

*EL PAPEL DE LA PREGUNTA BAJO INVESTIGACIÓN EN LA GENERACIÓN  
DE IMPLICATURAS ESCALARES EN ADULTOS Y NIÑOS HISPANOHABLANTES*

**AMY S. PRATT**

ORCID.ORG/0000-0002-8878-0755

THE OHIO STATE UNIVERSITY

apratt1@uci.edu

**JOHN A. GRINSTEAD**

ORCID.ORG/0000-0001-6667-8250

THE OHIO STATE UNIVERSITY

grinstead.11@osu.edu

**NICOLETTE LEON**

ORCID.ORG/0000-0002-5617-9316

THE OHIO STATE UNIVERSITY

leon.74@osu.edu

**RAMÓN PADILLA-REYES**

ORCID.ORG/0000-0003-3713-7396

THE OHIO STATE UNIVERSITY

padillareyes.1@osu.edu

**Resumen:** *Existen líneas independientes de investigación que han examinado tanto lo que los niños saben acerca de las implicaturas como, con respecto al alcance de los cuantificadores, el papel desempeñado por la estructuración del discurso experimental con una Pregunta Bajo Investigación (PBI) explícita, con el fin de hacer que los niños accedan más fácilmente a las interpretaciones. En esta investigación, nos preguntamos si una PBI explícita puede facilitar la generación de implicaturas, por lo cual comparamos dos PBIs particulares para determinar si el nivel de especificidad es importante. Los resultados demuestran que los adultos, a diferencia de los niños, generaron implicaturas y que sus juicios eran más categóricos que en la investigación previa. No había diferencias significativas entre las PBIs generales vs. las específicas.*

**PALABRAS CLAVE:** SEMÁNTICA EN DESARROLLO; PRAGMÁTICA EN DESARROLLO; INDEFINIDOS; PRAGMÁTICA; SEMÁNTICA

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## GENERATION OF SCALAR IMPLICATURES IN SPANISH-SPEAKING ADULTS AND CHILDREN: THE ROLE OF THE QUESTION UNDER DISCUSSION

**AMY S. PRATT**

ORCID.ORG/0000-0002-8878-0755

THE OHIO STATE UNIVERSITY

apratt1@uci.edu

**JOHN A. GRINSTEAD**

ORCID.ORG/0000-0001-6667-8250

THE OHIO STATE UNIVERSITY

grinstead.11@osu.edu

**NICOLETTE LEON**

ORCID.ORG/0000-0002-5617-9316

THE OHIO STATE UNIVERSITY

leon.74@osu.edu

**RAMÓN PADILLA-REYES**

ORCID.ORG/0000-0003-3713-7396

THE OHIO STATE UNIVERSITY

padillareyes.1@osu.edu

**Abstract:** Independent lines of research have examined both what children know about pragmatic implicatures and, with respect to quantifier scope, the role of structuring experimental discourse with an explicit Question Under Discussion (QUD) to make interpretations easier for children to access. Our research question was whether an explicit QUD can facilitate the generation of implicatures. We compared two specific QUDs to determine whether the level of specificity is important. Results showed that adults, but not children, generated implicatures and that their judgments were more categorical than in previous research. General *vs.* specific QUD were not significantly different.

**KEYWORDS:** DEVELOPMENTAL SEMANTICS; DEVELOPMENTAL PRAGMATICS; INDEFINITES; PRAGMATICS; SEMANTICS

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Existential quantifiers, such as *some* in English, have been argued to form part of a pragmatic scale in the lexicon, such that using *some* to refer to a set of objects or individuals that are prominent in discourse implies “not all”, under the Gricean assumption that had a cooperative conversation participant wished to use *some* to mean “some, and possibly all” —its logical meaning—, they would have simply used *all*, the quantifier at the extreme edge of the pragmatic quantity scale (Horn, 1972; Grice, 1975). A great deal of work over the last ten years has attempted to uncover the conditions under which semantics and pragmatics interact to allow or prevent the generation of these scalar implicatures, some of which has included adult work on Spanish (Vargas-Tokuda, Grinstead and Gutiérrez-Rexach, 2009), and some of which has addressed child Spanish-speakers’ developing knowledge (Miller, Schmitt, Chang and Munn, 2005; Vargas-Tokuda, Grinstead and Gutiérrez-Rexach, 2009).

While the literature on what children know about pragmatic implicatures suffers from a number of confounds, other domains of child language development have taken advantage of a particular means of structuring discourse to help children access difficult interpretations. In particular, work by Gualmini and colleagues (Gualmini, Hulsey, Hacquard and Fox, 2008) employs an explicit Question Under Discussion (QUD) (Roberts, 2003) in the construction of the pragmatic context given in their Truth Value Judgment Tasks (TVJT), to help children access certain quantifier scope interpretations that are notoriously difficult for them. In what follows, we address two issues, fundamentally: first, whether attempting to incorporate an explicit QUD in our TVJTs influences adult Spanish-speakers’ generation of implicatures, in general, and second, whether a specific contrasting set of Questions Under Discussion, in the sense of Roberts (2003), yields differential degrees of implicature generation in adult and child Spanish.

## SCALAR IMPLICATURES

Scalar implicatures are a type of pragmatic enrichment of the meanings given by truth-conditional semantics. In particular, quantifiers sit on a scale of informativeness from *all* to *none*, as in {all, most, many, some, three, few, none}. In this way, when a weaker quantifier on the scale is used, such as *some*, an inference can be made that a stronger quantificational statement would not have been appropriate (see Grice, 1975; Horn, 1972; Gazdar, 1979; Levinson, 1983). Thus, when someone eats all the cookies on a plate, they can truthfully say, “I ate some cookies.” However, such

a statement would not be the most informative contribution, given the presence of a more informative quantifier on the scale, namely *all*. Similar pragmatic scales have been proposed to account for other dimensions of meaning, including inclusive *vs.* exclusive *or* (see Chierchia, Crain, Guasti and Thornton, 1998) and collectivity and distributivity (see Beghelli and Stowell, 1997; Dotlačil, 2010; Padilla-Reyes, Grinstead, Nieves-Rivera and González-Bonilla, 2015).

Among the kinds of meaning that can be expressed, two possible interpretations are the logical, truth-conditional interpretation, signifying “some and possibly all” and the other is the pragmatically enriched conversational scalar implicature, also called the “covert partitive,” which represents the “some but not all” interpretation. Conversational implicatures have the interesting property that they are calculated in specific syntactic and pragmatic contexts, which can also cancel them. This can be illustrated by comparing them to entailments. In the following examples, we see that the “covert partitive” meaning associated with *some*, can be canceled, using the “in fact” test, given in Grice (1975). In (3) and (4), we see that the same relationship holds with the Spanish versions of *some*: *unos* and *algunos*.

- (1) Some students went to class, in fact, all of them did.
- (2) #All of the students went to class, in fact, some (of them) did.
- (3) Algunos/unos estudiantes fueron a clase, de hecho, todos lo hicieron.
- (4) #Todos los estudiantes fueron a clase, de hecho, algunos/unos lo hicieron.

In this way, we can see that conversational implicatures are dimensions of meaning that represent the plausible use of language in particular contexts, and do not represent invariant lexical meaning, as in the entailment associated with *all* / *todos*.

### Children’s treatment of scalar implicatures

Regarding children’s knowledge of the scalar implicatures associated with *algunos*, and analogous quantifiers in other languages, the primary learning-theoretic question addressed in the literature is the Poverty of the Stimulus argument, as in Chomsky (1959). That is, *unos* and *algunos* are remarkably similar grammatical elements, with identical truth-conditional meanings. It is therefore very surprising if children are able to learn that *unos* does not interact with discourse pragmatics, while *algunos* does, given the absence of explicit instruction and assuming that only positive evidence drives the acquisition of their knowledge (Brown and Hanlon, 1970; Morgan and Travis, 1989). What is the state of their knowledge, then? There are a number

of by now very entrenched confounds that prevent us from discovering what they know. Among these, the most prominent are: the undifferentiated treatment of individual-level predicates vs. activity predicates in experimental stimuli, the undifferentiated treatment of covert (*algunos caballos*) and overt (*algunos de los caballos*) partitive structures in the subjects of experimental stimuli sentences as implicature generating and the undifferentiated treatment of the phonetic variants of the English quantifier *some* in experimental stimuli. This is worthy of comment only because so much research on the topic has been carried out in English.

While it is true that the subjects headed by *some*, as in sentences such as (5) to (9), from Noveck (2001: 187), can generate implicatures in adult English, said implicatures critically depend on one's world knowledge of giraffes, televisions, cars, etcetera, given that they make generic statements, using individual level predicates, about these individuals/objects, as opposed to them being descriptions of an activity that a child had just observed in an experiment.

- (5) Some giraffes have long necks.
- (6) Some televisions have screens.
- (7) Some cars have motors.
- (8) Some cats have ears.
- (9) Some airplanes have wings.

Individual level predicates are characterized by Carlson (1977) as those that attribute an inherent property to an individual. Consequently, using these sentences measures both children's ability to generate implicatures and their knowledge of whether cars, for example, can exist without motors. A child's rejection of these sentences could simply represent their non-adult-like knowledge of cars, and not their pragmatic ability. This kind of stimuli has also been used in Smith (1980), Feeney, Scafton, Duckworth and Handley (2004) and elsewhere.

A second confound in the literature consists of using overt partitive structures to measure children's knowledge of implicatures. Stimuli include sentences such as the following.

- (10) The elephant pushed some of the trucks. (Katsos and Bishop, 2011: 79)
- (11) Merika apo ta aloga pidiksan pano apo to fraxti (Papafragou and Musolino, 2003: 262)  
Some of the horses jumped over of the fence  
'Some of the horses jumped over the fence.'

Overt partitive expressions are fundamentally different from covert partitive expressions in a number of respects. To begin with, by virtue of containing a definite article, they always carry a uniqueness presupposition (see Russell, 1905; Roberts, 2003) associated with the set of objects, the set of trucks in (10), for example, of which the existential quantifier forms a part. This differs from the set of trucks under consideration in (12), which only become salient by virtue of the implicature associated with *some*.

(12) The elephant pushed some trucks.

Further, overt partitives are “strong NPs” in Milsark’s (1977) terms, in the sense that they can always combine with individual level predicates, as in (13), while NPs quantified by *some* can only combine with individual level predicates in English when they occur with a full vowel, as in (14), and not with the syllabic nasal version, which is anomalous in (15) and simply ungrammatical in (16).

(13) Some of the men are smart.

(14) Some men are smart.

(15) #Sm men are smart.

(16) \*Sm of the men are smart.

The relevance of this distinction is that it should be easier to generate an implicature with the sentence in (10), which carries a presupposition introducing the superset from which the partitive is drawn, than it is in (12), in which the superset is inferred by the same implicature that carries the much weaker claim as to the existence of the superset.

Finally, as illustrated by the difference between (14) and (15), there are multiple phonetic realizations of *some* in English, each of which has its own particular interpretative properties. Grinstead, Thorward, Ross and Maynell (2010) show that the syllabic nasal version, *sm*, appears to be interpreted as a pure existential and will not associate with an implicature, regardless of syntactic and pragmatic context, while the full-vowel, pitch-accented *some* is primarily used to convey the implicature, although this interpretation can be attenuated in downward-entailing contexts, such as the antecedent of a conditional sentence. With two notable exceptions (Papafragou and Musolino, 2003; Miller, Schmitt, Chang and Munn, 2005), however, research into what children know about the interpretation of *some* does not make this distinction.

In spite of these confounds, there are, nevertheless, three studies that appear to show, using activity predicates, with covert partitives, in Italian and in Spanish (languages that do not have the phonetic properties that English *some* has) that seven-year-old and five-year-old children can generate pragmatic implicatures of the *some, but not all* type, namely Miller, Schmitt, Chang and Munn (2005); Guasti, Chierchia, Crain, Foppolo, Gualmini and Meroni (2005) and Vargas-Tokuda, Grinstead and Gutiérrez-Rexach (2009). In the latter case, the authors show that five-year-old Spanish-speakers in Mexico generate pragmatic implicatures associated with *algunos*, when it is paired with activity predicates, such as *Algunos conejos brincaron sobre la niña* (Some rabbits jumped over the girl), accepting such sentences when they are used to describe 4 of 4 rabbits under consideration jumping over a girl only 30% of the time, while they accepted the same subject-predicate pairing 80% of the time in the antecedent of a conditional sentence, as in *Si algunos conejos brincan sobre la niña, recibo una moneda* (If some rabbits jump over the girl, I get a coin). Further, the same children treated *unos* as more acceptable in both contexts (67% in implicature-generating contexts and 96% in implicature canceling contexts).

In sum, there is at least some evidence that children are able to generate the *some, but not all* conversational implicature associated with existential quantifiers in Spanish, Italian and English. The fact that adults in Vargas-Tokuda, Grinstead and Gutiérrez-Rexach (2009) generate implicatures at 80%, with children rendering even less categorical judgments, raises the possibility that we might obtain more starkly dichotomous judgments on their part. We now turn to the question of how structuring the discourse of TVJTs can sometimes produce more categorical judgments.

## QUESTION UNDER DISCUSSION

The notion of Question Under Discussion (QUD) views discourse structure as a series of questions, which are answered by the replies and comments of cooperative interlocutors (see Clifton and Frazier, 2012; Roberts, 2003). On the QUD view, all conversations are guided by an explicit or implicit question and all contributions to the conversation are more or less relevant as a function of this QUD. An explicit question-answer pair is one in which the question is overt and the answer is a direct reply.

The relevance of the QUD to developmental semantics relates to whether certain interpretations are accessible to children. In an attempt to explain Musolino's (1998) "Observation of Isomorphism"—an apparent restriction on children's quantifier scope

interpretations—, Gualmini, Hulsey, Hacquard and Fox (2008) propose that the structure of discourse, as guided by the QUD, must be taken into account. Specifically, Musolino observed that in ambiguous examples such as (17), children appear to be limited to the interpretation in which no pizzas are delivered, which they refer to as the “isomorphic” interpretation. This interpretation is isomorphic in the sense that the quantifier is interpreted, as if its scope were limited to its phonological position in the sentence below negation, which yields a “not some” interpretation, which is equivalent to “none”.

(17) The troll didn't deliver two pizzas. (Gualmini, Hulsey, Hacquard and Fox, 2008: 217, ex. 21)

In contrast, interpretations such as the one in which sentence (17) means that there exist two pizzas that the troll did not deliver (the non-isomorphic interpretation) have appeared to be largely inaccessible to children (see Musolino, 1998). In order to make this non-isomorphic interpretation available to children, Gualmini, Hulsey, Hacquard and Fox, (2008) explicitly state the QUD in their research, as a means of making it more salient. In this case, the Truth Value Judgment Task includes the specific question, uttered by the narrator, “Did the troll deliver all the pizzas?”. In contrast with previous work, a four-year-old child English-speaking sample ( $n = 17$ ) accepted the non-isomorphic interpretation 75% of the time, suggesting that the use of an explicit Question Under Discussion could enable children to access otherwise difficult interpretations more easily.

## SPANISH DETERMINERS: *UNOS* AND *ALGUNOS*

*Unos* and *algunos* represent two plural existential Spanish determiners that are identical in their truth conditional meaning, as intersective quantifiers, but not identical in a range of semantic-pragmatic properties that have been detailed in the literature (Gutiérrez-Rexach, 2001, 2010; López-Palma, 2007; Martí, 2008; Alonso-Ovalle and Menéndez-Benito, 2003). They encode specific semantic properties, which may make studying the logical *vs.* pragmatic interpretation of the existential quantifier more straightforward. While Spanish allows contrastive focus to be expressed prosodically, similar to English, this prosodic function does not interact with vowel duration, as it does in English. Concretely, previous work on developmental semantics in Spanish showed that preschool children know the difference between these existentials with



regard to generation of pragmatic implicatures (see Vargas-Tokuda, Grinstead and Gutiérrez-Rexach, 2009), without considering the confounding effects of phonological development that exist in English.

Returning to the semantic properties of *unos* and *algunos*, perhaps the most relevant difference is that while *algunos* can be linked to the Conversational Common Ground, in the sense of Stalnaker (1974), and consequently can generate a pragmatic implicature, *unos* cannot. This discourse resistance property of *unos* explains the following contrast (Gutiérrez-Rexach, 2001, 2010):

- (18) Llegaron varios estudiantes. Algunos/\*unos se sentaron.  
 ‘Several students arrived. Some (of them) sat down.’

This inability to link to the common ground means that while *algunos* may generate a *some, but not all* conversational implicature, *unos* may not. This difference is illustrated in the following sentences, in which four out of four cats are in a house:

- (19) #Algunos gatos están en la casa. (*some, but not all* infelicitous)  
 ‘Some cats are in the house.’  
 (20) Unos gatos están en la casa. (*some, and possibly all* felicitous; *some, but not all* not implicated)  
 ‘Some cats are in the house.’

Rather, *unos* appears to permit truth-conditionally similar *some, but not others* interpretations, through its *unos... otros no* articulation, but by itself does not allow the generation of implicatures. Critically, this *unos... otros* combination, which Gutiérrez-Rexach (2010) suggests could constitute a kind of discontinuous morpheme, erases the discourse-resistance property of *unos*.<sup>1</sup> In this regard, Vargas-

1 A reviewer provided corpus examples from CORPES (RAE – Corpus del Español del Siglo XXI) including sentences illustrating how *unos* can be made discourse-accessible, with the presence of *unos... otros*, as pointed out in Gutiérrez-Rexach (2001, 2010):

2006 Arg. ...menos la edad que tengo ahora; o un poco más. Se había dedicado a negocios varios, unos por izquierda y otros por derecho.

2006 Esp. (Marbella) mezcla varios polvos diferentes en su nitropipirrana de bacalao ahumado, unos obtenidos con la Paco Jet y otros con la Thermomix.

Tokuda, Grinstead and Gutiérrez-Rexach (2009) demonstrate that *unos*, used in a syntactic context that theoretically generates implicatures, such as *Unos conejos brincaron sobre la niña* (Some rabbits jumped over the girl), is accepted by adults 100% of the time. However, the same sentence used with *algunos*, *Algunos conejos brincaron sobre la niña*, is only accepted 20% of the time. Interestingly, *unos* and *algunos* appear roughly equally acceptable in syntactic-semantic contexts that appear to cancel conversational implicatures (“downward entailing” contexts, in Ladusaw’s 1979 terms). Vargas-Tokuda, Grinstead and Gutiérrez-Rexach report that *unos* was accepted 90% of the time by adults, while *algunos* was accepted 80% of the time in downward entailing contexts, which were, in their experiment, the antecedents of conditional sentences (e.g. *Si unos/algunos animales están en la cubeta, recibo una moneda*, “If some animals are in the bucket, I get a coin”).

## RESEARCH QUESTIONS

Methodological differences may help to explain some of the variability seen in previous studies. In particular, Gualmini, Hulsey, Hacquard and Fox (2008) have shown that QUD matters for scope assignment and, thus, may matter for implicature generation as well. In what follows, we propose to manipulate the QUD variable to determine whether differences in QUD promote the generation of implicatures in Spanish, both in adults and children. Specifically, we ask:

- (a) Do adults and children generate implicatures more than in previous research by virtue of our Truth Value Judgment Task using an explicit Question Under Discussion?
- (b) Does a specific *cuántos* “how many little pigs” vs. a more general *quiénes* “who” QUD matter for implicature generation?
- (c) Do adults and children distinguish *unos* from *algunos*, as in previous work?

## METHODS

### Participants

60 adults (range: 220–445 months, mean age = 305.5 months, SD = 63 months) and 42 children (range: 61–84 months, mean age = 69.74 months, SD = 5.42) participated in the experiment. All participants lived in Mexico City, Mexico and were monolingual Spanish-speakers. Only those with no history of speech or language issues participated. One child was excluded because of a dyslexia diagnosis and one

adult because of reported hearing loss. One child and two adults were excluded by virtue of being multilingual.

## Procedures

Adult participants were largely recruited from a major public university in Mexico City. Research staff presented a brief explanation of the experiment and provided interested adults with consent paperwork. Consented participants filled out a brief participant history questionnaire before completing the experiment.

Child participants were recruited from a variety of Mexico City preschools. Depending on the locale, research staff presented a brief information session to parents and/or spoke with parents one-on-one at the school drop-off. Parents who wished for their children to participate were given a consent form and a brief participant history questionnaire. Following the survey, children completed the 30-minute experimental stimuli (described in detail in the following section) in a quiet room in their school.

The present study uses a between-subjects methodology. We intentionally distributed participants into one of two age conditions (adult vs. child), one of two quantifier conditions (*unos* vs. *algunos*), and one of two QUD conditions (*cuántos* vs. *quiénes*). The distribution of participants is shown in table 1.

TABLE 1. DISTRIBUTION OF PARTICIPANTS ACROSS EXPERIMENTAL CONDITIONS\*

	Adults ( <i>n</i> = 60)		Children ( <i>n</i> = 42)	
	<i>Quiénes</i>	<i>Cuántos</i>	<i>Quiénes</i>	<i>Cuántos</i>
<i>Unos</i>	15	15	9	9
<i>Algunos</i>	15	15	11	13

## Experimental Stimuli

As in Guasti, Chierchia, Crain, Foppolo, Gualmini and Meroni (2005), Papafragou and Musolino (2003) and Vargas-Tokuda, Grinstead and Gutiérrez-Rexach (2009), the current experimental protocol utilized a Truth Value Judgement Task (TVJT) (Crain and McKee, 1985). Traditionally, a TVJT features one experimenter acting out a story in front of the participant while another experimenter acts as a puppet that watches the story along with the participant. At the end of the story, the puppet utters the

\*The tables are self made.

target expression conveying what happened in the story. The participant then has to judge whether the puppet accurately describes what happened in the story, by responding “yes” or “no” to the question “Was the puppet right?”.

This experiment utilized a variation on the traditional TVJT, as first implemented by Padilla-Reyes, Grinstead, Nieves-Rivera and González-Bonilla (2015). This variation uses stop motion software (iStopMotion) to create short videos on a Macbook Air. The videos allowed experimenters to control various aspects of the context —including prosody, Conversational Common Ground, and QUD—, as well as homogenize the contextual variables for each participant. Experiments were presented in three different orders to account for order of presentation effects. None were found ( $p > .05$ ).

To distinguish between our two QUD conditions, *quiénes* (who) vs. *cuántos* (how many), one of two possible QUD sentences were used, as a function of QUD condition. For example, in the scenarios in which Peppa Pig and her friends catch a dog, one of the two following explicit questions under discussion was stated before the experimental sentence (which are given below, in 28 and 30):

(21) ¿Cuántos cerditos atraparon al perro?

‘How many piggies caught the dog?’

(22) ¿Quiénes atraparon al perro?

‘Who caught the dog?’

Each participant was presented with 12 experimental scenarios, six filler scenarios and four warm-up scenarios (see appendix for complete list). The purpose of the warm-up scenarios was to familiarize participants with the TVJT format. In particular, the warm-up items, shown in sentences (23) and (24), asked participants to confirm or deny whether the characters in the stop-motion movie (the Peppa Pig characters, a family of popular cartoon pigs, which is shown in Mexico, among other places) managed to catch a dog that had escaped. In the warm-up items, either all of the pigs trapped the dog or none of the pigs trapped the dog. Feedback was given to participants if they did not appear to understand the task during the warmup; no feedback was given during the task. The six filler items, examples of which are shown in (25) and (26), were randomly distributed throughout the experimental items and consisted of similar *todos* (all) or *ningún* (none) sentences. Only participants who scored above chance on the six fillers (significantly above chance = 6 of 6 correct) were retained in the sample. Two adults and eight children were excluded for not

answering fillers correctly, suggesting that they were not paying attention or did not understand the task.

Example training sentences:

- (23) Todos los cerditos atraparon al perro. (4 of 4)  
 ‘All of the pigs trapped the dog.’
- (24) Todos los cerditos atraparon al perro. (0 of 4)  
 ‘All of the pigs trapped the dog.’

Example filler sentences:

- (25) Todos los cerditos cerraron la puerta. (0 of 4)  
 ‘All of the pigs closed the door.’
- (26) Todos los cerditos rescataron al caballo. (4 of 4)  
 ‘All of the pigs rescued the horse.’

The between-subjects format of our methodology yielded eight experimental conditions, varying by age, quantifier, and QUD. Table 2 summarizes these conditions. Each target sentence followed the structure in (27). Every target sentence began with one of the two quantifiers (*unos/ algunos*) followed by the Spanish word for pigs (“cerditos”) followed by a verb with an indefinite DP. See appendix for complete list.

- (27) [unos/algunos] cerditos [vp...].  
 ‘Some pigs vp...’

TABLE 2. EXPERIMENTAL CONDITIONS

Condition	Age	Quantifier	QUD
A	Adult	<i>Algunos</i>	<i>Quiénes</i>
B	Adult	<i>Algunos</i>	<i>Cuántos</i>
C	Adult	<i>Unos</i>	<i>Quiénes</i>
D	Adult	<i>Unos</i>	<i>Cuántos</i>
E	Child	<i>Algunos</i>	<i>Quiénes</i>
F	Child	<i>Algunos</i>	<i>Cuántos</i>
G	Child	<i>Unos</i>	<i>Quiénes</i>
H	Child	<i>Unos</i>	<i>Cuántos</i>

Example target sentences:

- (28) Algunos cerditos abrieron la puerta. (3 of 4)  
 ‘Some pigs opened the door.’
- (29) Algunos cerditos levantaron al elefante. (4 of 4)  
 ‘Some pigs lifted the elephant.’
- (30) Unos cerditos movieron al elefante. (3 of 4)  
 ‘Some pigs moved the elephant.’
- (31) Unos cerditos rescataron al caballo. (4 of 4)  
 ‘Some pigs rescued the horse.’

## RESULTS

To begin with, we consider the descriptive statistics. First, we have mean acceptance of scenarios with 3 of 4 agents carrying out an action. Here, as expected, we find across the board acceptance.

TABLE 3. DESCRIPTIVE STATISTICS – 3 OF 4 CONDITION

QUD	Quantifier	Adult Acceptance	Child Acceptance
		Percentage (mean rating/ total possible)	Percentage (mean rating/ total possible)
<i>Quiénes</i>	<i>Unos</i>	98% (5.87/6)	98% (5.85/6)
	<i>Algunos</i>	99% (5.93/6)	89% (5.36/6)
<i>Cuántos</i>	<i>Unos</i>	92% (5.53/6)	98% (5.89/6)
	<i>Algunos</i>	100% (6/6)	100% (6/6)

In contrast, from the 4 of 4 condition, in which an implicature associated with *algunos* could be observed, we find *algunos* being treated differently from *unos*, at least by adults.

TABLE 4. DESCRIPTIVE STATISTICS – 4 OF 4 CONDITION

QUD	Quantifier	Adult Acceptance	Child Acceptance
		Percentage (mean rating/ total possible)	Percentage (mean rating/ total possible)
<i>Quiénes</i>	<i>Unos</i>	26% (1.53/6)	92% (5.54/6)
	<i>Algunos</i>	0% (0/6)	85% (5.09/6)
<i>Cuántos</i>	<i>Unos</i>	45% (2.73/6)	91% (5.44/6)
	<i>Algunos</i>	6% (0.4/6)	98% (5.89/6)

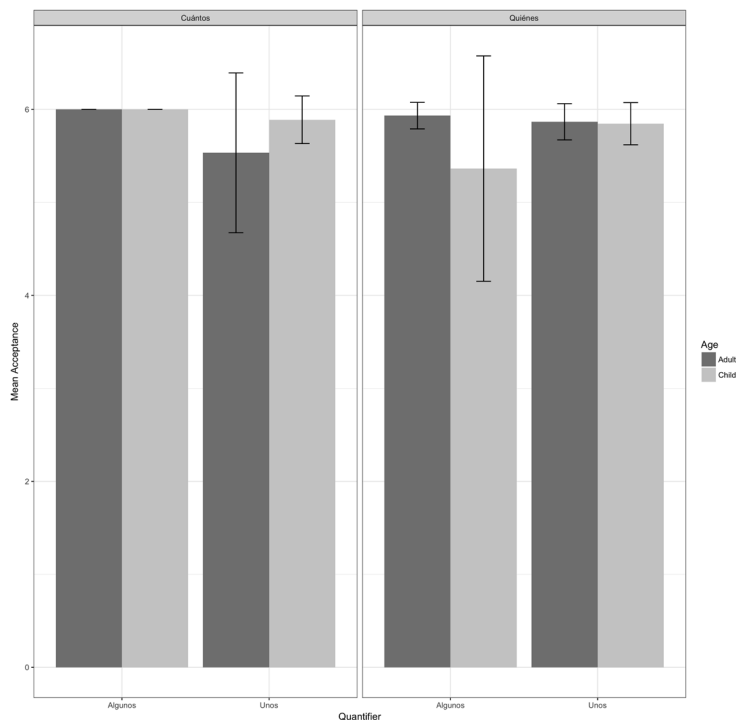
Turning to our inferential statistics, given the six total possible yes-no answer pairs, we treat our dependent variable as an ordinal scale, expressed as the log odds of being at or below a given response category, in our case, the seven adjacent categories represented by acceptance of 0–6 of the test sentences given at the end of each Truth Value Judgment Task scenario. We use our three independent variables (each of which is 2-valued) as categorical predictors. We fit the first model with answers to scenarios in which 3 of 4 agents engage in an action and a second model, in which 4 of 4 agents are engaging in an action.

Beginning with the scenarios in which 3 of 4 agents participate in an action, we use an interaction model to test for main effects of Age, Quantifier and QUD. The -2 log-likelihood statistic comparing this main-effects model to the intercept-only model yields a chi-square value of 3.018 ( $df = 3$ ), which is non-significant ( $p = .389$ ). Further, there are no main effects of any predictor variables. This is what we would expect for adult Spanish-speakers, given that both *unos* and *algunos* seem acceptable when less than all of a set of participants engages in an activity. It is interesting to note that children are not different from adults in this way, as illustrated in the following bar graph.

Moving on to the scenarios in which 4 of 4 agents participate in an action —scenarios in which a *some, but not all* implicature could be generated with *algunos*— we inspect our data and discover that the great majority of responses were 0 and 6, with a very small proportion of 1, 2, 3, 4 and 5 answers. For this reason, we collapse the 1, 2, 3, 4 and 5 answers into a single 1-5 variable, giving our dependent ordinal variable three values: 0, 1-5 and 6. An ordinal regression model with these variables passes the Test of Parallel Lines with a nonsignificant value ( $X^2 = .243$ ,  $df = 3$ ,  $p = .970$ ),

indicating that our assumption —that the relationship between independent and dependent variables are the same across the cumulative splits of the data— is correct.

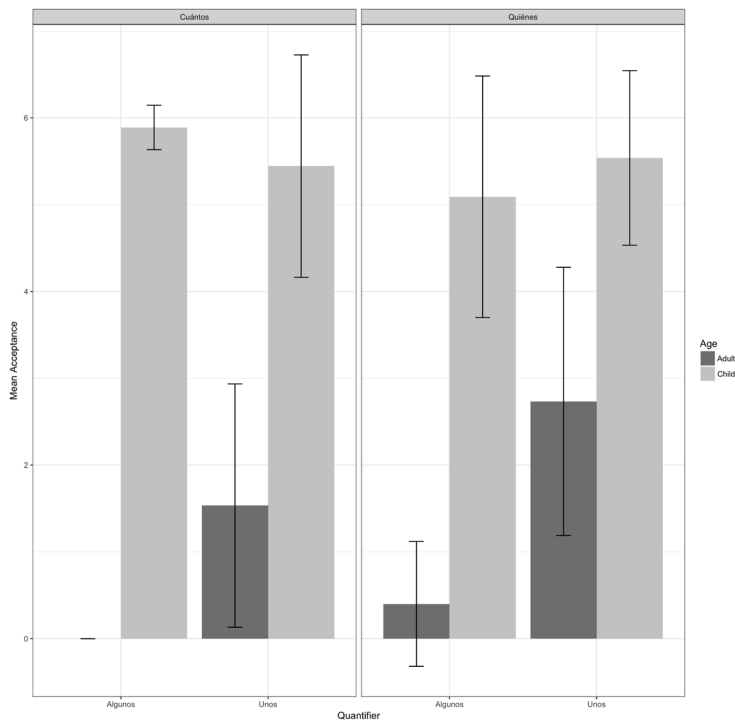
GRAPH 1. MEAN ACCEPTANCE RATE OF CHILDREN AND ADULTS WITH QUANTIFIERS *UNOS* AND *ALGUNOS* IN *CUÁNTOS* AND *QUIÉNES* QUD CONDITIONS, WITH 3 OF 4 AGENTS PERFORMING THE ACTION



Proceeding to our ordinal regression model with the collapsed dependent variable values, we test for main effects. In this case, the  $-2$  log-likelihood statistic, comparing this model to the intercept-only model, yields a significant chi-square of 79.493,  $df = 3$ ,  $p < .001$ , with a Nagelkerke Pseudo R-square of .637. Further, significant main effects are found for both Age ( $B = -4.512$ ,  $SE = .714$ ,  $p < .001$ ) and Quantifier ( $B = 1.843$ ,  $SE = .618$ ,  $p = .003$ ). Because there was no significant effect of QUD ( $p > .05$ ), which coheres with our visual inspection of the following graph, we fit a group comparison model, without QUD, to explore possible group differences.



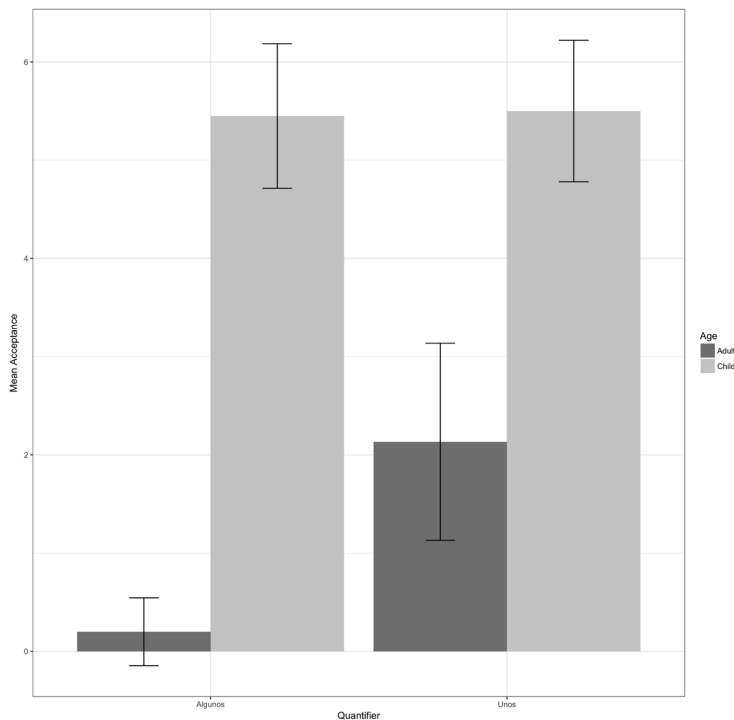
GRAPH 2. MEAN ACCEPTANCE RATE OF CHILDREN AND ADULTS WITH QUANTIFIERS *UNOS* AND *ALGUNOS* IN *CUÁNTOS* AND *QUIÉNES* QUD CONDITIONS, WITH 4 OF 4 AGENTS PERFORMING THE ACTION



Having removed the non-significant QUD variable from consideration, we can examine the specific combinations of age and quantifier that we are interested in, by creating a “group” variable to construct a group comparison model, which includes only the four-level group predictor variables (adult-*algunos*, adult-*unos*, child-*algunos*, child-*unos*) and the three-level response variable (0, 1-2-3-4-5, 6).

In our group comparison model, we find that adult *unos* was accepted significantly less than was child *unos* ( $B = 3.4341$ ,  $SE = .838$ ,  $p < .001$ ) and that adult *algunos* was accepted significantly less than was child *algunos* ( $B = 5.349$ ,  $SE = 1.003$ ,  $p < .001$ ). Further, while adult *unos* was accepted significantly more than was adult *algunos* ( $B = 2.458$ ,  $SE = .824$ ,  $p = .003$ ), there was no significant difference between child *unos* and child *algunos* ( $p > .05$ ). These comparisons are illustrated in the following graph, which removes the QUD variable, and collapses responses across the QUD conditions.

GRAPH 3. MEAN ACCEPTANCE RATE OF CHILDREN AND ADULTS WITH QUANTIFIERS *UNOS* AND *ALGUNOS* ACROSS BOTH QUD CONDITIONS, WITH 4 OF 4 AGENTS PERFORMING THE ACTION



## DISCUSSION

Turning to our research questions, the first one was whether the inclusion of an explicit QUD would facilitate the generation of implicatures. In this regard, we note that adults only accepted *algunos* presented in contexts in which 4 of 4 agents carried out an action 3% of the time (mean acceptance = 0.2/6 possible), which means that they generated an implicature a striking 97% of the time. For this kind of experimental work, this is a starkly categorical mean response. The adults in Vargas-Tokuda, Grinstead and Gutiérrez-Rexach (2009), for comparison, generated this implicature 80% of the time. Although there are other differences between this TVJT and the one used in Vargas-Tokuda, Grinstead and Gutiérrez-Rexach (*e.g.* video presentation, multiple predicates, etcetera), perhaps the adult results are more categorical because of the inclusion of the explicit QUD. Similarly, in Guasti, Chierchia, Crain, Foppolo, Gualmini and Meroni (2005), the rejection rate is 83% for adult Italian speakers.

The children, in contrast, generated dramatically fewer implicatures with *algunos* than children did in Vargas-Tokuda, Grinstead and Gutiérrez-Rexach. We speculate that this might be attributable to predicate type. Specifically, in Vargas-Tokuda, Grinstead and Gutiérrez-Rexach a consecutive, distributive action was carried out, i.e. four rabbits jumped, one after the other, over a girl. In our predicates here, the action was not consecutive and distributive, but rather simultaneous and collective, i.e. four little pigs trap a horse together, all at once. We suspect that there may have been something about the repeated, distributive, consecutive actions in the previous experiment that highlighted the partitivity of the action, in contrast to the current experiment. Further support for this conjecture comes from the fact that in Guasti Chierchia, Crain, Foppolo, Gualmini and Meroni (2005), in which children generated the implicature 75% of the time, at least some of the sentences appear to be distributive (e.g. “Some clowns are fishing,” Appendix A, p. 696). While this may have been an important factor for children in our experiment, it was not for adults, who gave categorical responses consistent with the generation of an implicature. Thus, we are faced with a more specific developmental question than was faced, for example, in Noveck (2001), in which adults generated implicatures 59% of the time and children generated them 11-15% of the time, because at least we know that adults are near 100% doing what we expect. This suggests that the difference on our task between adult and child performance represents a real developmental difference and not a confound of some type. Finally, with regard to the differential treatment of *unos* vs. *algunos*, adults were categorical in their treatment of the two quantifiers as distinct. Children, in contrast, appeared to treat them as interchangeable.

In sum, while children did not appear to generate a *some, but not all* implicature in this experiment, and while they did not appear to treat *unos* as different from *algunos*, as they have in previous experiments, we nonetheless find that adults behaved more categorically in this experiment than in previous experiments, in both regards. In future research, we will attempt to isolate and directly compare the distributive-consecutive vs. collective-simultaneous distinction to determine whether it is of consequence for generating implicatures.

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## **APPENDIX**

### **Warm-up sentences (Each presented in contexts in which all agents acted or no agent acted – total of 4 sentences)**

Todos los cerditos atraparon al perro.  
Todos los cerditos rescataron al caballo.

### **Filler sentences (Each presented in contexts in which all agents acted or no agent acted – total of 6 sentences)**

Todos los cerditos atraparon al perro.  
Todos los cerditos cerraron la puerta.  
Todos los cerditos rescataron al caballo.

### **Experimental sentences (Each presented in contexts in which 3 of 4 agents acted or 4 of 4 agents acted – total of 6 sentences per participant, as a result of between-subjects design)**

Algunos/Unos cerditos rescataron al caballo.  
Algunos/Unos cerditos abrieron la puerta.  
Algunos/Unos cerditos atraparon al perro.  
Algunos/Unos cerditos movieron al elefante.  
Algunos/Unos cerditos levantaron al elefante.  
Algunos/Unos cerditos cerraron la puerta.

**AMY S. PRATT:** Ph.D., Postdoctoral Scholar, School of Education, University of California, Irvine. Her research investigates the co-occurrence of language and reading disorders, especially in children who speak Spanish, and the underlying relationships among language ability, reading ability, and cognition.

**JOHN A. GRINSTEAD:** Ph.D., Professor, Department of Spanish and Portuguese, Department of Linguistics, Department of Speech and Hearing Science, The Ohio State University. Academic Interests include typical and atypical linguistic and cognitive development, especially in Spanish; the relationships among mental faculties, formal theories of linguistics and language development.

**NICOLETTE LEON:** B.A., Department of Spanish and Portuguese, The Ohio State University. Academic interests include child language development, second language acquisition and Spanish-English bilingualism.

**RAMÓN PADILLA-REYES:** Ph.D., Linguist, Facebook. Interests include Psycholinguistics, Semantics and Pragmatics, Philosophy of Language and Caribbean & Latin American Spanish. His research addresses pluractionality, semantic and pragmatic scales and intensionality.

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