

# Linguistic Interfaces and Child Spanish

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## Introduction

In this paper, I will argue that there is evidence both from the interaction of language with other cognitive domains, including spatial cognition and numerical cognition, as well as evidence from within the language faculty stemming from the interaction of syntax with discourse-pragmatics, that where interfaces are invoked, cognitive development slows. I speculate, following Jackendoff (1997), that there are higher level or more “central” symbolic systems of cognition which allow such interfaces to function and that the rate of their development varies as a function of how different the respective representations are. I will begin by laying out my assumptions regarding interfaces and cognitive architecture. Then, I will summarize work on Interface Delay and the development of overt subject use in child Catalan and Spanish, especially as compared to child German. Next, I will review work detailing the existence of root nonfinite verbs in the grammars of both typically-developing child Spanish-speakers as well as those with specific language impairment (SLI), which I again attribute to Interface Delay. I add that interface-independent constructions such as plural marking on nouns appear unaffected, even in the grammars of children with SLI. Finally, I turn to an interface which, if Jackendoff (1997) is correct, may not exist at all, namely the connection between truth-conditional logical terms – in this case, existential quantifiers – and their pragmatically enriched counterparts. As a measure of delay that might exist at this putative interface, I then present experiments testing children’s ability to use the Spanish existential quantifiers “unos” and “algunos”.

## 1. Interfaces and Interface Delay

Given the recent proliferation of analyses using the interface concept, it may be helpful to define what is meant in this paper by “interface”. Certain mental faculties must communicate with each other. This seems to be true because information which is believed to be primarily associated with one mental faculty is either directly expressed by or indirectly referenced by another mental faculty. There are conceptual arguments and some empirical evidence that the information from some mental faculties cannot be directly used by others. Nonetheless, we see that the information is used by other faculties, so there must be a way to represent the information from one faculty in another.

Domain-specific representations do not, however, appear to flow freely from one mental faculty to another because symbolic knowledge appears to be faculty-specific, as argued by Fodor (1983) and Jackendoff (1992, 1997, 2002). Jackendoff (1997), for example, cites neurobiological evidence, mostly from the study of non-human primate sensory perception (Bradley, Maxwell, Andersen, Banks, & Shenoy, 1996; Rauschecker, Tian, & Hauser, 1995; Weinberger, 1995), that the sense data from particular faculties determines the form of their symbols and the nature of the computations that range over them. If this argument for primate cognition extends to human cognition in roughly the sense intended by Jackendoff, then it would seem likely that symbols from one domain cannot be used directly in another domain. Concretely, linguistic cognition cannot use spatial or visual symbols of angle and hue, numerical cognition cannot use musical symbols of tone and musical cognition cannot use linguistic semantic representations.

In earlier work (Grinstead, MacSwan, Curtiss & Gelman 1998), it was argued that the development of children’s counting abilities exemplifies this. In particular, numerical cognition independent of language seems well-developed by 3;0, as do many aspects of grammatical cognition. However, they are not coordinated in the linguistic counting process by children until after 3;0 (Wynn 1992). Number and Language do interface in the counting process and the lexicon appears to be the interface. Language uses the “best approximation” it can find of a symbol native to the numerical domain, which Gelman and Gallistel (1978), Gallistel and Gelman (1992) refer to as a “numeron”. A quantifier comes close to having the properties of a numeron, though they are not identical. In this work, we argued that children’s slowly developing ability to use their numerical ability to count linguistically was an example of “Interface Delay” – namely the integration between two cognitive domains seemed to be slowed, not by delayed development in either domain, but rather by the incompatibility of the respective representations, which is to say, the interface between the two domains.

In summary, Following Jackendoff (1992, 1997, 2002), domain-specific knowledge may be shared across domains, but the homology may not always be perfect. Sometimes only part of a representation can cross an interface and perhaps this less than perfect fit is one reason why development across interfaces is delayed. This appears to be the case for the number-language interface and it also appears to be the case for interface between language and spatial cognition, as characterized by Landau & Jackendoff (1993).

## 2. Interface Delay, Syntax and Discourse-Pragmatics

How does Interface Delay play out between the syntax and discourse-pragmatics interface? One dimension of Interface Delay between these domains is that children behave as if their interlocutors shared their presuppositions (Grinstead 1998). This phenomenon is well-documented in, for example, Maratsos (1974), who shows that child English speakers overuse definite articles in a series of elicited production studies. More anecdotally, anyone spending time with small children will sooner or later experience a scenario in which children mistakenly assume that their interlocutors share their presuppositions. For example, a child playing in a room full of plastic dinosaurs may look at an adult who is present and ask, “Where’s the dinosaur?” in spite of the fact that he is surrounded by 75 of them. Similarly, a child playing hide-and-go-seek with 4 little girls, may ask the same adult, “Where is she?”. Both scenarios allow us to see that the children sometimes assume, infelicitously, that their interlocutors share their presuppositions regarding which referents are salient in the Conversational Common Ground (cf. Roberts 2003, Stalnaker 1978).

Are these problems with children’s use or understanding of articles and pronouns? This seems unlikely, given their early ability to mark articles and pronouns correctly for morphosyntactic purposes, at least (e.g. Pérez-Leroux & Battersby 2009). Alternatively, could this be a problem with Pragmatics itself, as suggested by Schaeffer (2000) or Avrutin (1994)? Again, this seems unlikely. If the delay were really a problem of pragmatics, independent of language, we would expect a delay in non-linguistic cognitive domains that are plausibly responsible for children’s inability to take the perspectives of their interlocutors, such as Theory of Mind (e.g. Wimmer & Perner 1983), or at least the component of Theory of Mind abilities that seems most likely to be relevant to taking interlocutors’ beliefs into account, namely belief tracking. Are children generally deficient in this area when they are young? Children are able to pass the belief tracking component of nonlinguistic Theory of Mind tests from 15 months of age (Onishi & Baillargeon 2005). Further, infants (Baker & Greenfield 1988) are able to distinguish new from old information – another crucial non-linguistic ability necessary for appropriate use of definite descriptions such as pronouns and noun phrases with definite articles. In sum, it appears that, as in the cases of language and number and language and spatial cognition, children are able to use one side of the interface: the syntax of articles, and the other side of the interface: taking the perspective of interlocutors into account, but they cannot coordinate these distinct kinds of information.

In this framework, then, Linguistic Interface Delay is a sub-case of the general phenomenon of Interface Delay which may take place across other pairs of cognitive domains including language and number as well as language and spatial cognition and possibly others. Given this picture, a speculative account of how cognitive domains interact could address the symbols that allow these domains to interact. According to Jackendoff (1997, 2002), domain-specific symbols and computations must find higher level, more abstract or “central” symbols, to represent them when mental faculties interface. In particular, he conceives of a level of representation common to linguistic semantic and non-linguistic conceptual information, which includes both “semantic” and “pragmatic” information. For example, the symbols and computations necessary for determining the familiarity of the antecedent in an antecedent-definite description chain, or of the speech time-event time relationship, in cases of temporal anaphora, must exist at this level. They are independent of syntax, though they interact with it.

The acquisition question, assuming this framework to be on the right track, is: why are these symbols slow to develop and often allow an interpretation consistent with familiarity? Do they require greater processing resources? Do they mature? Are they simply limited in number, somehow? There are no clear answers to such questions. Most importantly, a result of interface delay is that in the absence of adult-like symbolic resources for marking familiarity, children assume familiarity.

An example of Interface Delay is found in child Catalan speakers’ and child Spanish speakers’ overuse of null subjects. In Spanish, Catalan, and other Southern Romance languages, null subjects may be used when speakers assume that their interlocutors share their presuppositions of familiarity. Catalan and Spanish-speaking children appear to show this behavior (Grinstead 1994, 1998, 2000, 2004; Grinstead &

Spinner 2009), even when their interlocutors do not share their presuppositions, while child German speakers use overt subjects as a function of finiteness and not of discourse-pragmatic considerations. This claim, however, has not been uncontroversial. It has been argued (Bel 2001, 2003) that child Spanish and Catalan-speakers show the same percentages of subject use that adults do. Bel demonstrates that, averaged over 6-12 months (between 1 year, 6 months of age and 2 years, 8 months of age), 3 child Spanish-speakers and 3 child Catalan-speakers use the same percentage of overt subjects as adults. This approach to data puts together data, which, if analyzed file by file, could show a No Overt Subject Stage. However, because the No Overt Subject Stage claim is grammatical and not chronological, it predicts the appearance of overt subjects beginning at the same MLU across children, but not at the same chronological age. What we find, however, is that in the Spanish of the one publically available corpus used by Bel (María, of the López-Ornat 1994 corpus), the child's earliest recording session shows syntax that is generally much more advanced than that of the three Spanish-speaking children studied in Grinstead & Spinner (2009). Her MLUw (mean length of utterances, calculated in words) is higher than two of the three children studied by Grinstead, as illustrated in Table 1.<sup>1</sup>

Child	Age	MLUw	Words	Utterances
Carlos	1;10.13	1.37	222	161
Eduardo	2;9.10	1.98	325	164
Graciela	2;1.08	1.29	137	106
<i>Total</i>			684	431
<b>Average</b>		<b>1.55</b>		
María	1;07	1.93	1180	612

Table 1 - Spanish-speaking children when they began using overt subjects.

Perhaps more illustrative of her advanced syntax is the fact that María uses two past, imperfect tense verb forms, along with *wh*- questions and fronted objects, which suggests a level of syntactic development not found before subjects begin to be used in any of the three Spanish-speaking children studied in Grinstead & Spinner (2009) or in any of the Catalan-speaking children studied in Grinstead (2004). In short, María's data is simply uninformative regarding the claim that there is an early No Overt Subject Stage in child Spanish, as she has already progressed to a level of syntactic sophistication in which not only overt subjects, but other left-peripheral constructions, including fronted objects and *wh*- questions begin to be used.

However, a slightly different point must be made with respect to Bel's claim regarding overt subject appearance in child Catalan. The earliest recorded use of an overt subject by Júlia, studied in both Bel (2001) and Bel (2003), contrasts with María's, in that, according to Bel (2003, p.10), "...Júlia starts with a high proportion of null subjects." In fact, she produces 1 overt subject out of 13 utterances which contained verbs (7%), according to Bel. In sum, Júlia's data appears identical to the recording sessions in which the child Catalan speakers in Grinstead (2004) began using their first overt subjects and consequently poses no challenge to the claim that there exists an early period without overt subjects in child Catalan.

Child	Age	MLUw	Words	Utterances
Pep	1;10.6	1.53	891	582
Guillem	1;9.24	1.76	58	33
Gisela	2;1.23	1.45	64	44
Laura	2;4.11	1.44	223	155
<b>Average</b>		<b>1.55</b>		
Júlia	1;11.23	1.46		

Table 3 - Catalan-speaking children when they began using overt subjects.

To be certain, there are important methodological considerations in determining early overt subject use in child Southern Romance, however, another interesting dimension to the phenomenon is its relation to the theoretical debate in adult Southern Romance regarding whether overt subjects are left-peripheral constituents. The argument in Grinstead (1998, 2004) is that overt subjects are constituents that reside at the left edge of the clause in the same syntactic positions that house focused and topicalized objects, as well as wh- elements. This follows the work of Ordóñez (1997), Ordóñez & Treviño (1999) and others. The theoretical dimension of this argument holds that if overt subjects, fronted objects<sup>ii</sup> and wh elements all move to the same type of position in the left periphery in the adult language, then they should pattern together in their emergence in child null subject languages, all else being equal. The point is that the interface between discourse and syntax will prevent the left-peripheral region of the clause from being used, as access to discourse-pragmatic information is necessary for all three of these constructions. The empirical question of interest, then, is whether all three of these constructions begin to be used at the same time.

To determine what “the same time” means, I follow Snyder (2007) who proposes the use of a binomial test to make the determination. The test works as follows. In the recording sessions following what is determined to be first use of wh- questions, in which children use both wh- questions (WH) and overt subjects (OS), the ratio of WH/WH + OS is determined. For example, in the 34 recording sessions of Graciela’s, following her first use of an overt subject, there were 302 overt subjects and 14 wh- questions.  $302/302+14 = 0.96$ . In between the first overt subject Graciela used and the first wh- question she used, there were 15 overt subjects (across 3 recording sessions which covered about 3 weeks). To determine the probability that a wh- question should have been produced somewhere among those 15 overt subjects, calculate  $0.96^{15}=0.542$ , which is not significant. For fronted objects in the same child, the ratio was .84 and there were 40 overt subjects between the first overt subject and the first fronted object.  $0.84^{40}=0.001$ , which is significant.

	Overt Subjects	Wh- Questions	Fronted Objects
Carlos	1;10.13	2;9.15 $0.85^{103}, p < 0.001s$	2;2.07 $0.66^6, p = 0.08ns$
Eduardo	2;9.10	2;9.10 <b>Same Session</b>	2;10.28 $0.85^{13}, p = 0.12ns$
Graciela	1;11.29	2;0.25 $0.85^{10}, p = .20ns$	2;3.25 $0.84^{40}, p < 0.001s$

Table 4 – The Onset of Left-Peripheral Constructions in Child Spanish

In Table 4 we see that the contingency between overt subjects, fronted objects and wh- questions obtains in Eduardo’s speech, while in the speech of the other two children, a contingency was found between subjects and either fronted objects or wh- questions. The child Catalan data, shown in Table 5, is stronger in that a contingency among all three constituents was found in the 3 of the 4 children considered with only 1 child, Gisela, showing a significant difference between the onset of overt subjects and wh- questions, but not between fronted objects and overt subjects.

	Overt Subjects	Wh- Questions	Fronted Objects
Gisela	2;1.23	2;8.0 p < .0001s	2;1.23 <b>Same Session</b>
Guillem	1;11.13	2;3.28 p = .051ns	1;11.13 <b>Same Session</b>
Laura	2;4.11	2;4.11 <b>Same Session</b>	2;8.30 p = .596ns
Pep	1;10.06	1;11.06 p = .248ns	1;10.06 <b>Same Session</b>

Table 5 – The Onset of Left-Peripheral Constructions in Child Catalan

To bring the Spanish and Catalan results into clearer cross-linguistic relief, and to answer the question of “Won’t an absence of overt subjects be found, if one looks early enough in the development of any language?”, Grinstead & Spinner (2009) show that there is a significant difference between the point at which overt subjects begin to be used and the points at which both wh- questions and fronted objects begin to be used in the child German of the Caroline and Simone corpora, from Powers et al (2001), as illustrated in Table 6.

	Subjects	Wh-questions	Fronted objects
Caroline 0;10 – 4;0 239 sessions	1;10.17	2;2.10 0.89 <sup>125</sup> , p < .001	2;3.0 0.72 <sup>174</sup> , p < .001
Simone 1;9 – 4;0 71 sessions	1;10.20	2;10.04 0.86 <sup>350</sup> , p < .001	2;01.16 0.70 <sup>112</sup> , p < .001

Table 6 – The Onset of Left-Peripheral Constructions for Simone and Caroline, with the Results of the Binomial Tests

In summary, children learning a null subject language, very quickly learn that their language is null subject and they begin overusing them. In contrast, children learning an overt subject language quickly learn that their language is overt subject and that the occurrence of overt subjects is not discourse-sensitive.

### 3. Temporal Interface Delay and Root Infinitives

If nominal anaphora includes a presupposition of familiarity in the Conversational Common Ground regarding the salience of antecedents, temporal anaphora could include a similar presupposition regarding the salience of speech-time/event time relationships. Consider the following examples:

1. What is Wallace doing, Gromit?
2. Eating cheese!
3. What does Wallace do every day after work, Gromit?
4. Eat cheese!
5. What has Wallace done since he got home, Gromit?
6. Eaten cheese!

In the answers given in 2, 4 and 6, the lexical aspect associated with the root verb form is conveyed, which depends on the verbal morphology, as is an absolute temporal interpretation, which depends on the temporal value established in discourse by the preceding sentences in 1, 3 and 5. This absolute temporal interpretation is not represented by overt morphology on the bare verb. Adults answering these questions assume, correctly, that their interlocutors share their presuppositions regarding the salience of the relationship between speech-time, event-time and reference-time, in the sense of Reichenbach (1947), in the Conversational Common Ground. Children producing root nonfinite verbs assume, incorrectly, that adults share their presuppositions regarding the salience of temporal relationships. That is, they too

frequently assume that temporal relationships are salient, when they are not. Assuming familiarity, as discussed above, they use forms that do not specify the temporal interpretations, as in 2, 4 and 6.

Many spontaneous production studies of child Spanish and other Southern Romance languages have concluded that children produce few, if any, nonfinite utterances: Spanish (Grinstead 1994, Torrens 1995), Catalan (Torrens 1995, Grinstead 1994, Bel 2001) and Italian (Guasti 1994). Many other spontaneous production studies of child Spanish have found that children do produce plausibly nonfinite utterances (Radford & Ploennig-Pacheco 1995, Davidiak & Grinstead 2004, Clahsen, Avelado & Roca 2002, Licerias, Bel & Perales 2006, Buesa 2006, Sanz-Torrent, Serrat, Andreu & Serra 2008). Examples of spontaneous root infinitive utterances from Grinstead (1998), include the following:

7. Carlos - 2;1.08  
Va yo.  
go stem I-nom  
"I goes."Mis
8. Carlos - 3;3.28  
Yo va a buscar.  
I-nom go stem to look for-inf  
"I goes to look for."
9. Graciela - 2;6.5  
Hace esto yo.  
do (root + "e" theme vowel) this I-nom  
"I does this."
10. Graciela - 3;3.26  
Este, yo quiere.  
this, I-nom want (root + "e" theme vowel)  
"This, I wants."

In summary, the spontaneous production literature is mixed as to the existence of root nonfinite verbs in child Spanish. Some of this ambiguity results from the methodology itself, which forces researchers to make decisions regarding the nature of children's verbs which are underdetermined by the evidence present in a transcript, even when supplemented by video. Among other decisions, what is the child's intended referent for a null subject utterance? Roughly 80% of adult Spanish utterances use null subjects and the percentages are even higher in child Spanish (Silva-Corvalan 1977, Bel 2003). If the null subject utterance occurs in third person singular, present tense form, as an overwhelming preponderance of them do (cf. Hernández-Pina 1984, Radford & Ploennig-Pacheco 1995, Davidiak & Grinstead 2004, Clahsen, Avelado & Roca 2002, Licerias, Bel & Perales 2006, Buesa 2006, Sanz-Torrent, Serrat, Andreu & Serra 2008), then the researcher must infer from what little context is represented in the transcript what the child intended. Most times this amounts to little more than a guess. If the intended subject of such utterance is actually a first person subject, as in examples 9 and 10 which actually occur with an overt first person subject, then these apparent 3<sup>rd</sup> singular present verbs, more likely bare stems, are plausible cases of Spanish root infinitives.<sup>iii</sup>

To attempt to overcome some of the obstacles encountered by spontaneous production studies of the root infinitive phenomenon in child Spanish, Pratt & Grinstead (2008) used a Grammaticality Choice Task, which is a forced choice version of the grammaticality judgment format, to test child Spanish-speakers' judgments of plausibly nonfinite verbs, paired with adult-like verb forms. In the task, two puppets (a cat and a turtle) observe a picture with the child, in which, for example, the cat and the turtle are sleeping. Then the cat puppet says "Yo duerme." (a plausible Spanish root nonfinite form) and the turtle puppet produces the adult-like form "Yo duermo." Then the investigator would ask the child if the cat or the turtle had said it correctly. The children in the study include both typically developing 4, 5 and 6 year-olds (n = 26) as well as a group of 11 children diagnosed with SLI.

	Present	Past	Total
SLI (n=11)	93/187 (50%)	91/176 (52%)	184/363 (51%)
4 Year-olds (n=5)	68/85 (80%)	61/77 (80%)	129/162 (80%)
5 Year-olds (n=10)	147/170 (86%)	138/160 (86%)	285/330 (87%)
6 Year-olds (n=11)	166/187 (89%)	146/176 (83%)	312/363 (86%)

Table 7 – Percentage Correct Choosing Between Root Finite and Root Nonfinite Verbs

The results, given in Table 7, show that while the typically developing children performed with relatively high levels of accuracy, there was nevertheless an effect of age, and, that child Spanish-speakers with SLI – a population known to have great difficulty with tense marking in other languages (cf. Rice, Wexler & Hershberger 1998; Rice, Wexler & Redmond 1999) – had severe difficulty distinguishing between finite and nonfinite verbs. Further work with children with SLI (Grinstead, Pratt, De la Mora & Flores 2009), including a MLU-matched control group has shown that child Spanish-speakers with SLI are significantly worse than either the MLU-matched or the age-matched control groups at distinguishing root non-finite verbs from adult-like finite verbs, as illustrated in Table 8 and Figure 1 (main effect for group:  $F [2, 24] = 18.204, p < .0001$ ; post-hoc testing showed that the SLI group was worse than the MLU group,  $p < .0001$ , and the Age group,  $p < .0001$ ).

	Past	Present	Average	SD
SLI (n=9)	44.44%	50.51%	47.47%	13.85%
MLU (n=9)	81.82%	69.70%	75.76%	15.08%
Age (n=9)	80.81%	81.82%	81.31%	8.33%

Table 8 - Percentage Correct Choice of SLI Children and 2 Control Groups

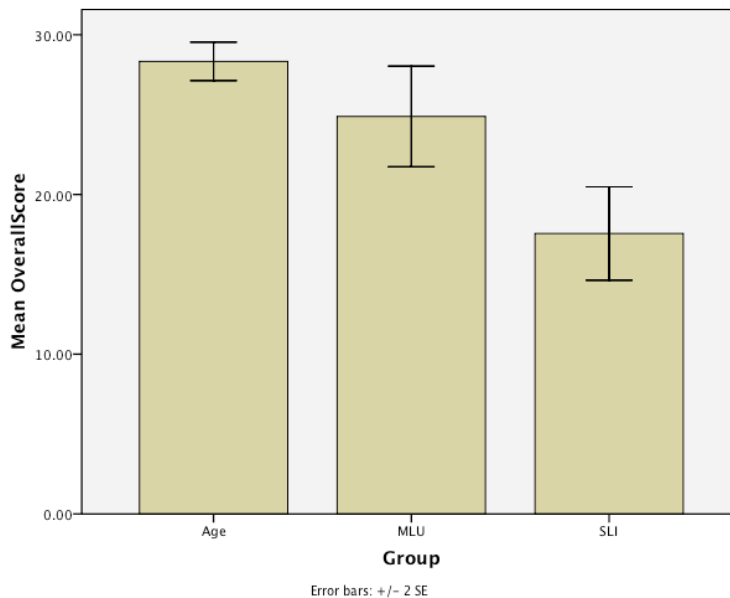


Figure 1 – Mean Percentage Correct for Three Groups on the Grammaticality Choice Task for Finiteness Marking

In a follow up to this study, Grinstead, De la Mora, Vega-Mendoza and Flores (2008) showed that 3 and 4 year-old Spanish-speaking children in Mexico would produce nonfinite utterances on an elicited production test, that their accuracy on this elicited production test correlated with their accuracy on the

Pratt & Grinstead (2008) Grammaticality Choice task (Pearson correlation = .652,  $p = .001$ , two-tailed) and that a group of 19 child Spanish-speakers with SLI were significantly worse than a group of 19 age-matched typically-developing Spanish-speaking children on the elicited production test, for a paired t-test,  $t(18) = -3.763$ ,  $p = .001$ , as illustrated in Figure 2.

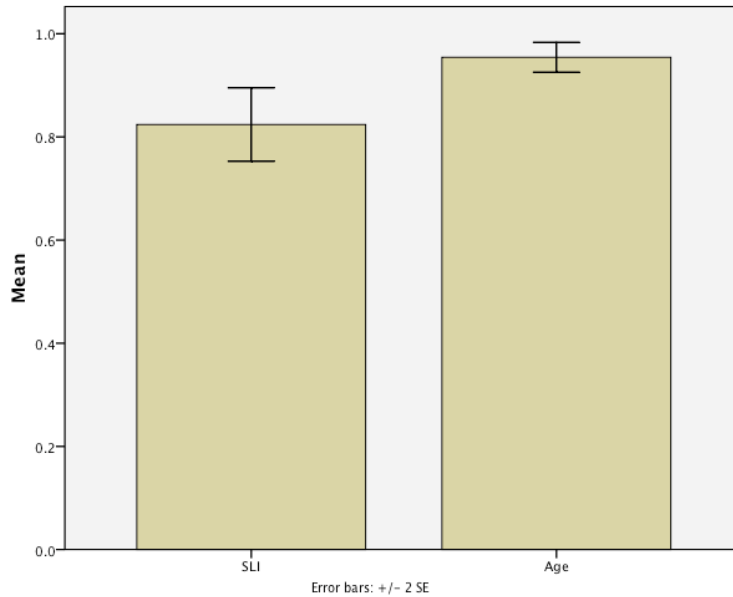


Figure 2 – Mean Percentage Correct for SLI and Age-Matched TD Groups on the Elicited Production Task for Finiteness Marking

In summary, child Spanish-speakers produce nonfinite verbs and judge nonfinite verbs to be grammatical at an early stage of development. Child Spanish-speakers with SLI are significantly worse than both age and language controls at judging the finiteness of verbs and are significantly worse than age controls at producing finite verbs. Tense marking in child Spanish-speakers may be a clinical marker of specific language impairment, as argued by Rice & Wexler (1996) for child English. If so, this may indicate a prolonged and severe inability to interface between syntax and pragmatics. With respect to Interface Delay, these results suggest that a dimension of the SLI deficit may be greater difficulty in establishing relations between syntax and discourse-pragmatics.

As a final note, if Interface Delay is correct and if children with SLI have particular difficulty in establishing cross-domain relations between syntax and discourse-pragmatics, then domains of syntax that do not characteristically interact with discourse should be left intact. In particular, we should expect that, for example, plural marking on nouns should be unaffected by the SLI deficit. In Grinstead, Cantú-Sánchez & Flores (2008), this is exactly what we show. On an elicited production test of plural marking of regular plurals (“mesa-mesas” or “table-tables”), Spanish-speaking children with SLI in Mexico performed at levels very similar to those of both age or language controls, as illustrated in Table 9. These results are consistent with the hypothesis that prolonged Interface Delay may be a dimension of SLI.

Group	Mean Percent Correct – Regular Plurals
SLI (n = 9, mean age = 4;9)	97.8% (176/180)
Age Control Group (n = 9, mean age = 4;9)	99.4% (179/180)
MLU Control Group (n = 9, mean age = 4;2)	100% (180/180)

Table 9 – Regular Plural Marking in Spanish-Speaking Children with SLI and Typically-Developing Age-Matched and Language-Matched Control Groups



## 4. Interface Delay and Semantics-Pragmatic Interface

If interfaces are slow to develop and if the syntax-pragmatics interface is slow to develop, we might expect that there could be a sufficient difference between the representations of semantics and the representations of pragmatics for there to be delay at the semantics-pragmatics interface. Noveck (2001), in fact, has made this argument on the basis of experimental results showing that children are more likely to provide “logical” or pragmatically unenriched answers to his experimental questions testing children’s knowledge of existential quantifiers than they are to provide answers which include a pragmatic implicature. To explain his results, Noveck appeals to the well-documented delay between syntax and pragmatics already described, asserting that a similar delay must exist between semantics and pragmatics. As we have pointed out, Jackendoff (1997) does not make a distinction at the level of conceptual structure that would warrant such a conclusion. Rather, under his assumptions, we might expect semantic and pragmatic information to consist of very similar types of representation perhaps processed in very similar ways. Further, there is empirical evidence that children are capable of interpreting both pragmatically-enriched and pure existential quantifiers with similar levels of proficiency (e.g. Guasti, Chierchia, Crain, Foppolo, Gualmini & Meroni 2005).

The question, then, is whether there is a dissociation of semantic and pragmatic interpretative abilities in young children. Noveck and Guasti et al tested 7 year-olds and found conflicting results. Vargas-Tokuda, Gutiérrez-Rexach & Grinstead (2009) tested 5 year-old Spanish-speakers to see whether at a younger age, a dissociation might be found. Spanish offers a unique opportunity to test the relative contributions of semantics and pragmatics to development because of the lexical nature of its existential quantifiers. One quantifier, “algunos”, may either have a pragmatically-enriched “some, but not all” scalar implicature associated with it<sup>v</sup>, or it may have the implicature cancelled in downward entailing environments (cf. Ladusaw 1979). Miller, Schmitt, Chang & Munn (2005) show that 4 and 5 year-old child Spanish-speakers tend to interpret “algunos” with the “some, but not all” implicature, but did not test implicature cancellation. The other existential quantifier under consideration, “unos” may be interpreted as a pure existential or it may render a “some, but not others” interpretation very similar to that of the implicature associated with “algunos”, but this interpretation is part of its inherent semantics, as demonstrated by the fact that it may not be cancelled in downward entailing contexts. To illustrate, consider the following examples:

11. 3 of 4 cats are in a house.
  - a. Encontré unos gatos en la casa. - Felicitous  
“I found some (unos) cats in the house.”
  - b. Encontré algunos gatos en la casa. - Felicitous  
“I found some (algunos) cats in the house.”
  
12. 4 of 4 cats are in a house.
  - a. Encontré unos gatos en la casa. - Felicitous  
“I found some (unos) cats in the house.”
  - b. Encontré algunos gatos en la casa. - **Infelicitous**  
“I found some (algunos) cats in the house.”

In the examples in 11, we see that both “unos” and “algunos” may felicitously refer to a situation in which 3 of 4 cats under consideration are in a house. In 12, however, we see that while “unos” – as a pure existential – may refer to a situation in which 4 of 4 cats under consideration are in a house, “algunos” may not. Rather, because “algunos”, as a term similar to “some” in English, forms part of a scale going from “none” to “all”, the stronger scalar term “all” or “todos” must be used in this situation (cf. Horn 1972). Crucially, we see in 13 that the effects of this pragmatic implicature disappear in the downward entailing environment created by the antecedent of a conditional sentence, erasing the distinction illustrated in example 12.

13. 4 of 4 cats are in a house.
  - a. Si hay unos gatos en la casa, me das una moneda. - Felicitous  
If there are some (unos) cats in the house, you give me a coin.
  - b. Si hay algunos gatos en la casa, me das una moneda. - Felicitous

If there are some (algunos) cats in the house, you give me a coin.

Given the similar kinds of sets calculated by using the pragmatic implicature associated with “algunos” and the alternative set calculated by using the lexical semantic meaning of “unos”, we have an opportunity to test the hypothesis that pragmatics and semantics undergo Interface Delay. In order to test this hypothesis, we performed two experiments, the first of which tested children’s implicature generation abilities with the two quantifiers and the second of which tested their implicature cancellation abilities with the two quantifiers.

## 4.1 Experiment 1

For the first experiment, we ask whether children will, as a function of the linguistic context, be able to generate the pragmatic implicature associated with “algunos” and whether children will, regardless of the linguistic context, be able to generate the alternative sets associated with the lexical meaning of “unos”.

### *Methods*

#### Participants

Twenty-seven monolingual, Spanish-speaking children (age range = 4;9 – 6;7, mean age = 5;9) from a daycare in Mexico City, and ten Spanish-speaking adults from Mexico City.

#### Procedures

Materials included a puppet (Donald Duck), 6 sets of plastic animals (multiple sets were used due to the discourse novelty property of “unos”) and 3 plastic figurines: Ninja Turtle, King Kong, and a girl (April). There were four target sentences, one control sentence, and up to three training sentences. Children had to pass the control sentence and at least the third training sentence to be included in the study. We used a Truth Value Judgment Task (Crain & McKee 1985) in which children were asked to judge whether the sentences were appropriate or not as descriptions of stories presented to them. The experimental sentences used were presented in a pseudo-random order in the same experimental session as Experiment 2, and are listed in the Appendix.

#### Stimuli

The target sentences, with either 2, 3 or 4 of 4 animals jumping over something, took the following schematic form<sup>v</sup>:

14. Unos X saltaron sobre A.  
Some Xs jumped over A.
15. Algunos P saltaron sobre A.  
Some Ps jumped over A.

The control and training sentences took the following forms:

16. Control sentences (with 1 animal jumping over something):  
Un Q saltó sobre B.  
A Q jumped over B.
17. Training sentences (with less than all the animals of a set jumping over something):  
Todos los M saltaron sobre C.  
All the M jumped over C.

### *Results*

In Table 10, we see that when all animals jump, adult Spanish speakers predominantly rejected the use of “algunos” and that children did the same. The pure existential use of “unos” however was accepted by both groups. Critically, children treated “unos” and “algunos” differently ( $X^2 = 7.42$ ,  $p = .006$ ).

	Algunos		Unos	
	Accepted	Rejected	Accepted	Rejected
Children	30% (8/27)	70% (19/27)	67% (18/27)	33% (9/27)
Adults	20% (2/10)	80% (8/10)	100% (10/10)	0% (0/10)

Table 10 – Responses when 4 of 4 Animals Jumped

In Table 11 we see that when 2 or 3 of 4 animals jumped, providing a felicitous context for both the implicature interpretation of “algunos” and the “some, but not others” interpretation of “unos”, children performed in a relatively adult-like fashion. In this case, children’s interpretations of “unos” and “algunos” did not differ ( $X^2 = 1.03$ ,  $p = .311$ ).

	Algunos		Unos	
	Accepted	Rejected	Accepted	Rejected
Children	85% (23/27)	15% (4/27)	74% (20/27)	26% (7/27)
Adults	100% (10/10)	0% (0/10)	100% (10/10)	0% (0/10)

Table 11 – Responses when 2 or 3 of 4 Animals Jumped

### *Discussion*

In contrast to the 7 year-old children in Noveck (2001), and similar to the 7 year-old children in Guasti et al (2005), the 5 year-old children in our study were able to generate a “some, but not all” pragmatic implicature with “algunos” (70% rejection of “algunos” when all animals jumped). “Unos” was as acceptable with less than all animals jumping (67%) as it was with all animals jumping (74%), which is consistent with relatively adult-like use of its focus property of calculating alternative sets.

## 4.2 Experiment 2

We have seen that children are willing to generate a “some and not all” pragmatic implicature with “algunos” under the appropriate circumstances and that they will not do so with “unos” under those same circumstances, but rather interpret it to mean “some and possibly all”, its existential interpretation. Now we turn to a test of one of the criterion asserted by Grice (1975) to characterize conversational implicatures, namely, that they may be cancelled. In experiment 2, we ask specifically whether children will, as a function of the linguistic context, be able to cancel the pragmatic implicature associated with “algunos” in a downward entailing environment. Further, we ask whether children will, regardless of the linguistic context, be able to generate the alternative sets associated with the lexical meaning of “unos” in a downward entailing context. That is, will downward entailing context have no impact on “unos”, as in the adult language.

### *Methods*

#### Participants

The same as in Experiment 1.

#### Procedures

The materials are the same as in Experiment 1, plus a bucket with a lid. Children were told that after jumping, some animals went to rest in the bucket and Donald Duck liked to guess who had gone there. Children were also told to reward Donald Duck with a coin when he guessed correctly.

**Stimuli**

There were four target sentences, one control sentence, and up to three training sentences. Children had to pass the control sentence and at least the third training sentence to be included in the study. We used a Truth Value Judgment Task (Crain & McKee 1985) in which children were asked to judge whether the sentences were appropriate or not as descriptions of stories presented to them.

Following Gualmini, Crain & Meroni (2000), we used conditional sentences. As the antecedent clause of such sentences are considered downward entailing environments in which conversational implicatures are cancelled, we presented the children with sentences containing either “unos” or “algunos” in their antecedent clauses, as in 18 and 19. The sentences were presented in a pseudo-random order during the same experimental session as those of Experiment 1 and are listed in the Appendix.

- 18. Si unos X están en la cubeta, recibo una moneda.  
If some Xs are in the bucket I get a coin.
- 19. Si algunos Z están en la cubeta, recibo una moneda.  
If some Zs are in the bucket I get a coin.

The control and training sentences took the following forms:

- 20. Si un P está en la cubeta, recibo una moneda.  
If a P is the bucket, I get a coin.
- 21. Si todos los Q están en la cubeta, recibo una moneda.  
If every Q is in the bucket, I get a coin.

*Results*

In Table 12, we can see that both adults and children were able to cancel the conversational implicature associated with “algunos” – the same quantifier with which they had generated a “some, but not all” implicature in Experiment 1. When 4 of 4 animals jumped, children hearing the quantifiers used in the antecedent of a conditional, treated them equally ( $X^2 = 3.00, p = .083$ ).

	Algunos		Unos	
	Accepted	Rejected	Accepted	Rejected
Children	81% (22/27)	19% (5/27)	96% (26/27)	4% (1/27)
Adults	80% (8/10)	20% (2/10)	90% (9/10)	10% (1/10)

Table 12 – Responses When 4 of 4 Animal Were In The Bucket

Further, children were aware that the implicature-cancelling impact of the downward entailing context on “algunos” had no impact on “unos”, which we can see in Tables 12 and 13. In Table 13, when less than all animals jumped and children heard the quantifiers in the antecedent of a conditional, they treated them equally, as the identical numbers show.

	Algunos		Unos	
	Accepted	Rejected	Accepted	Rejected
Children	89% (24/27)	11% (3/27)	89% (24/27)	11% (3/27)
Adults	100% (10/10)	0% (0/10)	100% (10/10)	0% (0/10)

Table 13 – Responses When 2 or 3 of 4 Animal Were In The Bucket

Of the 27 children tested, 3 of them, when asked why they had not accepted either “unos” or “algunos” as a representation of what they had just witnessed (2 or 3 of 4 animals in the bucket), said that they had rejected it “...because there are two/three of them.” That is, they were likely to have rejected “unos” or “algunos” because they had a set representation other than “some” – possibly a more specific one such as a cardinal number. We believe that this explains why adults have scores higher (100%) in Table 13 than those of the children (89%).

In summary, in contrast with previous studies, which found that children could not access the full range of truth conditions of “some”, we found, consistent with Chierchia et al (1998) and Gualmini et al (2000), that children could suspend the implicature associated with “algunos” in the downward-entailing environment created by the antecedent of a conditional (81%). Further, children showed that they understood that downward entailing context has no impact on the lexically-determined focus properties of “unos”, showing adult-like competence both when all animals were in the bucket (96% acceptance) and when only 2 or 3 of the animals were in the bucket (89%). At the youngest age that we found that our methodology could be used (4;9), children were equally able to access the truth conditions associated with set values generated by pragmatic implicature (“algunos”) as they were with set values generated by the lexically determined focus properties of “unos”. They were similarly able to cancel the implicatures in a downward entailing environment.

Returning to the debate regarding a possible Interface Delay between semantics and pragmatics, our results are consistent with either Jackendoff’s position that there is no interface between the two domains because they are one in the same, or with the position that there are two domains, but that there is no Interface Delay between them. In either event, it seems clear that the kind of pragmatics involved in generating an implicature, namely, the plausible inference drawn from interpreting a quantifier which sits on a pragmatic scale, is fundamentally different from the kind of pragmatics involved in tracking the beliefs of others regarding the salience of referents in discourse, i.e. the kind of pragmatics involved in the overuse of articles, null subjects and root nonfinite verbs. Fundamentally, this latter case of discourse-pragmatics involves memory, which may be an independent element in this equation, and which does not seem to play a similarly crucial role in implicature generation.

Finally, the learnability problem posed by these facts is truly difficult. It is hard to imagine how 4 year-olds could learn that “algunos” has one kind of meaning in the antecedent of a conditional (pure existential), but that outside of downward-entailing environments it has another meaning (the implicature). In our receptive experiment, the constructivist resort to lexical storage of constructions will not help because the children do not choose the precise nouns and verbs which combine with the quantifiers. Potentially most difficult for accounts of language development which assume that domain-general learning mechanisms such as generalization play a large role in language learning, a process of generalization would seem to make all of the wrong predictions in this situation. Most straightforwardly, it should lead children to erroneously generate implicatures for “unos” or to allow “algunos” to refer to 3 of 4 animals jumping, contrary to the implicature. This did not happen. Note that 5 year-olds, such as those who took part in our study, may still overgeneralize past tense –ed marking to irregular verbs in child English (cf. “eated”), suggesting that a process of generalization is not unimaginable for this dimension of grammar, yet it does not appear to have taken place. More mysterious still, is how children know which environments are downward-entailing and which are not, since they do not come labeled as such. Here, as yet poorly understood properties of grammar seem to be available to children to a roughly adult-like degree, which allow them to make this very subtle distinction.

## 5. Conclusion

In this paper, I have argued that cognitive domains appear to interact with one another through interfaces. Because these interfaces do not use the same symbols, they must find a common representation, perhaps at the level of Conceptual Structure, in Jackendoff's (1997) terms, which is sometimes a more apt representation of the native domain's symbols and computations than others. In the case of language and number and language and spatial cognition, the differences may cause developmental delays in children's abilities to coordinate information across the cognitive domains. Similarly, within the language faculty, there appear to be delays when syntax and discourse pragmatics interface – as in the case of null subject use and root nonfinite verb use – but not in cases in which no interface is invoked, as in the case of plural marking on nouns, even in the grammars of children with specific language impairment.

Moving to the semantics-pragmatics interface, if there is one, the representations in the two domains appear, at least on the basis of the data we have been able to collect with 5 year-olds, to be similar enough to produce no Interface Delay.

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# Appendix

## Implicature Generating Sentences

- Todos los pingüinos saltaron sobre la tortuga Ninja.
- Unos perros saltaron sobre la niña.
- Algunos borregos saltaron sobre King Kong.
- Un perro saltó sobre la niña.
- Algunas vacas saltaron sobre la tortuga Ninja.
- Unos tigres saltaron sobre King Kong.

## Implicature Cancelling Sentences

- Si todos los pingüinos están en la cubeta, yo recibo una moneda.
- Si algunos monos están en la cubeta, yo recibo una moneda.
- Si unos borregos están en la cubeta, yo recibo una moneda.
- Si una vaca está en la cubeta, yo recibo una moneda.
- Si algunos tigres están en la cubeta, yo recibo una moneda.
- Si unos perros están en la cubeta, yo recibo una moneda.

## Endnotes

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<sup>i</sup> Eduardo uses overt subjects, wh- questions and fronted objects before this point in his development, but not productively. Before this point, MLUw 1.98, his constructions appear to be more tied to specific lexical items. Thus Carlos and Graciela's data show that children can exit the No Overt Subject Stage and begin to use overt subjects at low MLUw values (1.29 and 1.37), while Eduardo's data shows that a child can also exit the No Overt Subject Stage at a higher MLUw (1.98). We can see this in these children's data because we can examine their production both before and after the emergence of overt subjects into their grammars. In the case of María, however, because she uses overt subjects in her very first recording session, her data is simply uninformative as to whether there exists a No Overt Subject Stage. She could have had no overt subjects at a linguistically earlier stage, as do Carlos and Graciela, or she could be just exiting the No Overt Subject Stage in her first recording session at MLUw 1.93, as did Eduardo.

<sup>ii</sup> The term “fronted object” is used to collapse the distinction between focused objects, which occur without an associated clitic, and topicalized objects (also known as “clitic left dislocation” constructions) which occur with a clitic because in early child Southern Romance, clitics are often omitted, making it impossible to distinguish between the two constructions.

<sup>iii</sup> For morphological and syntactic arguments for the nonfinite nature of bare stem forms in child Catalan and Spanish, see Grinstead (1998), Grinstead & Spinner (2009) and Grinstead, De la Mora, Pratt & Flores (2009).

<sup>iv</sup> This implicature is sometimes referred to as the “hidden partitive”.

<sup>v</sup> See the Appendix for a complete list of stimuli.