know that this apology applied to ‘some, but not all’ of the viewers? This phenomenon, known as *scalar implicature* (SI), was discussed in detail by Grice (1989), and extended by Horn (1972, 1989). SIs such as this one are part of a larger pragmatic phenomenon known as *conversational implicatures*. These are aspects of the meaning of an utterance that go beyond the literal, semantic meaning — and are not only intended by a speaker, but also retrievable by the hearer, given other aspects of the speaker-hearer relation and the discourse context. Thus, SIs lie at the intersection of lexical semantics and pragmatics, and therefore present an interesting case study for bilingual language acquisition.

While cross-linguistic effects of the syntax/pragmatics interface on bilingual acquisition have been studied in recent years (Argyri & Sorace 2007, Hulk & Müller 2000, Müller & Hulk 2001, Serratrice, Sorace & Paoli 2004, Sorace *et al.*, 2009), phenomena that lie at the lexical semantics/pragmatics interface (such as SIs) have received less attention. There are, however, exceptions. Slabakova (2010) has shown that adult Korean L2 learners of English at both intermediate and advanced levels have no difficulty calculating the ‘some, but not all’ implicature in English, and concluded that once an adult learns the relevant lexical items, the computation of the scalar implicatures associated with the target lexical items is supported by their native language (provided the lexical entry is comparable) and processing resources. Moreover, the same distribution of ‘logical’ and ‘pragmatically sensitive’ responders observed in previous studies of monolingual children (cf. Noveck (2001) and Guasti *et al.* (2005)) is observed in adult L2 learners. In addition, Miller *et al.* (in press) have observed comparable performance between adult near-native English L2 learners of Spanish and adult native Spanish speakers in the interpretation of quantificational sentences in Spanish. Finally, Siegal, Matsuo & Pond (2007) and Siegal, Iozzi, & Surian (2009) have explored similar SI calculations in Japanese-English bilingual children and Slovenian-Italian bilingual children, respectively, with intriguing results, some of which we review below. (While Experiment 1 of Siegal *et al.* (2009) was designed to investigate children’s knowledge of violations of conversational maxims, the test items most relevant here — those that implicated the Maxim of Quantity — did not involve entailment-based scales.)

However, the investigation of SIs has to date not targeted bilingual children who are acquiring languages with differences in the composition of the lexical items triggering the scalar implicatures, and with differential rates in the L1 acquisition of SIs. Spanish and English present precisely such a case, because Spanish has two lexical entries for ‘some’, which differ in their lexical semantics and felicity conditions, while English has one entry (*some*), which varies in its

interpretation based on context and its prosodic realization. In this paper, we explore how Spanish-English bilingual children approach the SI triggered by *algunos* in Spanish, comparing their responses to monolingual Spanish-speaking children of the same age, and bilingual adult heritage speakers of Spanish.

The paper is structured as follows. In section 2, we provide background on scalar implicatures (SIs). In section 3, we review the semantic and pragmatic characteristics of the Spanish indefinites *algunos* and *unos*, and compare them to English *some*. In section 4, we review previous research on how monolingual children and some bilinguals interpret sentences in which an SI should arise. We close the section with special focus on how Spanish-speaking children calculate SIs. In section 5, we present two experiments. The results reveal that while Spanish-English bilinguals may align with Spanish-speaking monolingual children and diverge from Spanish monolingual adults in their failure to calculate SIs in one task, they still appear to be sensitive to SIs in conversational contexts that highlight the role of implicature calculation in a speaker-hearer interaction. Finally, in section 6, we conclude, and outline the implications of the current results for future research.

2. Linguistic background on scalar implicatures (SIs)

Grice proposed that speakers and hearers operate according to a Cooperative Principle, as stated in (1).

- (1) **Cooperative Principle** (Grice, 1975)
 Make your contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged.

Thus, at each stage of the conversation, some conversational moves will be appropriate, and others will not. Grice further proposed four categories, or ‘maxims’ of cooperative conversation: Quantity, Quality, Relation, and Manner. In this paper, we draw attention to the first maxim (Quantity), and the scalar implicatures (SIs) that arise from it. More specifically, our goal is to investigate the unique challenges the young Spanish-English bilingual child faces when approaching utterances in which a speaker intends for the hearer to calculate an implicature.

Grice’s Quantity maxim reads as follows:

- (2) **Maxim of Quantity** (Grice, 1989)
 a. Make your contribution as informative as is required (for the current purposes of the exchange).
 b. Do not make your contribution more informative than is required.

And as Horn (2004) puts it, this maxim “is systematically exploited to yield upper-bounding generalized conversational implicatures associated with scalar values” (pg. 8).¹

The following example illustrates how an upper-bounded implicature is derived via the first submaxim. Imagine that a speaker delivers the utterance in (3).

(3) I ate some (of the) strawberries.

Upon hearing this utterance, a listener might calculate the implicature that the speaker ate ‘some, but not all’ of the strawberries, because if the speaker *had* eaten all of them, then s/he would have said, *I ate all of the strawberries*. The fact that s/he used *some* instead of *all* invites the ‘some, but not all’ implicature. The hearer relies upon his/her knowledge of the possible lexical alternatives (e.g., *some, many, most, all*) to infer either that the speaker *knows* that s/he did *not* eat all of them, or *does not know* whether s/he ate all of them — otherwise, the speaker would have used a stronger alternative instead of the weaker *some*. (That is, the implicature is epistemically modified.)

Calculating this ‘some, but not all’ implicature is referred to as retrieving an upper-bounded, or ‘two-sided’ meaning. This is because the weaker lexical item that has been used to trigger the SI is entailed by stronger lexical alternatives, with which it is also compatible. To eat *all* of the strawberries entails having eaten *some* of them. A hallmark of SIs stemming from this fact is that the implicature is defeasible, or cancellable. If the hearer (aghast) points at the empty bowl and looks at the speaker inquisitively, the speaker can reply (guiltily) as in (4).

(4) Yes, I ate some of the strawberries. In fact, I ate *all* of them.

If the speaker *did* eat all of the strawberries, s/he must have eaten *some* of them on the way to eating *all* of them, because *all* entails *some*. That this implicature is cancelable demonstrates its pragmatic status. An attempt to cancel entailed lexical content results in contradiction, as in (5).

(5) Yes, I ate [*some/all*] of the strawberries. #In fact, I ate *none* of them.

Psycholinguistic work on the processing of *some* by adults has probed the time course of implicature calculation. (See e.g., Bott & Noveck (2004) and Huang & Snedeker (2009a); Breheny et al. (2013) and Grodner et al. (2010); and Degen & Tanenhaus (2015), for contrasting evidence and accounts.)

We should note that the pronunciation of *some* (and the linguistic context in which it appears) carries implications for whether and how readily an SI is

1. The account of SIs we present here is consistent with that of Horn (1989, 2004). See e.g., Chierchia, Fox, & Spector (2012) for an alternative, grammatical account.

calculated. A weak, de-stressed pronunciation results an obligatorily weak construal without an upper bound, supporting a descriptive, orthetic, reading and allowing *some* to appear quite easily in an existential *there* construction and take narrow scope with respect to negation. By contrast, a stressed, or focused *some* typically supports a strong construal, a quantificational reading and categorical judgments, renders the appearance of *some* in an existential *there* construction degraded, and forces *some* to take wide scope with respect to negation (Giannikidou, 2011; Ladusaw, 1994; McNally & van Geenhoven, 1998; Milsark, 1974). When *some* simply carries a pitch accent without any contrastive focus contour, it licenses, but does not require, implicature calculation. In our stimuli, we do not de-stress *some* (as *sm*), but also do not assign it contrastive focus or a non-default prosody, which could favor SI calculation.

3. Linguistic analysis of *algunos* and *unos*

In Spanish, there are two indefinites that correspond to the interpretation of ‘some’: *algunos* and *unos*. Relevant to our research interests, these lexical items pattern differently with respect to SIs. Let us start by first establishing their similarity. As Gutiérrez-Rexach (2001) and Martí (2008) have observed, *algunos* and *unos* have overlapping distribution, and appear to have the same denotation of ‘some’. For example, in (6) (Gutiérrez-Rexach (2001)’s (7)), both sentences appear to assert that Juan read multiple books.

- (6) a. Juan leyó **unos** libros
 Juan read some books
 b. Juan leyó **algunos** libros
 Juan read some books

Likewise, both sentences in (7) (Martí (2009)’s (1)) assert something similar about a plurality of boys (a) or books (b). Note that both appear in an existential construction in (7b), signaling their weak quantificational status (Milsark 1974).

- (7) a. Llegaron **algunos/unos** chicos a la oficina.
 arrived some boys to the office
 ‘Some boys arrived at the office’
 b. Hay **algunos/unos** libros sobre la mesa.
 are some books on the table
 ‘There are some books on the table’

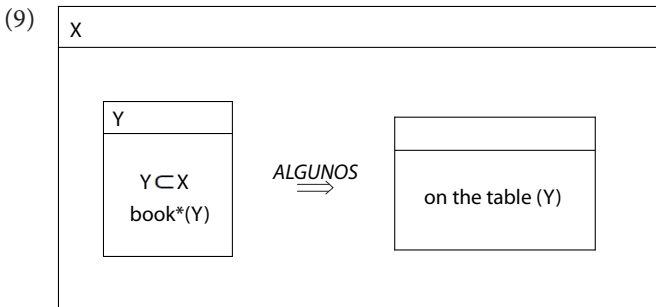
And with both quantifiers, the set denoted by the head noun must be non-empty, as shown in (8).

- (8) Trajeron **algunos/unos** gorilas asiáticos al zoo. #De hecho, no queda **ninguno**.
 brought some gorillas Asian to zoo in fact no remain none
 ‘They brought some Asian gorillas to the zoo. In fact, there are none left’

These requirements (or more precisely, entailments) of semantic plurality and non-emptiness are shared by these quantified NPs, and not by bare plurals, as Martí (2008) notes.

However, while *unos* and *algunos* have similar semantics, Martí argues (2007, 2008, 2009) that only *algunos* has two additional requirements: partitivity and contextual dependence. Both Gutiérrez-Rexach (2001) and Martí (2009) distinguish between *algunos* and the explicit partitive *algunos de los* (some of the). Martí argues that the latter involves ‘double context dependence’, because both *alg-* and the definite determiner *los* introduce context dependence. Gutiérrez-Rexach (2001) notes that like the English *some*, there are contexts in which *algunos* can mean ‘some’ or ‘some of the’, whereas *algunos de los* can only have the partitive reading. All of the linguistic stimuli in our experiments use the bare *algunos* without the explicit partitive.

Gutiérrez-Rexach (2001) captures these aspects of the semantics of *algunos* through a Discourse Representation Structure (DRS) that gives rise to an ‘obligatory linking’ constraint of *algunos*. (Gutiérrez-Rexach notes that this phenomenon is similar to proposals about D(iscourse)-linking (Pesetsky 1987) or partitive interpretation (Enç 1991).) This DRS is presented in (9) (his Figure 10), for a sentence like *algunos libros están en la mesa* ‘some of the books are on the table’. This representation says that there is a plurality of books (Y) that are part of a plural discourse referent X, and the Y books are on the table. *Unos* lacks such a constraint.



Martí (2007, 2008, 2009) and Fábregas (2010), following Martí, argue that the partitivity and context-dependence features that are particular to *algunos* arise because of the *alg-* component of the lexical item. While *unos*, Martí argues, only spells out part of the plural indefinite hierarchy, *algunos* spells out the entire hierarchy. When *alg-* is added to *unos*, it inherits all of its properties (e.g., plurality, existential quantification, etc.), and additionally an implicature that there are P

individuals who are *not* in Q, as captured in (10) (her (83) in (2008) and (28) in (2009)).

$$(10) \quad [[\mathbf{alg-}]] = \lambda R_{\langle et, \langle et, t \rangle \rangle} . \lambda P_{\langle et \rangle} . \lambda Q_{\langle et \rangle} . R(P)(Q)$$

Implicature: $R(P \cap C)(\{x: Q(x) = 0\})$

That this part of the meaning is an *implicature* is shown in (11) (Martí (2008)'s (54) and (12) (her (58)), where the implicature generated by *algunos* can be cancelled, and a similar attempt with *unos* fails. As we noted above, defeasibility is one of the hallmarks of conversational implicatures.

- (11) **Algunos** estudiantes vinieron ayer a verme. De hecho, vinieron **todos**.
 some students came yesterday to me in fact, came all
 'Algunos students came to see me yesterday. In fact, they all came.'
- (12) a. No están **ALGUNOS** libros encima de la mesa, están **TODOS**.
 not are some books on of the table are all
 'It's not that there are SOME books on the table, it's that they are ALL there.'
- b. *No están **UNOS** libros encima de la mesa, están **TODOS**.
 not are some books on of the table are all
 'It's not that there are SOME books on the table, it's that they are ALL there.'

4. Previous research on scalar implicatures in child language

4.1. Monolingual children

Given that SIs represent a pragmatic layer of meaning beyond the semantic content, and rely upon knowledge of the context and the dynamics of the speaker-hearer relation, it is perhaps not surprising that children across multiple languages typically encounter challenges in calculating these implicatures until quite late in development (Barner, Brooks, & Bale 2011; Noveck 2001; Papafragou & Musolino 2003; Smith 1980). One notable exception is experiments in which children are called upon to calculate so-called ad-hoc implicatures. In these cases, children perform quite well (Papafragou & Tantalou 2004), even at three years of age (Stiller, Goodman, & Frank 2015). Although performance improves when provided with training on felicity judgments and/or additional contextual support (Guasti *et al.* 2005; Papafragou & Musolino 2003), prosodic cues favoring an upper bound (Miller *et al.* 2005), or manipulation of task demands (Pouscoulous *et al.* 2007), it is clear that children even as old as 8–10 years of age (Noveck 2001)

differ from adults in how they approach utterances in which a speaker intends for the hearer to calculate an implicature.

Work by Noveck (2001) replicating and extending a statement evaluation paradigm employed by Smith (1980) and presenting a novel ‘box’ task seemed to indicate that French-speaking children are guided by semantic interpretations, failing to calculate scalar implicatures associated with ‘some’ and modals. This conclusion was bolstered by Papafragou & Musolino’s investigation of even younger Greek-speaking children. Using the Truth Value Judgment Task (TVJT) (Crain & McKee, 1985), Papafragou & Musolino (2003) uncovered differences among the rate that children calculate SIs based on the choice of three different lexical items (*start*, *some*, *two*) and their corresponding scales represented in the target sentence. For example, when children were presented with a scenario in which four horses all jumped over a fence, and the puppet delivered the underinformative sentence in (13), five-year-olds routinely accepted these statements (87.5%), whereas their adult counterparts routinely rejected them (7.5% ‘yes’). A similar pattern was observed for *arxizo* (*start*) in a ‘finish’ scenario, but not for the number term, which led to a separate set of conclusions regarding the semantics and pragmatics of numerals, which is not relevant here.

- (13) Merika apo ta aloga pidiksan pano apo to fraxti.
 some of the horses jumped over of the fence
 ‘Some of the horses jumped over the fence.’

Thus, in this study, too, children appeared to be more “logical” than adults (in Noveck’s terms), accepting the weaker, underinformative lexical term when the stronger one would hold. (See also Huang & Snedeker (2009b).)

A question that arose from this line of results was whether children simply lack the pragmatic wherewithal to respond appropriately, or whether they were not sufficiently aware that the task was tapping into judgments of felicity and conversational goals, rather than pure judgments of truth/falsity stemming from semantic content. Evidence in favor of the latter hypothesis comes from a manipulation implemented by Papafragou & Musolino in a follow-up experiment, and later replicated by Guasti *et al.* (2005) in Italian with *qualche* (*some*). Foppolo, Guasti, & Chierchia (2012) have also shown that children’s performance in a judgment task targeting SIs improves with age, and that their performance is no different with *qualche* (*some*) than with the partitive construction *alcuni dei* (*some of the*).

Children were given additional training before the experimental session designed to draw their attention to informative descriptions, and the speaker’s adherence to the Maxim of Quantity (and perhaps conventional means of expressing certain meanings). They were given a choice between two ways of describing an object, and asked to choose the ‘better’ way of saying it (e.g., *grape* or *fruit* for a

grape, and *chair* and *piece of furniture* for a chair). With this manipulation in place, children were more likely to reject the puppet's infelicitous statement, although they still did not reject the sentences at the adult level. That children's performance improves with training suggests it is within their capacity to calculate these implicatures, when given additional support for doing so.

More recent extensions by Katsos & Bishop (2011), who contrasted a binary true/false judgments task with one using a three-point judgment scale, have shown that five-year-olds speaking English are sensitive to the infelicity or underinformativity of the 'some' utterances. Children in their scalar judgment task (Experiment 2) did not indiscriminately accept the underinformative sentences; rather, they frequently rewarded the puppet with a medium-size strawberry — and not the largest strawberry representing acceptability — for such underinformative descriptions. (Children asked to perform binary judgments in their Experiment 1 patterned as with those in previous studies.)

Moreover, while results reported by Foppolo, Guasti, & Chierchia (2012) for four- and five-year-olds in their TVJT were consistent with Papafragou and Musolino (2003)'s in that the child's rejection rate was lower than that of adults, the rejection rate was still higher than in their earlier study (42% vs. 12.5%) — a result Foppolo *et al.* attributed to their increasing the set size of the characters involved in their stories to more than four, allowing for a proper subset of more than two (which they argue is a more representative sample size for *some*). (See also discussion in Degen & Tanenhaus (2015).) Thus, attention to the felicity conditions for the use of 'some', enhanced contextual support for implicature calculation, and methodological innovations increases the likelihood that children will calculate SIs with 'some'.

4.2. Monolingual Spanish-speaking children

Unlike their age-matched peers, Spanish-speaking children have been reported to consistently pattern like adults across various tasks in distinguishing between 'some' (*algunos (de los)*) and 'all' (*todos*). Since it is this very difference that drew us to look at Spanish-English bilingual children, we therefore review the relevant findings from Spanish monolingual children.

As part of a study investigating Chilean children's comprehension of plurals, Miller and Schmitt (reported in Miller *et al.* (2005)) asked children age four to seven (divided into two groups) to perform actions on sets of objects. Children were given instructions such as (14).

- (14) Pon **algunas** bolitas en la tapa.
 put some marbles in the tray
 'Put some marbles in the tray'

Children received four test sentences with *algunos/algunas*, four control sentences with *todos*, and four control sentences with *algunos de los*. In response to the *algunos* test items, children overwhelmingly provided upper-bounded responses, putting some, but not all, of the items on the tray (97% and 88% for the two age groups, respectively). (Results for *todos* and *algunos de los* controls were not reported.)

Evidence that children impose an upper bound with the partitive *algunos de los* also comes from Katsos *et al.* (2011), who, like Miller *et al.* (2005), employed a within-subject design, exposing participants to multiple quantificational items within a session (e.g., Spanish 'all', 'some', 'some...not', 'most', 'not all'). While the main purpose of their investigation was to probe the ability of children with SLI to calculate implicatures, the age-matched typically-developing controls (range 3.8–9.3; mean 6.4) are of interest. Children were shown displays with a series of five boxes, between 0 and 5 of which had a token in them, and asked to judge target sentences of the form '[quantifier] (of the) [objects] are (not) in the boxes'. When *all* of the boxes (5/5) contained a token, children who heard a sentence with *algunos de los* exhibited a rejection rate of 87%. (See the rightmost column of their Table 3.) The SLI children and the typically-developing language-matched control group (range 3.2–7.7; mean 4.7) did not perform as well (34% and 36% rejection rate, respectively).

It is possible, however, that in both of these experiments, the task design and the co-mingling of *algunos* with other quantificational scalemates within the same experimental session assisted children in their responses. For example, the presence of the partitive could have influenced children to assign an upper bound to all utterances with *algunos*, in contrast to those with *todos*. In addition, whereas a TVJT requires the relevant set(s) to be predetermined in order for participants to render a judgment of a corresponding sentence, an act-out task allows for participants to create these sets themselves (cf. Caponigro *et al.* 2012). Children may have formed contrasting sets of 'whole sets' for *todos* and 'proper subsets' for *algunos (de los)*, perhaps driving by something like mutual exclusivity (Markman & Wachtel 1988) or the principle of contrast (Clark 1987). (See discussion in Foppolo *et al.* (2012, pp. 388–389).) Still, the results demonstrate that young Spanish-speaking children can assign an upper bound to *algunos* sentences in appropriate contexts.

Vargas-Tokuda, Gutiérrez-Rexach, & Grinstead (2008), however, reported a high percentage of upper-bounded interpretations of *algunos* (without the *de los* partitive) by monolingual Spanish-speaking children age four to six and adults in

Mexico using a Truth Value Judgment Task (TVJT). During the experimental session, participants were presented with four target stories and scenarios, two with *algunos* and two with *unos*, as in (15).

- (15) **Algunos/unos** X saltaron sobre A.
 some X jumped over A
 ‘Some X jumped over A’

Children (like adults) appeared to assign an upper bound to *algunos* (and not *unos*), rejecting the statements in the ‘4 of 4’ scenario and accepting them in the ‘2 or 3 of 4’ scenarios. This asymmetry was replaced by overall acceptance when the statement appeared as the antecedent of a conditional (a downward-entailing environment, in which SIs are canceled). Their results are captured in Table 1.

Table 1. Percentage of rejection by children reported by Vargas-Tokuda *et al.* (2008) in two experiments for two Spanish indefinites (*algunos* and *unos*)

# characters	Declarative statement		Antecedent of Conditional	
	<i>algunos</i>	<i>unos</i>	<i>algunos</i>	<i>unos</i>
2 or 3 of 4	15%	26%	11%	11%
4 of 4	70%	33%	19%	4%

Thus, these Spanish-speaking children — who were younger than Noveck’s participants and who were a comparable age as those tested by others in TVJTs — appear to have readily calculated the ‘some, but not all’ implicature for the Spanish ‘some’ (*algunos*) without any prior training on felicity or conventional language. If indeed these Spanish monolingual preschoolers calculate an implicature with *algunos* — and moreover do not do so with *unos* — they appear to be aware of this aspect of the meaning of *algunos*.

It should, however, be pointed out that children may have succeeded in this task because, as in Miller *et al.* (2005)’s and Katsos *et al.* (2011)’s tasks, children were exposed to both *algunos* and *todos* within a session. Unlike these other tasks, however, children in this task were trained with three items designed to elicit ‘no’ responses, in which only *some* of the characters had the target predicate, and the puppet described the scenario by referring to *todos* (a rather surprising feature of this TVJT, given the similarity of these items to the test cases). Moreover, it appears from the description of the studies that *every* single test scenario involved characters jumping over something. Children were therefore inundated with this kind of scenario during the experimental session, and trained beforehand that *todos* sentences align with those scenarios in which *all* of the characters jump over the object.

This constellation of findings from these studies demonstrates that Spanish children age 4–6 are able to assign an upper bound to sentences with *algunos*. It appears, however, that while they did not receive the felicity/conventionality training that children from other languages received, which allowed their rejection rate to improve in the ‘all’ scenarios, they did still receive support in another form. We therefore hypothesized that Spanish-speaking children provided with similar evidence should also assign an upper bound to *algunos* (although perhaps not as robustly so if they are not bolstered with *todos*-specific training), and further that Spanish-English children could either pattern similarly, or, despite this support, fail to calculate the implicature in a comparable judgment task.

4.3. Bilingual children

To our knowledge, there have only been two studies that have looked at how bilingual children calculate SIs, both conducted by Siegal and colleagues. However, the results leave unclear what one should expect for bilingual children in general and for Spanish-English bilingual children in particular.

Siegal, Matsuo & Pond (2007) tested a group of Japanese-English bilingual children against two age-matched groups of Japanese and English monolinguals, using a version of Papafragou & Musolino (2003)’s TVJT, including a felicity training session prior to the experimental session. Participants saw four test scenarios in which a character did *all* of something, and then heard a puppet deliver a target statement with the word *some* (English) or *ikutuka* (Japanese) to describe the action. Bilingual children were tested in Japanese. While Siegal *et al.* (2007) reported that the bilingual children “outperformed” their monolingual peers, the results of the experiment do not actually indicate that bilinguals were *successful* in the task. Siegal *et al.* used a non-standard form of coding the results, tallying each of the ‘no’ responses as 1, for a possible score of 0 to 4. Since children do not generally calculate SIs at four to six years of age, a lower score might be predicted across trials, indicating failure to reject the *some* sentences in the ‘all’ scenarios. The results are presented in Table 2.

Table 2. Results from three language groups in Siegal *et al.* (2007)

Language group	Average age	SI score (out of 4)
English monolinguals	5;4	1.43 (1.5)
Japanese monolinguals	5;3	.35 (0.8)
Japanese-English bilinguals	5;5	2.30 (1.7)

The distribution of the bilingual children's responses reveals that they were scattered across 0–4 scores. Moreover, an average of a 2.3 out of 4 is 57% (chance-level performance). By contrast, Japanese and English monolinguals showed a clear inclination to answer affirmatively (36% and 9% 'no' responses, or 64% and 91% 'yes', respectively). Thus, while it may be true that the overall scores for the bilingual children were significantly higher than those of the monolingual children, it is not clear that they were proficient in calculating SIs.

Siegal, Iozzi, & Surian (2009) tested four- to five-year-old Slovenian-Italian children against age-matched Italian and Slovenian monolinguals on a variety of items related to a range of conversational maxims, without a focus on SIs in particular. While the monolingual and bilingual children performed comparably on items involving the Maxim of Quantity (where a speaker's response to a question was either under- or over-informative), bilingual children were more successful with items involving relevance, quality (truthfulness), and politeness. These results showed that the bilingual advantage was not tied to specific lexical items, but rather associated with a more general advantage for sensitivity to conversational dynamics between a speaker and hearer (an observation that may be relevant in the context of our Experiment 2).

There are two additional issues that arise from these studies. First, there did not appear to be any *a priori* linguistic reason to target these particular bilinguals. For example, it has not been found that children across these specific languages do or should pattern one way with implicatures, and children from the comparison group pattern in another way, based on scalar alternatives or grammatical differences. Second, although the bilingual children tested in the above experiments were learning two very different languages, the authors presented no lexical semantic differences between the targeted 'some' indefinites in these languages across different language families, as in the case of *algunos* and *unos* in Spanish.

A more interesting case might be one in which the languages are highly similar, and children are forced to deal with more lexical overlap. Given the linguistic and developmental background presented above, it seems especially informative to investigate how Spanish-English bilingual children approach SIs. Every child acquiring these lexical items must create an entry in the lexicon that allows it to be distinguished from other lexical items (particularly those in the same grammatical category). In addition, a child must learn to create a set of scalar alternatives among similar items, ranked by semantic strength. Thus, an English-speaking child must learn that *some* and *all* are part of a scale (and that prosodic realization affects the interpretation of *some*), and a Spanish-speaking child must learn that *algunos*, *unos*, and *todos* form a scale (and for both language groups, that the addition of the partitive induces the assignment of an upper bound). The Spanish-speaking child, however, must also learn that the two separate lexical entries for 'some' have

consequences for the calculation of SIs. The Spanish-English bilingual child has the added challenge of distinguishing *some*, *algunos*, and *unos*. It is possible that the combination of the lexico-semantic overlap among these items and the subtle pragmatic aspects of the meaning of *algunos* linked to the discourse context could pose a challenge for the young bilingual child, resulting in a behavioral pattern distinct from the one witnessed in previous studies with monolingual Spanish-speaking children. In particular, we might expect that cross-linguistic influence would result in a difference between the monolingual and bilingual children in their ability to calculate the SI associated with *algunos*, which overlaps with other lexical items meaning ‘some’, but (*ceteris paribus*) that the two groups would perform more similarly with *todos*, where pragmatics does not intrude. Our experiments were intended to explore this possibility.

5. Experiments

5.1. General participant information for both experiments

Monolingual Spanish children were recruited from a preschool in Peru. Bilingual child participants were recruited from two bilingual preschools in central New Jersey (USA).² The children were simultaneous bilinguals, who had been exposed to Spanish from birth and English between birth and 36 months of age, and were exposed to both English and Spanish in school at the time of data collection. Each child was tested individually in a quiet room, separate from the child’s class. Each child’s parent provided consent for him/her to participate, with an additional layer of consent for the bilingual children to record the experimental session, for the purpose of later transcription and verification of the child’s responses.

For bilingual children, we administered a version of a Spanish proficiency exam adapted from the BESA exam (Peña et al, in development), which included a forced-choice picture task measuring children’s knowledge of number and gender agreement, as well as their understanding of *unos* and *todos*. We also asked the children to name pictures of the lexical items used in our tasks (animals and inanimate objects) to test their familiarity with those words, and their production of gender and plural marking.

All adult participants were undergraduates at a public university in northern New Jersey who had been recruited through the participant pool of their Psychology courses. All were bilingual heritage speakers of Spanish who had

2. We are not aware of any dialectal differences between these two Spanish-speaking populations with respect to the rate of SI calculation associated with the target lexical items.

been exposed to Spanish since birth, and are therefore in a similar context of bilingual language acquisition as the bilingual children. They were proficient in both languages (Spanish and English) as verified by self-report and proficiency exam (Spanish). Most spoke Caribbean dialects of Spanish (from the Dominican Republic or Puerto Rico); others spoke dialects from Peru, Ecuador, Spain, Argentina, Colombia, El Salvador, and Mexico. They began learning English when they were between zero and three years old ($n = 5$), four to seven years old ($n = 10$), or eight to fifteen years old ($n = 5$).

5.2. Experiment 1

5.2.1. Participants

21 monolingual children (7 boys, 14 girls age 3;3 to 4;9, $M: 4;1$), 23 bilingual children (6 boys, 17 girls age 4;7 to 5;5, $M: 4;10$). 9 additional children were excluded (behavioral or attention issues $n = 1$, language proficiency reasons $n = 2$, *si* bias $n = 6$). 20 adults (18–34 years, $M: 23$ years) participated. One adult was excluded for missing more than half of the control items on both of the experiments.

5.2.2. Materials and procedure

The experimental paradigm employed was the Truth Value Judgment Task (Crain & McKee, 1985; Crain & Thornton, 1998). In this procedure, an experimenter tells the child a series of stories, while a puppet (played by a second experimenter) watches alongside the child. In our version, the story is accompanied by animated images presented as Powerpoint slides on a computer. The premise of the task is that the puppet is learning, and needs the child's help. During each story, the puppet watches very carefully. At the end of the story, the puppet delivers a statement about what he thought happened in the story. This statement features the target lexical item (e.g., *algunos* or *todos*). The child's job is to evaluate the statement in light of the preceding context — that is, to assess the truth value of the proposition it expresses. However, children did not explicitly say True or False: if the puppet was right, he nibbled a cookie, if he was wrong, he had to drink some milk. Children enjoyed the stories and had fun interacting with the puppet. (Adults participated in an automated task, in which narration was pre-recorded.)

Regardless of the answer, we occasionally asked children to tell the puppet *why* he was right or wrong (so that he could learn more) (see Lidz & Musolino (2002) and Syrett & Lidz (2011)). Eliciting such justifications provided us with a window into children's interpretations of these sentences beyond their mere acceptance or rejection of the puppet's statement. By asking for justifications for *both* types of responses, we ensured that we did not unintentionally favor one response type over another, or give children the impression that they had to provide additional

information only when they rejected the puppet's statement (which could result in a *yes* bias stemming from children's wanting the puppet to be correct more often than not). Before the experimental session proper, children participated in a training session to become accustomed to interacting with and rewarding the puppet for his responses. Neither of the training scenarios involved a target quantifier. The entire session took approximately 20 minutes.

Participants were presented with 12 items, pseudorandomized: four *algunos* test items, four *todos* test items, four controls. In each case, the target sentence was paired with a scenario rendering it True, False, or True but infelicitous. Children were presented with four *algunos* sentences and four *todos* sentences. Within each set of four target *algunos/todos* items, there were two scenarios in which *all* of the characters took part in the activity (the 'whole set' scenarios), and two in which only *some* of the characters did so (the 'subset' scenarios) (e.g., eating popsicles, kicking a ball into a goal, eating cookies, wearing tiaras). While in all of the scenarios all but one character clearly completed the activity, the last character always hesitated, and either inevitably did ('whole set' scenario) or did not ('subset' scenario) engage in the activity. This manipulation is intended to encourage children to attend to the end of the story, satisfy the condition of plausible dissent, and afford us the opportunity to increase the amount of contextual support provided to children for the purpose of interpreting these quantificational sentences.

In an example scenario, three horses are on a farm. The farmer has left some apples out for them, and they are all very hungry. The first horse says, "Let's eat some apples!" and dives right in, eating an apple. The second follows suit, and eats an apple as well. The third is hungry, and considers eating apples, too. He approaches the apples, ready to eat, but he sees that the last one is green, and does not like green apples at all. He declares, "I'm not going to eat any apples! I am going to look for something else to eat!" At the end of this story, the puppet would either utter the (a) or (b) version of (16).

- (16) a. **Todos** los caballos comieron manzanas.
 b. **Algunos** caballos comieron manzanas
 [*All/some*] horses ate apples.

In this scenario, the sentence with *todos* is False, while the sentence with *algunos* is True. A similar scenario in which *all* of the characters did the activity would make the *todos* sentence True, but the *algunos* sentence True, but infelicitous.

The control items were similar to the test items in structure, but did not feature a quantifier in the target sentence. The truth value of the sentence also varied, depending on the child's response to the previous test item, so that the experimenter could elicit both *sí* ('yes') and *no* ('no') responses during the test session. For example, in one story, Mickey and Goofy are playing with Play-Doh, and Mickey

asks Goofy to make him a red car out of the Play-Doh. Goofy does so. The puppet summarizes what happened saying either, *Yo creo que Goofy hizo un carro rojo* (I think that Goofy made a red car) (True) or *Yo creo que Goofy hizo un carro azul* (I think that Goofy made a blue car) (False). The full set of sentences is presented in Appendix 1.

5.2.3. Results

The results are presented in the figures below, for each participant group in turn (adult heritage speakers, monolingual Spanish-speaking children, and Spanish-English bilingual children). For each group, the dependent measure is the percentage 'yes' (*sí*) responses to the puppet's statement. The results for the *algunos* sentences are represented by the light grey bars, while those for the *todos* sentences are represented by the dark bars.

We begin with the adults, whose responses are presented in Figure 1.

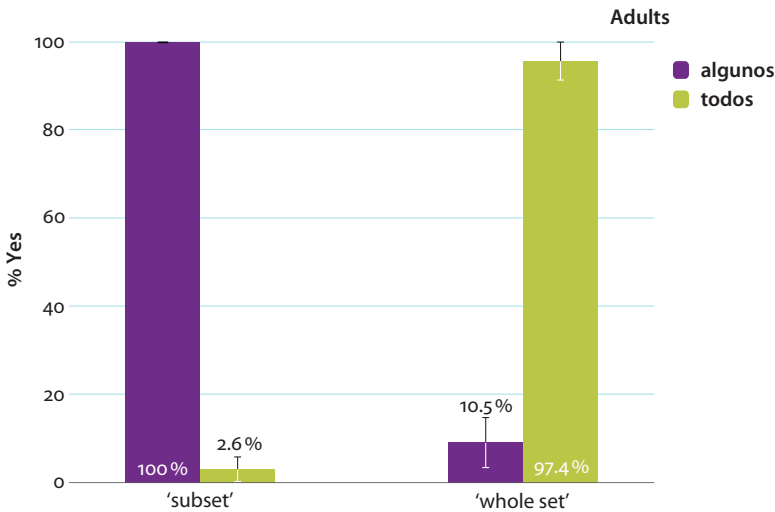


Figure 1. Percentage 'yes' provided by adults for 'subset' and 'whole set' scenarios for each test sentence type in Experiment 1

A Kruskal-Wallis H test showed that there was a statistically significant difference in acceptance rate for the four different quantifier-context combinations, $\chi^2(3) = 65.80$, $p < 0.0001$, with mean rank acceptances of *algunos*-'subset' (57.00), *todos*-'subset' (18.97), *algunos*-'whole set' (22.11), and *todos*-'whole set' (55.92). A Wilcoxon test reveals expected highly significant differences for acceptance rates between *todos*-'subset' and *todos*-'whole set' scenarios ($W = -190$, $z = -3.81$, $p = .0001$), and between *algunos*-'subset' and *algunos*-'whole set' scenarios ($W = 153$, $z = 3.61$, $p < .001$).

We now turn to the monolingual children, whose responses are presented in Figure 2.

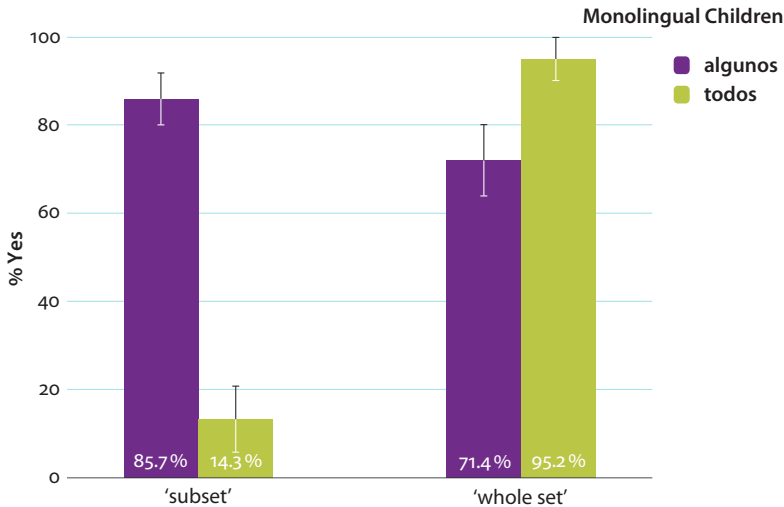


Figure 2. Percentage ‘yes’ provided by monolingual children for ‘subset’ and ‘whole set’ scenarios for each test sentence type in Experiment 1

A Kruskal-Wallis H test showed that there was a statistically significant difference in acceptance rate for the four different quantifier-context combinations, $\chi^2(3) = 38.62$, $p < 0.0001$, with mean rank acceptances of *algunos*-‘subset’ (50.95), *todos*-‘subset’ (18.71), *algunos*-‘whole set’ (44.24), and *todos*-‘whole set’ (56.1). A Wilcoxon test reveals highly significant differences for acceptance rates between *todos*-‘subset’ and *todos*-‘whole set’ scenarios ($W = -171$, $z = -3.71$, $p < .001$), but no significant difference between *algunos*-‘subset’ and *algunos*-‘whole set’ scenarios ($W = 33$, $z = 1.14$, $p = .25$). However, they were less likely to accept the *algunos* sentences than they were the *todos* sentences in the ‘whole set’ scenarios ($W = -48$, $z = -2.42$, $p = .02$).

Interestingly one child who rejected a *todos* sentence in a ‘subset’ scenario responded by saying, “*Algunos!*” This same child rejected an *algunos* sentence in a ‘whole set’ scenario, responding with, “*Todos!*” However, this child also accepted the other *algunos* sentence in a ‘whole set’ scenario, responding with, “*Todos!*” Other children accepted or rejected the *algunos* sentence in a ‘whole set’ scenario with similar responses, along with “*Sí, estos!*” [pointing at all four children], and “*Sí, cuatro!*” These responses seem — at least anecdotally — to indicate that a mere ‘yes’ or ‘no’ responses does not fully capture how children reasoned about such utterance-context pairs. Indeed, it does appear that at least some children recognize the defeasibility of the SI associated with *algunos*.

Finally, we present the data from the bilingual children, presented in Figure 3.

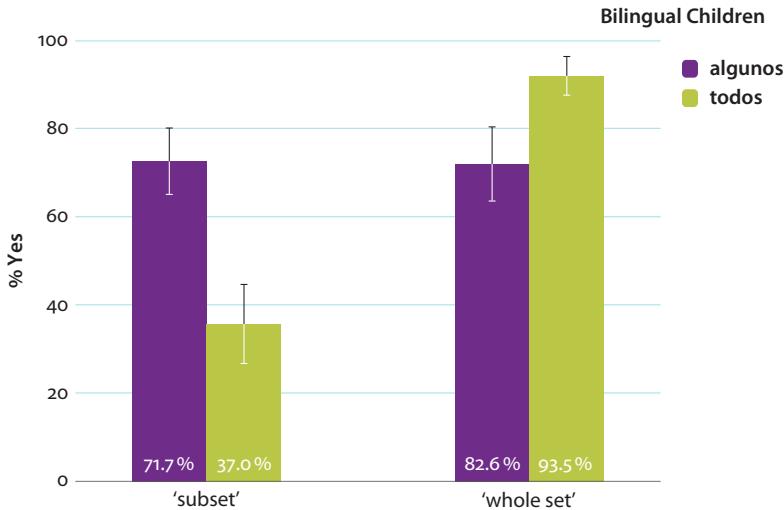


Figure 3. Percentage 'yes' provided by **bilingual children** for 'subset' and 'whole set' scenarios for each test sentence type in Experiment 1

A Kruskal-Wallis H test showed that there was a statistically significant difference in acceptance rate for the four different quantifier-context combinations, $\chi^2(3) = 22.38$, $p < 0.0001$, with mean rank acceptances of *algunos*-'subset' (46.48), *todos*-'subset' (28.37), *algunos*-'whole set' (51.98), and *todos*-'whole set' (59.17). There were highly significant differences for acceptance rates between *todos*-'subset' and *todos*-'whole set' scenarios ($W = -136$, $z = -3.5$, $p < .001$), but, as with the monolingual children, no significant difference between *algunos*-'subset' and *algunos*-'whole set' scenarios ($W = -26$, $z = -1$, $p = .32$). There was no difference in acceptance patterns for the 'whole set' items.

A direct comparison between the monolingual and bilingual children for the *algunos* items indicates that they had comparable acceptance rates for the *algunos*-'subset' items ($U_A = 199$, $z = .99$, $p = .32$), as well as for the *algunos*-'whole set' items ($U_A = 270$, $z = -.66$, $p = .51$). A comparison of the distribution of responses to the *algunos* sentences from the individual children in the monolingual and bilingual participant groups reveals that there was also no difference in their acceptance rates as individuals, as shown in Table 3 below. The difference between the two groups is not significant (Fisher Exact, $p = .36$).

Table 3. Comparison of individual children's responses to the *algunos* sentences for both child groups

Acceptance rate	Monolingual children	Bilingual children
0%	1	4
50%	6	4
100%	16	13

5.2.4. Discussion

The results of Experiment 1 demonstrated a difference in all participants' treatment of *algunos* and *todos*. Both groups of children (like the adults) were likely to accept the *todos* sentences in the 'whole set' context, and reject them in the 'subset' context. Notwithstanding, there was still a considerably high rate of acceptance (over 30%) by bilingual children in this context, indicating that these children may have experienced some difficulty with *todos*. The pattern of results for *algunos* was noticeably different from those of *todos* for all age groups. Adults consistently rejected the *algunos* sentences in the 'whole set' contexts, while monolingual children trended in this direction, and bilingual children showed no difference in acceptance between the 'subset' and 'whole set' contexts. By contrast, instead of rejecting the *algunos* sentences in the 'whole set' context, both the monolingual and the Spanish-English bilingual children in this experiment did not appear to calculate the SI. Rather, they accepted these *algunos* statements as True in both the 'subset' and 'whole set' scenarios. However, the monolingual children were more likely to accept the *todos* sentences in these scenarios, and in some cases did not seem to be just blindly accepting the *algunos* sentences in the 'whole set' scenarios, since in some instances, their *sí* response seemed to indicate that the implicature was cancelable, or that their 'yes' affirmation was qualified. Even so, such responses were not robust enough to pull these children towards an adult-like rejection pattern.

It may seem somewhat surprising that the monolingual children in our TVJT patterned differently than those in Vargas-Tokuda *et al.*'s (2008) study by failing to consistently calculate the SI associated with *algunos*. However, recall that the children in that task were given two crutches. First, their three-item pre-experiment training session was comprised of all false *todos* scenarios, and second, all test items were the same kind of 'jumping over x' events. Thus, the findings are interesting in that they complement previous studies by demonstrating that what might appear to be minor methodological approaches can significantly impact children's performance, and conclusions that are made about children's developing semantic and pragmatic knowledge.

There is, however, the matter of how the bilingual children compared with the monolingual children. This experiment demonstrated that they are similar in

their high acceptance rate of *algunos* sentences, but dissimilar in their relative acceptance of the *algunos* and *todos* sentences in the ‘whole set’ context. And while monolingual children seemed to trend towards lower acceptance for the ‘whole set’ scenarios than in the ‘subset’ scenarios, bilingual children manifested a trend in the opposite direction. This pattern raises the question of whether these bilingual children are capable of calculating SIs with *algunos* at all.

We thus sought to construct a task that could more successfully tap into children’s ability to distinguish between *algunos* and *todos*, and reject infelicitous sentences with *algunos* by enhancing the conversational role of, and motivation for, implicature calculation. While the TVJT provides contextual support for implicature calculation, it does not present participants with a discourse context in which a speaker and hearer rely upon each other’s adherence to being cooperative in their communicative goals. Experiment 2 was designed with this purpose in mind. Given that previous tasks have shown that methodological manipulations yield increased success rates with monolingual children, this time, we focus on bilingual children, in order to determine whether SI calculation with *algunos* is within their ability.

5.3. Experiment 2

5.3.1. Participants

22 bilingual children (6 boys, 16 girls age 4;7 to 5;5, *M*: 5;1) and 24 adults participated. 2 additional children were excluded for language proficiency reasons.³ 24 adults (19–35 years, *M*: 22 years) participated, one of whom was later excluded. These participants began learning English when they were between zero and three years old ($n = 13$), four to seven years old ($n = 5$), or eight to sixteen years old ($n = 4$) (Two did not provide us with this information.)

3. We attempted to run this task with other children ($n = 31$), but we did not use their data, as they consistently responded answered *sí* (‘yes’) in response to the experimenter’s question. We were quite surprised by this elevated ‘yes’ bias. We speculate, though that because no truly negative consequences resulted from the hearer failing to comply with the request, and both interlocutors remained happy, children may not have thought that the hearer had actually done anything wrong. Thus when asked, ‘¿Lo hizo bien?’ (*Did she do ok?*), children may have answered ‘yes’ because the question was vague enough to allow for the hearer to deviate from what was requested linguistically, as long as her actions could be reasonably accommodated and not throw a wrench in the speaker-hearer relationship. Because of this issue, we did not attempt to collect data on this task from the monolingual children in Peru, and instead focused on local adult heritage speakers.

5.3.2. *Materials and procedure*

This task was designed to highlight the role of the speaker-hearer relation in the calculation of implicatures. Recall that an implicature must be calculable; to that end, a hearer has to be able to call upon prior knowledge, shared beliefs or common ground, and aspects of the discourse context at hand to know that the speaker has intended for the hearer to retrieve a meaning above and beyond the asserted and logically true one. We therefore designed a task in which a speaker made a request of a hearer, and the hearer's job was to comply with the request as best she could, given the linguistic content of the speaker's utterance and the context.

Participants were presented with a series of nine short videos (six test videos, three controls). The control items involved a color term and the numbers two and three, but none of these controls involved SI calculation. Test and control items were pseudorandomized within the experimental session, and participants were presented with one of two counterbalanced orders. Videos were filmed in the laboratory with a Sony digital camera, and compiled and edited in iMovie. Each trial lasted less than 30 seconds, and the whole session took approximately five minutes.

All items had the same structure. Two girls sat at a table. One of them (Person 1) had a basket with some objects in it (all the same object kind). She turned to the other girl (Person 2) and delivered a request to put something on the table. See Figure 4. The second girl attempted to comply by taking some number of the objects out of the basket and putting them on the table. To conclude the exchange,



Figure 4. Setup for Experiment 4

the girls looked at each other and smiled, and the scene ended. The experimenter then asked the child, ‘¿Lo hizo bien?’ (*Did she do okay?*). A sample exchange for a ‘correct but infelicitous’ *algunos* ítem is presented in (17).

- (17) Person 1: Por favor, pon **algunos** libros en la mesa.
*Please put **some** of the books on the table.*
 Person 2: [puts **all** of the books on the table]
 Experimenter: ¿Lo hizo bien?
Did she do okay?

Person 1 held the basket at an angle, so that the child viewing the video could see whether any objects remained inside after Person 2 put some/all of them on the table. Children who were able to reject more than half of the incorrect items were included in the data analysis. The full set of verbal stimuli from Experiment 2 is presented in **Appendix 2**.

5.3.3. *Results*

The results, presented in terms of percentage of the actions that the children ‘allowed’ is presented in Figure 5 for the adults and in Figure 6 for the bilingual children.

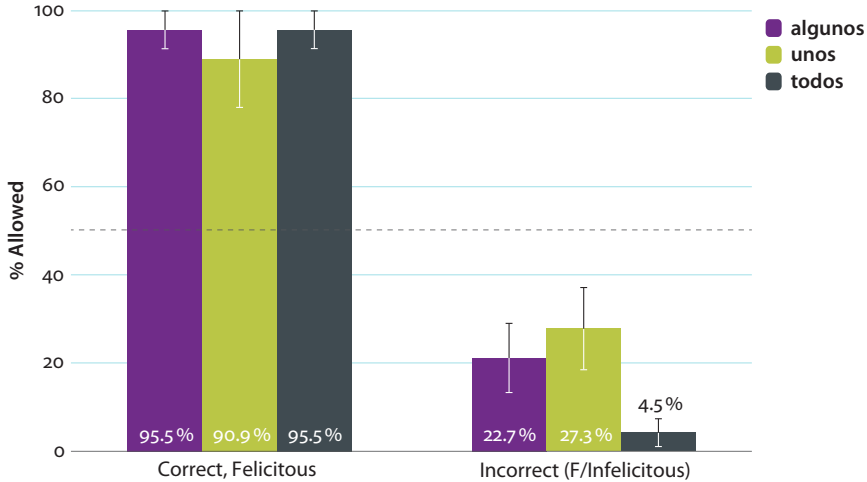


Figure 5. Percentage of time the hearer’s actions were allowed by **adult participants** in Experiment 2

Given the small sample size, and the number of tokens per test item (one per item type for each quantifier), we conducted a Chi-squared analysis comparing the number of contexts allowed and rejected in the ‘Correct, Felicitous’ contexts, and the ‘Incorrect (False/Infelicitous)’ contexts for each of the three quantifiers, and

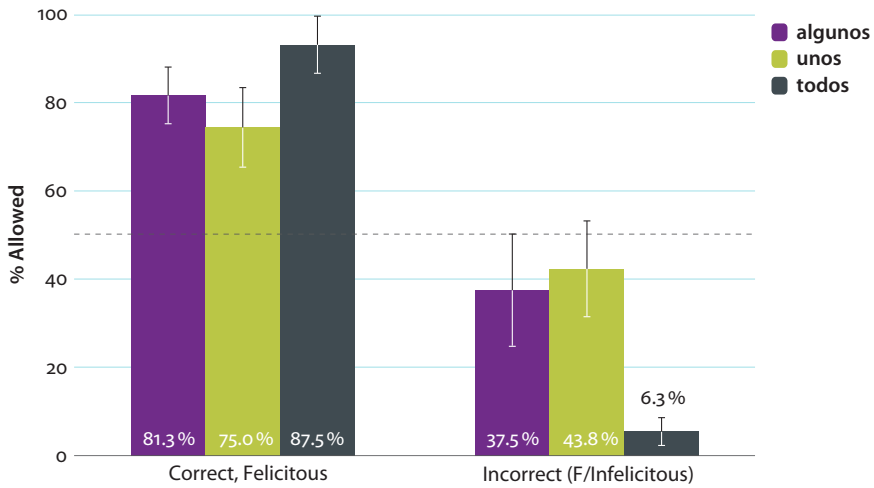


Figure 6. Percentage of time the hearer's actions were allowed by child participants in Experiment 2

then for all quantifiers pooled together. The raw number of contexts Allowed and Rejected for each sentence type, and overall, for the adult participants is presented in Table 4 and in Table 5 for the child participants.

Table 4. Distribution of contexts in which the hearer's actions were allowed by adult participants in Experiment 4

	<i>algunos</i>		<i>unos</i>		<i>todos</i>		Total	
	C	I	C	I	C	I	C	I
Allowed	21	5	20	6	21	1	62	12
Rejected	2	18	3	17	2	22	7	57

C: 'Correct, Felicitous' contexts

I: 'Incorrect (False/Infelicitous)' contexts

Table 5. Distribution of contexts in which the hearer's actions were allowed by child participants in Experiment 4

	<i>algunos</i>		<i>unos</i>		<i>todos</i>		Total	
	C	I	C	I	C	I	C	I
Allowed	13	6	12	7	14	1	39	14
Rejected	3	10	4	9	2	15	9	34

C: 'Correct, Felicitous' contexts

I: 'Incorrect (False/Infelicitous)' contexts

For the adults, a 2 (context: Correct, Incorrect) x 2 (response: Allowed, Rejected) Chi-squared test confirms highly significant differences in the distribution for *algunos* (Yates $\chi^2 = 19.9$, $p < .0001$), *unos* (Yates $\chi^2 = 14.95$, $p < .001$), and *todos* (Yates $\chi^2 = 31.45$, $p < .0001$). The difference in the overall distribution of responses was also highly significant (Yates $\chi^2 = 74.38$, $p < .0001$). A Wilcoxon signed-rank test on the overall means confirmed that participants were more likely to accept Person 2's actions in the 'Correct, Felicitous' contexts than in the 'Incorrect (False/Infelicitous)' contexts ($W = 1325$, $z = 6.03$, $p < .0001$).

The pattern of responses was similar for the children. A 2 (context: Correct, Incorrect) x 2 (response: Allowed, Rejected) Chi-squared test confirms a significant difference in the distribution for *algunos* (Yates $\chi^2 = 4.66$, $p = .03$) and a highly significant difference for *todos* (Yates $\chi^2 = 18.07$, $p < .0001$), but not for *unos*, although it trended in the predicted direction (Yates $\chi^2 = 2.07$, $p = .15$). The difference in the overall distribution of responses was significant (Yates $\chi^2 = 24.26$, $p < .0001$). A Wilcoxon signed-rank test on the overall means confirmed that participants were more likely to accept Person 2's actions in the 'Correct, Felicitous' contexts than in the 'Incorrect (False/Infelicitous)' contexts ($W = 350$, $z = 4.2$, $p < .0001$).

5.3.4. Discussion

While the bilingual children participating in Experiment 2 did not make a cut-and-dry distinction between *algunos* and *unos* with respect to the calculation of SIs (unlike the monolingual children in Vargas-Tokuda *et al.* (2008)), the results from Experiment 2 are striking for two reasons. First, bilingual children — like adults — distinguished between the Correct/Felicitous on the one hand, and Correct/Infelicitous and False cases on the other. Second, in the case of the 'Incorrect (False/Infelicitous)' cases, both children and adults were likely to reject Person 2's actions if Person 1 had used *algunos*. Thus, the bilingual children's knowledge of the lexical semantics of *todos* is evident, along with their sensitivity to calculate SIs associated with weaker indefinite scalemates. However, it is unexpected indeed that the adults did not distinguish between *algunos* and *unos*, and calculated an implicature with both lexical items. While it is possible the presence of scalemates may have encouraged contrastive reasoning in children, it is not clear why adults would not also benefit from this co-mingling and only set up a contrast between *algunos* and *unos* on the one hand and *todos* on the other, but not also between *algunos* and *unos*.

These results may be complemented by those reported by Miller *et al.* (in press), who found that adult near-native L2 Spanish speakers and adult native speakers who were presented with scenarios in which three or four out of four of the characters performed an action, along with a corresponding description

with *algunos*, failed to reject such utterances. For scenarios in which three of the four characters performed the action, acceptance rates for the *algunos* sentences were near ceiling, while for scenarios in which all four performed the action, acceptance rates for *algunos* sentences only dropped to just above 60%. Thus, while the adults in our task did consistently calculate the SI with *algunos*, they also did so with *unos* — a pattern that was not expected. And while the adults in their task distinguished between an ‘all’ and ‘most’ scenario, they also did not calculate the SI with *algunos* at the rate one might have expected. Further research should probe the conditions under which adults demonstrate a clear difference between Spanish existential quantifiers (or fail to do so), and pair these results with those from children.

We propose that the source of the difference in bilingual children’s performance between Experiments 1 and 2 is in the extent to which the conversational role of SI calculation was highlighted. In Experiment 1, children received contextual build-up in the story, and were also asked to evaluate a statement delivered by a puppet who was learning. In Experiment 2, we showed participants a speaker and a hearer interacting, and the speaker delivering a request to which the hearer responds. Children benefited from this additional pragmatic boost, and were more likely to reject an ‘all’ action by the hearer when the speaker had said *algunos* (an ‘Incorrect, Infelicitous’ case). Thus, Spanish-English bilingual children are able to calculate SIs, but their ability to do so varies with the nature of contextual support they are given to do so.

6. Conclusion

In this research, we examined the calculation of the ‘some, but not all’ scalar implicature (SI) by Spanish-English bilingual children, by comparing performance with *algunos*, *unos* and *todos*. We targeted these items both because they present an interesting contrast with English, given that Spanish has two distinct lexical items corresponding to English *some* (but which also diverge in their meaning in Spanish), and because Spanish-speaking children had been shown to be able to calculate the SIs that arise from the quantifier *algunos*, and distinguish it from *unos* (Miller et al, 2005; Vargas-Tokuda *et al.*, 2008). This is not, however, the pattern that either the Spanish monolinguals or the Spanish-English bilingual children exhibited in our tasks.

It is also not the pattern that we have observed in related work comparing Spanish monolingual and Spanish-English bilingual children. For example, in one experiment, Spanish monolingual children, Spanish-English-bilingual children, and adult Spanish heritage speakers were shown a display in which four scenes

were pitted against each other: one in which the individuals in the set *all* had the target object (e.g., treats), one in which only *some* of them did, one in which they all had another object (e.g., balls), and one in which they all had nothing, as in Figure 7. Thus, as in Experiment 1, we compared ‘whole set’ and ‘subset’ scenarios.

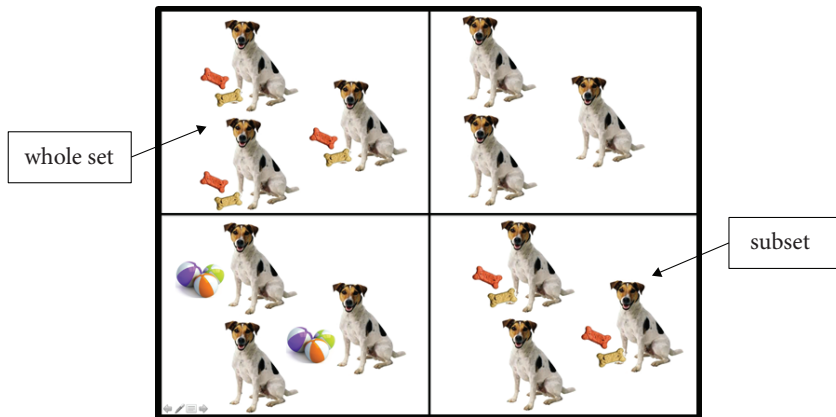


Figure 7. Sample stimulus from an independently-reported forced choice task in Syrett et al. *algunos* and *todos* were presented within subjects in sentences that invited the participant to choose the best of the four scenes corresponding to a target sentence, as in (18).

- (18) Muéstrame dónde [todos los/algunos] perros tienen galletas.
 Show me where [*all of the/some of the*] dogs have treats.

The adults showed the predicted pattern, robustly selecting the ‘whole set’ for *todos* sentences, and the ‘subset’ for *algunos* sentences, and choosing at chance between the two for *unos* sentences. Monolingual children also selected the ‘whole set’ for the *todos* sentences the vast majority of the time, but showed no difference in choice for either indefinite. Bilingual children diverged from both groups patterning at chance in their selection. Thus, here, too, we observe a task-specific ability to respond appropriately — not only to calculate implicatures, but also to respond correctly to judgments of sentences involving the universal quantifier *todos*. That they responded in the predicted direction to the *todos* sentences in our Experiments 1 and 2 here speaks to their knowledge of the universal force of this quantifier. Where the task briefly reported above diverges from these other tasks we have presented here is in the relatively impoverished contextual support that it offers. Thus, like researchers before us, we stress the importance of presenting children with a rich context in which they are called upon to render judgments of the target quantificational sentences, especially where a pragmatic phenomenon such as SI is concerned.

What Experiment 2 had to its advantage was that it presented children with a speaker-hearer interaction that replicated the conditions under which a hearer would need to evaluate Gricean principles in a naturalistic way. These new findings therefore highlight important variables relevant to the developing knowledge of conversational principles and the lexical semantics/pragmatics interface in bilingual children, and children in general. Previous research suggests that it is those areas of language that involve an interface between syntax and other domains that are most vulnerable to cross-linguistic influence in bilingual speakers (Sorace, 2000, Sorace & Filiaci, 2006) — particularly those for which there is partial overlap between the languages (Hulk & Müller, 2000; Müller & Hulk, 2001). We propose that the differences we found between the bilingual and monolingual children in their ability to calculate SIs is (at least in large part) the result of cross-linguistic influence from English.

Given that the ability to calculate SIs involves the interface between lexical, semantic, and pragmatic knowledge, and the fact that there is partial overlap between lexical entries that form scalemates across the target languages, the investigation of bilingual children's ability to engage in pragmatic reasoning relevant to conversational implicatures is an exciting avenue for future research. We thus view the current work as an invitation to other researchers to explore linguistic phenomena that lie at the interface of pragmatics and other areas of language, in order to identify the particular challenges and successes characteristic of ongoing language acquisition in bilingual children.

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Appendix 1: Materials for Experiment 1

Test items

todos

- (1) Creo que **todos** los caballos comieron manzanas.
I think that all of the horses ate apples.
- (2) Creo que **todos** los conejos saltaron sobre el tronco.
I think that all of the rabbits jumped over the log.
- (3) Creo que **todos** los pingüinos comieron las paletas.
I think that all of the penguins ate popsicles.
- (4) Creo que **todos** los gatitos comieron una galleta.
I think that all of the cats ate a cookie.

algunos

- (5) Creo que **algunas** vacas recibieron premio.
I think that some (of the) cows received a prize.
- (6) Creo que **algunos** niños marcaron goles.
I think that some (of the) boys scored a goal.
- (7) Creo que **algunos** perros jugaron con las pelotas.
I think that some (of the) dogs played with balls.
- (8) Creo que **algunas** chicas se probaron una corona.
I think that some (of the) girls tried on a tiara (crown).

Filler items

- (9) Creo que Max dibujó [dos/tres] perros.
I think that Max drew [two/three] dogs.
- (10) Creo que Boots le trajo [una/tres] manzana(s).
I think that Boots brought [one/three] apple(s).

- (11) Creo que Goofy hizo un carro [rojo/azul].
I think that Goofy made a [red/blue] car.
- (12) Creo que Blue dibujó [una/tres] estrella(s).
I think that Blue drew [one/three] star(s).

Appendix 2: Materials for Experiment 2

Test items

todos

- (13) **Correct** response
Person 1: Por favor, pon **todos** los círculos en la mesa.
*Please put **all** of the circles on the table.*
Person 2: Puts **all** of the circles on the table.
- (14) **Incorrect** response
Person 1: Por favor, pon **todos** los cuadrados en la mesa.
*Please put **all** of the squares on the table.*
Person 2: Puts **some, but not all** of the squares on the table.

algunos

- (15) **Felicitous** response
Person 1: Por favor, pon **algunos** marcadores en la mesa.
*Please put **some** of the markers on the table.*
Person 2: Puts **some, but not all** of the markers on the table.
- (16) **Infelicitous** response
Person 1: Por favor, pon **algunos** libros en la mesa.
*Please put **some** of the books on the table.*
Person 2: Puts **all** of the books on the table.

unos

- (17) **Felicitous** response
Person 1: Por favor, pon **unos** animales en la mesa.
*Please put **some** of the animals on the table.*
Person 2: Puts **some, but not all** of the animals on the table.

(18) **Potentially Infelicitous** response

Person 1: Por favor, pon **unos** cubos en la mesa.

*Please put **some (but not all)** of the blocks on the table.*

Person 2: Puts **all** of the blocks on the table.

Filler items(19) **Correct** response

Person 1: Por favor, pon **tres** carros en la mesa.

*Please put **three** cars on the table.*

Person 2: Puts **three** cars on the table.

(20) **Incorrect** response

Person 1: Por favor, pon los círculos **rojos** en la mesa.

*Please put the **red** circles on the table.*

Person 2: Puts the **purple (not the red)** circles on the table.

(21) **Incorrect** response

Person 1: Por favor, pon **cuatro** marcadores en la mesa.

*Please put **four** markers on the table.*

Person 2: Puts **two** markers on the table.

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