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Spanish-speaking children's use of verbal inflection in comprehension

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Abstract

This paper examines children's use of verbal agreement in comprehension in two varieties of Spanish with the goal of determining how the input affects their behavior. Both dialects are identical in allowing null subjects and having rich verbal morphology in contrast to English. The dialects differ however in that in Chilean Spanish a phonological lenition process affects the realization of second person singular /-s/. In Mexican Spanish, no such variation is found for the second singular. The results indicate that children acquiring languages with rich verbal morphology use agreement in comprehension in much the same way as children acquiring a language with less robust agreement. Moreover, we find that variable input for the second singular marker affects acquisition.
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Keywords: Agreement; Child language; Acquisition; Spanish; Morphology; Variable input

1. Introduction

Languages vary as to how much (if any at all) morphological agreement they display. Since agreement is not required in language (not all languages have it), it remains somewhat puzzling why 75% of the languages in the world do have some form of agreement (Corbett, 2006). Agreement patterns vary across languages, from relatively simple systems to quite complex systems. As agreement patterns are acquired, an important question is what is being acquired, besides the forms and their distribution. The answer to this question varies across frameworks and, even within the same framework, some domains of agreement are deemed more informative than others. For example, number and person morphology in subject–verb agreement has been considered more informative for parameter setting than number within the noun phrase. On the other hand, number information in the noun phrase has been thought to provide semantic import in a way that number agreement in the verbal paradigm does not.

In the eighties subject–verb agreement was considered an important way in which the learner could determine whether there was verb-raising in the language, and/or whether the language allowed null subjects or not. The empirical basis for such hypotheses was correlations between rich agreement and null subjects and rich agreement and head movement (see Rizzi, 1986; Baker, 1988; Alexiadou and Anagnostopoulou, 1998). Unfortunately, the correlations turned out to be not as strong as initially thought, and these strong hypotheses had to be substituted by weaker ones or dropped altogether

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(see Holmberg, 2010). The combination of the minimalist program and powerful tools from Distributed Morphology (fusion and impoverishment mechanisms, for example) have cast further doubts on a transparent link between morphology and syntax. It is not unfair to say that today many linguists assume that morphology is not a very reliable source of information about particular parametric choices of a language (see Bobaljik, 2008; Holmberg and Hróarsdóttir, 2003; Holmberg, 2010).

Independently of how much syntax the learner can acquire based on the morphological forms of a particular language, if the language has morphological agreement, the child must learn not only its forms but also the underlying formal system that constrains the distribution and interpretation of those forms. In other words, the learner must be able to produce the relevant morphology and also determine in an agreement chain which features enter into the agreement relation and where they are interpreted (i.e. at which point in the derivation they are added to the interpretation).

There is a consensus that morphological agreement signals asymmetric grammatical relationships: one or more elements in an agreement chain copy/inherit features from the element that controls the agreement. Subjects control agreement on predicates, and modified elements control agreement on modifiers. The common assumption is that the features that enter an agreement relation are interpreted only once, and there is an expectation that the interpretability is related to the controller of agreement.

The acquisition task then involves establishing for each agreement relation which member carries the features independently (the controller of agreement) and at what point they are associated to an interpretation. To demonstrate this knowledge in both production and comprehension, the learner has to have stored morphological forms with enough feature information so that these forms can be inserted into the appropriate syntactic positions. Assuming Distributed Morphology, the forms are stored with a feature specification and no form can have more features than the terminal node where it is inserted.

The mapping is not a one-to-one mapping, and various factors may cause the link between a form or forms and a particular set of features to be more or less reliable, which may consequently affect the strength of the relation.

Recent results from acquisition of agreement have yielded a very complicated pattern. The production of agreement morphology starts early (Brown, 1973), even though in some languages children do not always reach adult-like levels until relatively late. In comprehension tasks, the research is much more recent and has yielded a series of results that point to an early awareness of agreement markers in on-line measures (Brandt-Kobele and Hohle, 2010; Legendre et al., 2010) but in general a difficulty to draw inferences from agreement that can lead to semantic decisions (Johnson et al., 2005; Miller, 2012; Pérez-Leroux, 2005).

This paper aims to contribute three experiments on children's ability to use number agreement in the noun phrase and subject–verb agreement in offline comprehension tasks. We focus on two dialects of Spanish that vary in the reliability of overt agreement: Mexico City Spanish (henceforth Mexican Spanish) and Punta Arenas, Chile Spanish (henceforth Chilean Spanish). There is a major difference between these two dialects. In Chilean Spanish a phonological process of lenition weakens syllable final -s to [h] or zero. Lenition affects both the realization of nominal plural morphology – realized as /-s/ – and the realization of second person singular (2sg) morphology, in the tenses where this form is realized as /-s/. In the Mexican dialect both plural /-s/ and second person singular /-s/ morphology are always realized, as there is no syllable-final /s/ lenition.

The immediate goal of this paper is to examine differences in performance across dialects of Spanish and within dialects we examine performance in cases in which number information is on the noun phrase and the verb phrase or only on the noun phrase or the verb phrase. The overarching goal is to contribute to the research that determines how different agreement systems are acquired under different input circumstances, which may help us understand properties of the learning function and how the mapping from form to syntax and semantics is accomplished.

The paper is laid out as follows: in section 2 we provide a review of previous research on the acquisition of subject verb agreement and the acquisition of grammatical morphology occurring variably in the input. In sections 3–5 we present two comprehension experiments that examine Spanish-speaking children's use of 3sg and 3pl verbal agreement in comprehension and one experiment that examines comprehension of the 2sg verbal affix /-s/ in Chilean and Mexican Spanish. Section 6 concludes with a discussion of the results.

2. Language acquisition background

Evidence for agreement varies across many dimensions. In some languages agreement is robust and in some languages very weak. Within the same language, agreement forms may be categorically realized or they could occur variably. In the latter case, the realization is probabilistic and depends on various different factors. In this section we briefly consider children's knowledge of agreement marking across different language types. First, we examine acquisition of agreement marking in languages with rich vs. weak verbal morphology (e.g. Spanish vs. English). Second, we investigate acquisition in two varieties of the same language, one in which the input shows variability due to extra-linguistic factors, and the other where no such variability exists. Our motivation for examining children's ability to use agreement marking in

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comprehension in two empirical domains stems from our underlying research question of how the learner interacts with the input during the course of acquisition.

2.1. Acquisition of agreement marking

Children's comprehension abilities of verbal morphology have been tested in only a few studies. To our knowledge, the first paper to present a systematic study of children's ability to infer the subject's number based on verbal inflection on regular verbs was carried out by Johnson et al. (2005) (but see Leonard et al., 2000 for a study on irregular verbs). This work therefore constitutes a natural starting point for our investigation.

Johnson et al. (2005) tested sentences like those in (1a) and (1b).

(1) a. Show me the picture where the duck swims in the water
b. Show me the picture where the ducks swim in the water

In their study, children were shown two pictures: (i) a singular picture depicting one single duck swimming in water and (ii) a plural picture depicting two ducks swimming in water. Children had to choose the picture that matched the sentence they heard. Importantly, the onset of the verb was always /s/ so that the nominal plural marker /-s/ was masked. In this way, children were required to rely on the presence or absence of the third singular /-s/ to infer whether the subject was to be interpreted as singular or plural.

Johnson et al. (2005) found that only 5- and 6-year-old children, but not 3- and 4-year-old-children, performed at above chance levels. To account for the younger children's low performance, de Villiers and Johnson (2007) suggest – within a minimalist framework (Chomksy, 1995) – that because verbal inflection is associated with a feature that is checked and eliminated (i.e. an uninterpretable feature) prior to LF (i.e. the point in the derivation in which an interpretation is assigned), it is not meaning-bearing and hence not accessible to younger children in comprehension tasks. They propose that tasks of this sort become metalinguistic, reflective tasks, which are only within the reach of older children and adults. In other words, because the semantic content of the verbal affix comes by association to the controller of the agreement (the subject noun phrase), when the plural marker on the subject noun phrase is masked, younger children are unable to infer the number of the subject from verbal inflection.

While the results presented in Johnson et al. (2005) show that English-speaking 4-year-old children cannot use third singular -s in comprehension, we do not know whether this finding extends to languages with more robust verbal morphology. As such, we cannot know with certainty whether English-speaking children's low performance is indeed due to an inability to use agreement in comprehension or whether it is due to the impoverished morphological system of English.

In languages with rich morphology, such as Spanish, verbal agreement is viewed as having a stronger interpretative role. In some analyses, verbal agreement morphology is understood as playing the role of pronominal elements, which then allow the licensing of what appears to be null subjects (Alexiadou and Anagnostopoulou, 1998; Contreras, 1991 for a similar account). Under this view, Spanish person and number morphology on the verb is interpretable and not the result of agreement. In other words, while English verbal agreement is [-interpretable], Spanish verbal inflection is associated to [+interpretable] features for person and number.

Under the assumption that children can use interpretable features in comprehension tasks before they can use uninterpretable features, the prediction is that Spanish-speaking children should perform better than English-speaking children on tasks measuring their ability to use verbal inflection to infer subject number.

There are very few studies focusing on Spanish-speaking children, but those that exist have shown mixed results. Building on Johnson et al. (2005), Pérez-Leroux (2005) explored comprehension of verbal morphology in Spanish-speaking children from the Dominican Republic. Using similar experimental procedures, Pérez-Leroux tested children on sentences with both overt and null subjects, as shown in (2a&b) and (3a&b), respectively.

(2) a. El pato nada en el charco
The.SG duck-SG swim-3SG in the pond
'The duck swims in the pond'

b. Los patos nadan en el charco
The-PL ducks-PL swim-3PL in the pond
'The ducks swim in the pond'

(3) a. Nada en el charco
Swim-3SG in the pond
'(It) swims in the pond'

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b. Nadan en el charco
Swim-3PL in the pond
'(They) swim in the pond'

The results were almost identical to those reported by Johnson et al. (2005) for English-speaking children. That is to say, 3- and 4-year-old Dominican Spanish-speaking children were unable to use verbal inflection in comprehension, while 5- and 6-year-old children performed at above chance levels. Pérez-Leroux concluded that a developmental gap in using verbal morphology in comprehension also exists in Spanish and that, despite the more robust verbal agreement system of Spanish,[2] the Spanish data are fully comparable to the English data in Johnson et al. (2005). An additional similarity between the two studies was that both Spanish-speaking and English-speaking 5- and 6-year-old children performed better on the marked member of the verbal paradigm than on the form expressed by zero morphology. For Spanish-speaking children this was 3pl /-n/. For English-speaking children this was 3sg /-s/.

Contrary to the results presented in Pérez-Leroux (2005), Childers et al. (2001) use a similar sort of picture matching task and find that by 3 years of age, Spanish-speaking children use verbal inflection in comprehension tasks and that interpretability emerges first for the 3sg form of the verb and only later for the 3pl form of the verb. Childers et al. (2001) argue that children are acquiring verbal inflections in a gradual and piecemeal fashion, learning first those forms that are more frequent in their input, which would be the 3sg form in Spanish. These results seem to show the complete opposite pattern of those results presented in Pérez-Leroux (2005).

One possible explanation for the differences may be related to response-type biases. A closer look at the results of Childers et al. indicates that the 3-year-old children had a bias toward the picture depicting a single character over the picture with two characters, regardless of the experimental condition. For example, in one of their experiments Spanish-speaking children chose the singular picture in the 3sg condition 64% of the time and the singular picture in the 3pl condition 61% of the time (i.e. they report that children choose the plural picture 39% of the time in the 3pl condition). Such a bias does not appear to be found in Pérez-Leroux. In order to control for biases in children's behavior, Johnson et al. (2005) suggest that two additional measures be carried out. These are 'sensitivity' and 'response bias'. Both measures will be incorporated in the present study and will be discussed in more detail below. Nevertheless, the findings for Spanish-speaking children's comprehension of verbal agreement are uncertain at this point and warrant further study.

Before turning to the topic of variable input, two more studies deserve mention. Both studies used implicit measures to determine children's sensitivity to subject–verb agreement in languages with richer morphological systems than English (French and German) but that, unlike Spanish, do not allow null subjects.[3]

Brandt-Kobele and Hohle (2010) examined German-speaking children's use of verbal inflection in a picture matching task that was similar in design to Johnson et al. (2005) and they also examined children's sensitivity to verbal inflection through eye-tracking. Similar to previous findings on English and Dominican Spanish, in the offline picture matching task German-speaking children were unable to infer subject number from verbal inflection. Instead, they showed at-chance behavior in accuracy. On the other hand, the eye-tracking results indicate that German-speaking children were sensitive to verbal inflection.

In order to compare the results of this eye-tracking experiment to previous studies employing offline picture matching tasks more details of the experiments must be discussed. Unlike the offline picture matching tasks, the eye-tracking task had two phases: an experimental phase and a baseline phase. In the baseline phase children looked at two pictures one depicting a single character and the other depicting two characters – without hearing any spoken stimulus so that it could be determined whether they showed a preference for the singular picture or the plural picture. In the experimental phase, children looked at the pictures after hearing the experimental sentence. The comparison between the baseline phase and experimental phase showed a significant decrease in looking times at the plural picture when children were presented with a sentence from the 3sg condition. The results for the 3pl condition were inconclusive because children showed an overall bias for looking at the plural picture.

The authors interpreted their results as indicating that German 3–4-year-old children are able to infer the number of the sentential subject solely by relying on verbal inflection and that processing factors must account for children's failure in previous offline tasks. However, it is worth noting that the different analyses employed in the eye-tracking study and previous offline experiments may have masked similarities in findings between the two types of experiments. In the eye-tracking task if we examine the proportion of looks toward the accurate picture in the testing phase only – similar to what has been done for children's pointing in previous offline tasks – the results show that children reach roughly 58% accuracy (i.e. 58% of looks to the picture matching the experimental sentence). These results seem more in line with previous offline

[2] Toribio (2000) reports that in many varieties of Dominican Spanish syllable-final /n/ is variably elided. While this may affect the input to children for the 3pl affix /-n/ in Dominican Spanish, Toribio points out that nasalization remains on the preceding vowel even when /n/ is elided.

[3] While neither French nor German allow null referential subjects, German does allow null expletives and topic drop.

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picture matching tasks showing that children do not perform at above chance levels on their interpretation of subject–verb agreement. We will come back to this point below.

The second study was by Legendre et al. (2010) who examined French-speaking children's use of verbal inflection in comprehension using a preferential looking paradigm. The authors note that in vowel-initial verbs (a subset of French verbs), *liaison* phenomena will allow the /s/ of the third person plural pronoun in subject position to resyllabify with the verb (e.g. *Ils embrassent* 'they hug'), resulting in different phonological forms for the 3sg and 3pl forms of the verb. Building on previous work showing that word final consonants are less clearly articulated, they hypothesized that agreement marking in word-initial (i.e. verb-initial) position, may result in earlier comprehension than agreement marking that surfaces as a suffix.

Similar to Brandt-Kobele and Hohle (2010), they find differences in looking times to the target picture between the baseline phase and the experimental phase; nevertheless, in the experimental phase children still only reach about 55% accuracy on average. For example, in one experiment, children looked at the matching picture in the experimental phase only 53% of the time but in the baseline phase they looked at that same picture 46% of the time, a difference which turned out to be statistically significant. However, if behavior in the experimental phase were compared to chance – as was done in previous offline tasks – 53% would not be above chance performance. The difference is that with the offline tasks, there is no baseline phase that asks children to point to a picture without hearing an experimental prompt. Instead, offline tasks – although they take response biases into account – determine children's use of agreement in comprehension by comparing their performance to chance. Because the analyses are different, it is difficult to reconcile the sensitivity to verbal inflection in these two online studies with the accuracy or sensitivity measures in previous offline tasks; however, it is important to realize that if analyses were more comparable, we might find that the results of these offline and online tasks diverge less than previously thought.

In summary, previous studies on languages like French and German indicate that 3- and 4-year-old children are sensitive to verbal inflection (i.e. they show differences between baseline and testing phases) even though they do not appear to look at the picture matching the stimulus sentence at above chance levels (chance = 50%). Moreover, in offline picture matching tasks, German children perform at chance levels. For languages with less robust verbal morphology, which also do not allow null subjects (e.g. English), the results are similar. Finally, in Spanish, a language with rich verbal morphology and null subjects, the findings are mixed. One study shows that 3- and 4-year-old children can use agreement in comprehension, while the other shows that they cannot. Because Spanish allows null subjects, it may be that verbal morphology would be relied on more heavily than, for example, in languages like German and French, because when the subject is null, the remaining cue to subject number is the verbal affix.

2.2. Acquisition and variable input

In spite of the growing number of studies on children's comprehension of subject–verb agreement, relatively few studies have examined the effect of variable input on the acquisition of grammatical morphology (but see Miller, 2007, 2012, 2013a; Miller and Schmitt, 2010, 2012). One way that variability arises in the input to children is through sociolinguistic variation and one such case is syllable final /s/ lenition in Chilean Spanish.

Syllable final /s/ lenition is a phonological process that reduces /s/ to either an aspiration or an omission (zero) (Lipski, 1985; Cepeda, 1995). As such, the pronunciation of Spanish /s/ is described in the literature as either fully articulated [s], aspirated [h], or deleted (zero). Because the nominal plural marker and the 2sg verbal affix both have the form /-s/ in word final position, lenition not only affects the production of lexical /s/ in words such as *bus* 'bus' and *pescado* 'fish', but it also affects the production of morphological /-s/ in cases like *comes* 'eat-2SG' and *gatos* 'cat-PL'. In cases where the /-s/ stands for the plural marker in the noun phrase (determiner, noun and/or adjective), the result of omission is a form that is identical to the singular form. In cases where /-s/ stands for the 2sg (which is the case in the present tense, past imperfective, subjunctive, and future tenses), its omission creates a form that is identical to the 3sg form. In the case of nominal plural morphology, an omission does not always mean that the plural noun phrase is identical to the singular noun phrase. Because the elements inside the Spanish noun phrases agree in number, when the plural marker is omitted on the noun it may still be produced as an aspiration or alveolar fricative on the determiner. For example, plural marking on definite noun phrases tends to occur as an aspiration on the determiner and omission on the noun (e.g. [lah niña] 'las niñas') and plural nouns that are bare or headed by a quantifier often have no grammatical plural marking in the noun phrase (e.g. [to: lo día] 'todos los días') (Miller, 2007). On the other hand, when the 2sg verbal affix is omitted, the 2sg form ([kanta] 'cantas') and the 3sg form ([kanta] 'canta') overlap.

As such, the input to Chilean children provides evidence both for (overt forms [-s] and [-h]) and against (omission) plural morphology and the 2sg verbal affix. Mexican Spanish (of Mexico City), on the other hand, does not have /s/ lenition and both the plural and the second singular morphemes are always pronounced as /-s/. Importantly, when lenition eliminates the contrast between singular and plural, the input is left with no evidence for grammaticalized number in the noun phrase, but when lenition eliminates the contrast between 2nd and 3rd person singular, we are still left with a variety of person-number contrasts within the verbal paradigm.

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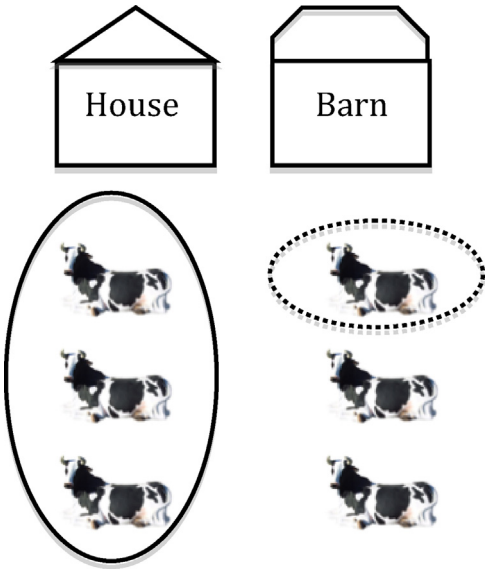

Fig. 1. Experiment 2: sample experimental display.

Past research on the acquisition of plural morphology has shown that many 4- and 5-year-old Chilean children exposed to an input with /s/ lenition are unable to associate the plural marker to a 'more than one' interpretation in comprehension tasks, while the same-aged children exposed to an input without /s/ lenition have no such difficulties (Miller, 2007; Miller and Schmitt, 2010, 2012).

Miller (2007) ran a series of experimental studies examining Chilean and Mexican Spanish-speaking children's production and comprehension of plural morphology. The comprehension experiments showed that many 4-year-old Chilean children did not associate the plural indefinite *unos* 'some-PL' to an interpretation of more-than-one. For plural definite noun phrases, two studies found that many 4-year-old Chilean children did not distinguish between plural and singular forms (*la* vs. *las*) and, instead, associated both plural and singular definite noun phrases to an interpretation of more-than-one. Both findings – treating the singular definite noun phrase as plural and the plural indefinite noun as singular – were different from the adult results and also were not consistent with the input to which Chilean children were exposed. In particular, in Chilean adult speech the plural marker is rarely omitted on the definite determiner in plural definite noun phrases (Miller, 2013b) and is produced as an [h] or as [s]; therefore based on the input frequencies it is unlikely that children were interpreting the singular definite noun phrase as a plural definite noun phrase with omissions – due to /s/ lenition – on the determiner and noun. In the case of the plural indefinite *unos* 'some-PL', a singular interpretation is never consistent with the plural indefinite noun phrase in adult speech. Contrary to Chilean children's low performance on these tasks, Mexican children of the same age showed adult-like performance in their interpretation of plural indefinite and definite noun phrases.

In one of the two studies on definite noun phrases, Chilean and Mexican children were presented with toys (e.g. 6 miniature cows, a toy barn, and a toy house) arranged as depicted in Fig. 1 and were asked to act out sentences like those shown in (4a) and (4b).[4]

(4) a. Dame la vaca durmiendo al lado de la granja
Give.me the-F-SG cow-F-SG sleeping to.the side of the barn
'Give me the cow sleeping next to the barn'

b. Dame las vacas durmiendo al lado de la casa
Give.me the-F-PL cow-F-PL sleeping to.the side of the house
'Give me the cows sleeping next to the house'

[4] It should be noted that in Miller (2007) there were two types of experimental sentences tested with Mexican children. Two thirds of the Mexican children received *Dame la/s vaca/s dormida/s al lado de la granja* 'Give me the cows asleep next to the barn' which contained an agreeing adjective, instead of (4a,b). This choice was made because the native-speaking Mexican consultants preferred this sentence to the ones used in Chile. Chilean consultants preferred the sentences used in (4). While sentences were changed for two thirds of the Mexican children, no difference in performance was found between the two mexican groups.

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Upon hearing (4a), the expected response was to choose the singular cow circled by the dotted line. Upon hearing (4b), the expected response was the plural set of cows circled by the solid line. We did not expect children to choose the plural set of cows for sentences like (4a) because – even when the plural marker is lenited in Chilean Spanish – it is generally the case that the definite determiner carries an aspiration (i.e. 4a is not consistent with a plural interpretation in the adult speech). The results showed that only 33% of Chilean children distinguished between the plural and singular definite nouns phrases while 93% of Mexican children distinguished between plural and singular forms.

Miller (2007) proposed that the variable production of the plural marker in the input to Chilean children affects their acquisition of plural morphology. In particular, she hypothesized that grammatical morphology that occurs variably in the input to children (due to structured sociolinguistic variation) will take longer to be acquired than grammatical morphology that is consistently produced in the input. This is because young children must make decisions about the grammatical morphology at play in their language while they are still acquiring the sociolinguistic variation. For this reason, children may not, for example, initially link the presence or absence of the morphological marker to particular sociolinguistic contexts. This hypothesis predicts that Chilean children should also take longer than Mexican children to acquire the 2sg verbal affix /-s/ because, in Chilean Spanish, this marker is also omitted variably due to the phonological process of /s/ lenition.

In addition to the experimental studies in Miller (2007), there are a few other studies that suggest that variable input affects acquisition of grammatical morphology. With respect to Spanish /s/ lenition, Marrero and Aguirre (2003) report that a child exposed to /s/ lenition in Canary Island Spanish[5] did not produce any tokens of the plural marker until 3 years of age, which was much later than what was reported for two Madrileño Spanish-speaking children exposed to consistent input for plural morphology (as early at 1;9 years of age). In this case, however, it is not clear whether the child had not yet acquired the plural marker or whether she omitted it because she had already learned the phonological process of /s/ lenition.

Johnson (2005) tested African American English-speaking (AAE) children's comprehension of 3sg /-s/ under the assumption that the input to these children contained variable realization of the 3sg marker. The experimental procedures were the same as in the study presented in Johnson et al. (2005), described earlier in this paper. The results showed that AAE-speaking children performed at lower levels than the Mainstream English-speaking children (presented in Johnson et al., 2005). The author concluded that this difference was due to the omissions of the 3sg verbal marker -s in the input to the AAE-speaking children (see Miller, 2012 for similar results on English-speaking children's acquisition of agreement on the auxiliary *do* in dialects that allow non-agreeing *don't*).

As we see it, there are two issues at stake in the present paper. First, subject–verb agreement, by its very nature, may be difficult for children to use in comprehension. To be more precise, it may be the case that, no matter how rich the morphology is or whether or not there are null subjects in the language, 4-year-old children will show difficulty making semantic decisions about the subject number based on verbal inflection. The second issue is related to variability in the input and is an issue that we believe cannot be ignored. While most acquisition research generally does not consider sociolinguistic variability in the input as a possible explanation for children's behavior, past work has indicated that it may affect acquisition. As such, this paper attempts to address both issues by posing the following two research questions.

i. Does the richness of verbal morphology and the presence of null subjects in Spanish impact children's ability to use the verbal affix in offline tasks measuring comprehension?
ii. Does variable input (due to sociolinguistic variation) for the 2sg marker in Chilean Spanish affect acquisition?

3. Experiment 1: null subjects with 3SG and 3PL verbal inflection

The goal of Experiment 1 is to test whether Spanish-speaking children can use inflectional marking on the verb to infer subject number. Similar to Pérez-Leroux (2005), we tested children's comprehension of Spanish verbs inflected for 3pl and 3sg; however, we used a different experimental task. If our results pattern with those of Pérez-Leroux (2005) – regardless of the experimental task difference – then we have much stronger evidence for the notion that agreement is hard for children to use in comprehension, even in morphologically rich languages that allow null subjects.

3.1. Design and procedure

To prevent the expression of number in the noun phrase, we used embedded null subject sentences in the subjunctive (which forces disjoint reference with the matrix subject). This way number was expressed only on the verb. In order to

[5] Both Marrero and Aguirre (2003) and Lipski (1994) discuss the presence of /s/ lenition in the Canary Islands.

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create a context for embedded sentences with null subjects, we set the experimental task up in the following way. Children were presented with a puppet and three dolls. One doll was introduced as the child-doll and the other two as the child-doll's parents. The parent-dolls were placed together while the child-doll was placed alone. Children were told that the puppet was going to ask that they carry out different actions either with the parent-dolls or with the child-doll. To make the experimental procedure felicitous, the puppet whispered in the research assistant's ear what he wanted the child to do and the research assistant then relayed that information to the child.

Both 3sg (5a) and 3pl (5b) forms of the verb were tested (4 trials each) and trials were counterbalanced between the two conditions. In addition, there were 4 control trials that were identical to the test trials except they included an overt subject. Two control trials required children to carryout an action on the child-doll (e.g. *Pepe quiere que el niño duerma* 'Pepe wants that the boy sleep-3SG') and two required them to carryout an action on the parent-dolls (e.g. *Pepe quiere que los papás duerman* 'Pepe wants that the parents sleep-3PL'). The control trials were included to ensure that children would choose both the child-doll and also the parent-dolls during the task. The four verbs that were used in the experimental prompts were: *dormir* (sleep), *saltar* (jump), *bailar* (dance), *dibujar* (draw).

(5) a. Pepe quiere que salte
Pepe wants that jump-3SG
'Pepe wants him to jump

b. Pepe quiere que salten
Pepe wants that jump-3PL
'Pepe wants them to jump'

Research assistants were native speakers of Spanish who were from the same local area of the children being tested. A sample trial is shown in (6).

(6) **Research Assistant:** *Este es Pepe (point to the puppet). Este es un niño (point to child doll) y ellos son sus padres (point to parent dolls). Pepe me va a decir al oído lo que él quiere que este niño haga o lo que él quiere que los padres hagan. Escucha muy bien y haz saltar or bailar a la persona que Pepe dice.* This is Pepe (point to the puppet). This is a child (point to the child doll) and these are his parents (point to the parent dolls). Pepe is going to tell me in my ear what he wants this child doll to do and what he wants the parents to do. You need to listen carefully and make the right person jump or dance just as Pepe says.

Research Assistant: *¿A ver, Pepe?* Let's see Pepe? (Pepe whispers in researcher assistant's ear).
Research Assistant: *Ah! Pepe quiere que salte/n.* Oh! Pepe wants him/them to jump.

Responses were scored as correct in the 3sg condition if the participant made the child-doll (or any singular doll) carry out the action, and as correct in the 3pl condition if the participant carried out the action on two or more of the dolls, as this would indicate that they associated the verbal inflection -n to a plural subject.

3.2. Results and discussion

Sixteen Spanish-speaking children between 4;03 and 5;01 (Mean: 4;07) years of age were tested in preschools in Chile. On the control trials, children performed as expected, choosing the parent-dolls in the plural condition and the child-doll in the singular condition 100% of the time. This indicates that children are willing to choose both sets of dolls.

What happens when we take the overt subject out of the experimental prompt in the target conditions? The results show that in the target conditions, children performed very differently. Two paired samples *t*-tests were conducted to compare proportion correct in the plural target and control conditions and the singular target and control conditions. The results confirm that children have difficulty using verbal morphology in comprehension as the differences between target and control conditions was significant for the plural ($t(15) = -3.296$, $p < .01$) and the singular ($t(15) = -4.070$, $p < .01$). A one-sample *t*-test comparison with chance (50%) performance revealed that children were more accurate than chance in the 3rd plural target condition ($t(15) = 2.908$, $p < .05$) but not in the 3rd singular target condition ($t(15) = 1.593$, $p = .132$).

While percentage correct shows the accuracy of children in matching up the verbal affix with the correct subject (i.e. either a plural or singular subject), Johnson et al. (2005) note that accuracy scores could potentially disguise the child's sensitivity to the verbal affix. In particular it might be the case that children rarely choose the singular doll in the target condition, but if the only time they choose the singular doll is when they hear the third singular form of the verb, then they are showing sensitivity to this form. Following procedures used in Johnson et al. (2005), we carried out three analyses

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Table 1
Accuracy, response bias, and sensitivity in children for Experiment 1.

Accuracy		Bias (out of 8)		Sensitivity (out of 1)	
sg	pl	sg	pl	sg	pl
31	75*	2.4	5.6	.58	.53
(31)	(29)	(1.3)	(1.3)	(.35)	(.32)

Note: Scores are compared to chance behavior (50%).

* Significant at the $p < .05$ level.

SD in parentheses.

that looked at children's accuracy, bias, and sensitivity in the target conditions. Bias refers to whether there was a tendency to choose a singular (e.g. child-doll) or plural (e.g. parent-dolls) set more often in the target conditions. As such, the range is from 0 to 8, as there were eight trials. Sensitivity is the proportion of times children chose the set of dolls (i.e. singular or plural) matching the spoken stimulus over the proportion of times they chose that same set in both the singular and plural target conditions. The results are shown in Table 1.

To determine whether children were sensitive or not to the verbal affixes two comparisons were made. For the first comparison the dependent measure was the proportion of times children chose a plural subject in both the singular target condition and the plural target condition. A paired samples *t*-test revealed that children did not behave differently in the two conditions ($t(15) = 1.464$, $p = .164$). In addition, a second statistic comparing sensitivity to the chance value of .5 shows at chance performance both in the plural target condition ($t(15) = .194$, $p = .849$) and in the singular target condition ($t(15) = .110$, $p = .914$).

These findings are in line with previous work showing that at 4 years of age, children are unable to use verbal agreement to make semantic decisions about subject number in comprehension tasks. We employed a different methodology than was used by Pérez-Leroux (2005) with Dominican Spanish-speaking children but, nevertheless, our results are quite similar. This experiment, taken together with previous work, indicates that subject–verb agreement (3sg and 3pl forms) is difficult to use in comprehension tasks regardless of how rich or weak the verbal morphology of the language is.

4. Experiment 2: overt subjects with 3SG and 3PL verbal inflection

Experiment 2 asks whether Chilean Spanish-speaking children can use a combination of an overt subject and verbal inflection to determine subject number. Past work has shown that Chilean children do not associate the plural marker in the noun phrase alone to a plural interpretation (Miller, 2007; Miller and Schmitt, 2012) but that performance increases when there is an agreeing verb in the experimental prompt (Miller and Schmitt, 2009). However, Pérez-Leroux (2005) did not find that performance increased with an overt subject. In experiment 2, we use a different methodological procedure (i.e. different from that used in Miller and Schmitt, 2009 and Pérez-Leroux, 2005) to determine whether an increase in performance is found when an overt subject is included. If our results show improved performance when children are tested on an overt subject + an agreeing verb, then we have support suggesting that multiple cues facilitate children's use of verbal agreement in comprehension.

The overt subjects in Experiment 2 are different from those used in Experiment 1. In Experiment 2 overt subjects form minimal pairs where the only difference is the presence or absence of the plural marker (e.g. *la vaca* vs. *las vacas*). In addition, we also tested Mexican children on this task because past research has indicated that Mexican children associate the plural marker in the noun phrase to plurality much earlier than Chilean children (Miller, 2007). As such, if children can use verbal agreement in comprehension, we expect previous differences found between Mexican and Chilean children to decrease in Experiment 2.

4.1. Design and procedure

Following a procedure used in Miller (2007), we carried out an act-out task that examined children's comprehension of sentences like those in (7). Toys were arranged in front of children as depicted in Fig. 1. These sentences asked children to pick up a plural or singular set of the toys and hand them to the research assistant. The toys were miniature-sized so that children could easily pick up more than one at a time.

Experimental sentences from the present study are shown in (7) and sample sentences from Miller (2007) are shown in (8) for comparison. The principal difference between Miller's (2007) experiment and the one presented here is that the sentences in Miller (2007) did not include a verb that agreed with the subject. Miller (2007) also tested both Chilean children and Mexican children.

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Experimental sentences used in the present study:

(7) a. Dame la vaca que está durmiendo...
Give.me the-F-SG cow-F-SG that is-3SG sleeping...
'Give me the cow that is sleeping next to the barn'

b. Dame las vacas que están durmiendo...
Give.me the-F-PL cow-F-PL that are-3PL sleeping...
'Give me the cows that are sleeping next to the house'

Experimental sentences used in Miller (2007):

(8) a. Dame la vaca durmiendo al lado de la granja
Give.me the-F-SG cow-F-SG sleeping to.the side of the barn
'Give me the cow sleeping next to the barn'

b. Dame las vacas durmiendo al lado de la casa
Give.me the-F-PL cow-F-PL sleeping to.the side of the house
'Give me the cows sleeping next to the house'

Experiments were carried out by native Spanish-speaking research assistants who were from the same local area as the children and who were trained on the experimental procedures. To be consistent with Miller (2007), the research assistants always pronounced the plural marker in the noun phrase as [-s]. Upon hearing (7a), the expected response is to choose the single cow circled by the dotted line. This is because both the noun and verb provide information that the subject is singular. Upon hearing (7b), the expected response is the plural set of cows circled by the solid line because both the noun phrase (determiner and noun) and verb provide information that the subject is plural. A sample trial is shown in (9).

(9) **Research Assistant:** (Read only once at the beginning of the experiment) *Yo te voy a decir cuantas*[6] *me tienes que dar y tú me des la cantidad que yo te digo. ¿Te parece?* I am going to tell you how many you have to give me and you give me the amount that I tell you. Ok?
Research Assistant: *Dame las vacas que están durmiendo al lado de la casa.* Give me the cows that are sleeping next to the house.

The target conditions always tested plural or singular feminine definite noun phrases and the copula verb *estar*. The only difference between plural and singular feminine definite noun phrases is the presence or absence of the plural marker (e.g. *las vacas* 'the-PL cow-PL' vs. *la vaca* 'the-SG cow-SG'). Since past work has indicated that Chilean children are unable to use the nominal plural marker in comprehension, the goal is to determine whether the addition of an agreeing verb will affect their performance.

There were also two control conditions containing four trials each and eight fillers. The control conditions involved the plural quantifier *todas* ('all-F-PL') and the singular indefinite *una* ('one-F-SG') and were included to insure that children would choose both a plural set and a singular set of objects during the task. Previous work has shown that Chilean and Mexican children are adult-like in comprehension of both *todas* and *una* by at least 3 years of age (Miller, 2007; Miller and Schmitt, 2010, 2012). The fillers involved questions about the physical properties of the toys in the display (e.g. Do the cows have feathers?).

4.2. Results and discussion

Forty-seven Chilean children (4;00–6;00, Mean: 5;00) and twelve Mexican children (3;04–5;01, Mean: 4;06) participated in this study. Chilean children were divided into two groups. The younger group was comprised of 25 children (4;00–4;11, Mean: 4;05) and the older group 22 children (5;00–6;00, Mean: 5;06). This age division allows comparison to

[6] It was noted by an anonymous reviewer that the use of the Spanish word *cuantas* ('how many') in the experimental prompt might be pragmatically odd when the following trial contains a definite noun phrase. We chose to use *cuantas* in the prompt in order to focus children's attention to number information during the experiment. This experimental prompt was read only once, at the beginning of the experiment. It was not read before each trial.

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Table 2
Accuracy, response bias, and sensitivity in children for Experiment 2.

	N	Accuracy		Bias (out of 8)		Sensitivity (out of 1)	
		sg	pl	sg	pl	sg	pl
Young Chilean	25	80***	71**	4.4	3.6	.77***	.86***
M = 4;05; R = 4–4;11		(29)	(30)	(2.1)	(2.1)	(.24)	(.17)
Old Chilean	22	64	88***	3	5	.75**	.89***
M = 5;06; R = 5–6;00		(38)	(23)	(1.9)	(1.9)	(.38)	(.16)
Mexican	12	94***	90***	4.2	3.8	.90***	.94***
M = 4;06; R = 3;04–5;01		(16)	(20)	(2.6)	(2.6)	(.21)	(.10)

Note: Scores are compared to chance behavior (50%).
* Significant at the $p < .05$ level.
** Significant at the $p < .01$ level.
*** Significant at the $p < .001$ level.
M = Mean Age; *R* = Age Range; SD in parentheses.

Johnson et al. (2005) who found that children below 5 years of age were unable to use verbal inflection in comprehension. Moreover, in the present experiment only younger Mexican children were tested, as it was expected that they would perform at ceiling since past studies have shown that Mexican children associate the nominal plural marker to number by this age. In other words, their success in this task does not rely upon their ability to use verbal inflection in comprehension.

The results show that both the Chilean and Mexican children are at ceiling in the control conditions, indicating that they are willing to choose both the plural set and singular set of toys. In addition, Mexican children are also at ceiling in the target conditions. Chilean children did not reach the same levels of accuracy as the Mexican children; however, they were accurate in the Singular Condition 72% of the time and in the Plural Condition 79% of the time.

To examine the effect of age on performance, an ANOVA [between-subjects factor: group (Young Chilean, Old Chilean) and within-subjects factor: condition (Plural Target Condition, Singular Target Condition)] and proportion of plural responses as the dependent variable was conducted. The results showed a main effect for condition, indicating that overall Chilean children gave a plural response in the plural target condition more often than in the singular target condition ($F(2, 45) = 107.299$, $p < .001$). In addition, there was a main effect for age ($F(2, 45) = 4.874$, $p < .05$). There was no significant interaction between age and condition.

While the Chilean children did not reach the same level of performance as the Mexican children, independent samples *t*-tests comparing the proportion of correct responses to chance (chance = 50%) indicates that the younger Chilean children were above chance in both the plural target condition ($t(24) = 3.460$, $p < .01$) and the singular target condition ($t(24) = 5.196$, $p < .001$). However, the older Chilean children were only above chance in accuracy in the plural target condition ($t(22) = 7.707$, $p < .001$) but not in the singular target condition ($t(22) = 1.667$, $p = .110$). Mexican children also performed above chance levels in both the plural target condition ($t(11) = 6.917$, $p < .001$) and the singular target condition ($t(11) = 9.753$, $p < .001$).

Following procedures used in Experiment 1, we carried out three analyses that examined children's accuracy, bias, and sensitivity in Experiment 2. As noted for Experiment 1, bias refers to whether there was a tendency to choose a singular (i.e. one toy) or plural (i.e. more than one toy) set more often. As such, the range is from 0 to 8, as there were eight trials. Sensitivity is the proportion of times children chose the set matching the spoken stimulus over the proportion of times they chose that set in both the singular and plural target conditions. The results are shown in Table 2.

To determine whether children were sensitive or not to the verbal affixes chance performance was examined. A One-way ANOVA comparing sensitivity to the chance value of .5 shows above chance performance for both Chilean age groups in both the plural target condition (Chilean Young: $t(24) = 10.624$, $p < .001$; Chilean Old: $t(21) = 11.278$, $p < .001$) and the singular target condition (Chilean Young: $t(24) = 5.658$, $p < .001$; Chilean Old: $t(21) = 3.022$, $p < .01$). Similar to what was found in Experiment 1, the measures of accuracy and sensitivity show different results. We believe that the sensitivity measure is a more precise way for interpreting the data because it takes into account any response biases in children.

The sensitivity results indicate that by 4 years of age, Chilean (and Mexican) children can use a combination of an overt subject and verbal inflection to determine subject number. This finding differs from Pérez-Leroux (2005) who shows that 4-year-old Dominican Spanish-speaking children are unable to use in comprehension a combination of an overt full NP subject and verbal inflection (e.g. *el pato nada* 'the duck swims' vs. *los patos nadan* 'the ducks swim') at above chance levels. Moreover, the results indicate that performance improves when verbal inflection is added to the experimental prompt as Chilean children in the present study performed at higher levels than those tested only on the plural marker in Miller (2007).

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Finally, the differences found between Mexican and Chilean children suggest that it is the combination of the overt subject and the verbal inflection that affects performance, and not one or the other alone. Mexican children have two consistent cues to subject number (the plural marker in the noun phrase and the verbal inflection) and show at ceiling performance. Because it has been shown that Chilean children rely less on the plural marker in the noun phrase in comprehension, it may be that they have fewer consistent cues to subject number (i.e. the plural marker in the noun phrase is variable and the verbal inflection is consistent), which may account for their lower performance in Experiment 2.

5. Experiment 3: null subjects and 2SG verbal inflection

The goal of Experiment 3 is to examine Chilean children's use of the 2sg verbal affix in comprehension. Much like the nominal plural marker /-s/, the 2sg verbal inflection /-s/ is also affected by /s/ lenition and is reduced to an aspiration or omission. In Experiment 3 we ask whether variation in the input for the 2sg marker (e.g. pronounced as [-s], [-h], or zero) will affect children's ability to use it in comprehension. Moreover, because omission of the 2sg marker -s results in an input where the 2sg and 3sg forms of the verb are identical (e.g. when 2sg -s is omitted on *estás* 'be-2SG', the 2sg form becomes *está*, which is identical to the 3sg form *está*), we ask whether Chilean children will assign both a 2sg and 3sg interpretation to 3sg forms of the verb.

5.1. 2SG verbal affix in Chilean Spanish naturalistic speech

Before examining children's comprehension of the 2sg verbal affix, it is important to establish how often the 2sg verbal affix is omitted in the input to Chilean children and compare production of the 2sg marker to production of the plural marker in the noun phrase.

The production data come from the Miller-Schmitt Chilean Corpus[7] which consists of approximately 260 hours of spontaneous speech between Chilean adult caregivers and their children. Because transcription and coding efforts are still underway, for the present paper, we present the production data of 5 caregivers. Adult speakers were caregivers of children ages 2;05, 3;04, 3;10, 5;04, and 5;09 and they were recorded while speaking to their children.

Two research assistants coded the 2sg verb affixes /-s/ in the mothers' speech for pronunciation as [-s], [-h], or zero (omission). Only verbs that were followed by a pause, voiceless plosive, or nasal were analyzed, as these phonological contexts facilitate perceptual coding. Additionally, using the same criteria, the plural marker /-s/ on determiners, nouns, and adjectives was also coded for comparison. It should be noted that, while a segmental coding system was used (i.e. tokens were coded as three discrete pronunciations: [-s], [-h], or omission) and is the procedure used in most studies on Spanish /s/ lenition, in reality the /s/ lenition represents a continuum (see File-Muriel and Brown, 2010, 2011; Erker, 2012).

Both coders participated in 4 training sessions that lasted approximately 1 hours each session. Sessions occurred over a two-week period. After training, the research assistants coded the data and then discussed between themselves any differences in coding in order to resolve any disagreements. They initially coded 77% (583/753) of the tokens in exactly the same way. After discussing their disagreements (170/753), they came to an agreement on 745 tokens (370 tokens of the plural marker and 375 tokens of the 2sg verbal marker) but could not come to an agreement on 8 of the 753 tokens. These 8 tokens were not included in the final analysis. Table 3 shows the overall production of the 2sg affix and the plural marker in caregiver speech.

Table 3 indicates that in Chilean Spanish the 2sg verbal affix /-s/ is omitted at about the same rate as the plural marker [-s] in the noun phrase. However, Miller (2013b) finds that omissions of the nominal plural marker /-s/ are slightly more frequent (occurring 58% of the time; $N = 440$ tokens) than omissions of the 2sg verb affix /-s/ (occurring 41% of the time; $N = 192$ tokens), a difference that may be due to differences in coding procedures; Miller coded final /s/ in additional phonological contexts that were not coded for in the present study. This suggests that the 2sg verbal inflection -s occurs as much or slightly more often in the input to Chilean children than the plural marker -s.

A closer look at the data reveals differences in the variant used depending on the syntactic category to which the marker is attached. This is illustrated in Table 4 for the plural marker and in Table 5 for the verbal affix.

The differences in the rates of omission depending on word class may lead to very different predictions for nominal plural morphology but this is not the case for 2sg -s where rates of omission are the same for both main verbs and auxiliary verbs. In addition, it is also important to note that plural nouns occur much less often than singular nouns in the input to children. In fact, plural nouns constitute less than 15% of all nouns produced. However, verbs in Spanish are always

[7] The Miller-Schmitt Chilean Corpus (NSF # BCS-1061805, # BCS-0746089) was collected in 2008 and 2009 in Punta Arenas, Chile (see Miller, 2013b, for more details).

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Table 3
Percentage of variants for 2sg marker and plural marker in child directed speech.

	2sg marker			Plural marker		
	[s]	[h]	Omission	[s]	[h]	Omission
M	23	34	42	22	42	35
N	88	130	157	82	157	131

Table 4
Percentage of variants for plural marker in child directed speech.

	Determiner			Noun			Adjective		
	[s]	[h]	Zero	[s]	[h]	Zero	[s]	[h]	Zero
M	9	71	20	32	27	42	21	8	71
N	12	102	29	64	54	85	5	2	17

Table 5
Percentage of variants for verbal affix in child directed speech.

	Main verb			Auxiliary verb		
	[s]	[h]	Zero	[s]	[h]	Zero
M	28	32	40	10	44	46
N	78	90	114	9	40	41

inflected. This means that there is substantial evidence for verbal agreement in the input to children and this may play an important role in children's ability to use verbal morphology in Spanish when compared to noun phrase morphology.

5.2. Experimental study on the 2SG verbal affix

The goal of Experiment 3 is to determine whether variable input for the 2sg affix affects children's use of the 2sg and 3sg affixes in comprehension tasks. In Chilean Spanish the 2sg affix is variably omitted due to /s/ lenition while in Mexican Spanish (of Mexico City) no such lenition process occurs. Testing children acquiring both varieties allows us to determine whether variable input affects acquisition of these verbal inflections.

5.2.1. Design and procedure

The procedure for Experiment 3 is similar to that in Experiment 1, except that the 2sg form of the verb was also tested. Children were presented with a puppet and three dolls and were told that the dolls were of a child and his parents. A puppet whispered a command to the research assistant who then repeated the sentence to the child. Children were instructed to listen to the researcher's instructions and carry out the action themselves, on the child-doll, or on the parent-dolls.

There were three forms of the verb that were tested: 2sg, 3sg, and 3pl. A sample trial from each condition is shown in (10).

(10) a. Pepe quiere que saltes
Pepe wants that jump-2SG
'Pepe wants you to jump'

b. Pepe quiere que salten
Pepe wants that jump-3PL
'Pepe wants them to jump'

c. Pepe quiere que salte
Pepe wants that jump-3SG
'Pepe wants him to jump'

There were four response types: (1) the child performed the action him/herself, (2) s/he made the child-doll perform the action, (3) s/he made the parent-dolls perform the action, or (4) s/he made both the parent-dolls and child-doll perform the

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action. Upon hearing a 2sg form of the verb in (10a), we expected that participants would perform the action themselves. Upon hearing (10b) or (10c), we expected that participants would move the parent-dolls (or all of the dolls) or the child-doll (or any singular doll), respectively. However, it should be noted that (10c) is also consistent with a 2sg interpretation if the child assumes that the researcher is omitting the 2sg marker /-s/ because of the phonological process of syllable final /s/ lenition. Children were tested by native Spanish-speaking researchers who were from the same local area as the children. Researchers were instructed to pronounce the 2sg marker as [-s]. A sample experimental trial is presented in (11).

(11) Research Assistant: *Este es Pepe (point to the puppet). Este es un niño (point to child doll) y ellos son sus padres (point to parent dolls). Pepe me va a decir al oído lo que él quiere que tú hagas o lo que él quiere que este niño haga o lo que él quiere que los padres hagan. Escucha muy bien y haz saltar or bailar a la persona que Pepe dice.* This is Pepe (point to the puppet). This is a child (point to the child doll) and these are his parents (point to the parent dolls). Pepe is going to tell me in my ear what he wants you to do and what he wants this child doll to do and what he wants the parents to do. You need to listen carefully and make the right person jump or dance just as Pepe says.

Research Assistant: *¿A ver, Pepe?* (Pepe whispers in researcher's ear) Let's see Pepe.
Research Assistant: *Pepe quiere que salte/s/n.* Pepe wants him/you/them to jump.

A within-subjects design was used such that the same children were tested in three different sessions. In the first session, children were tested on the 3sg inflection only, followed by the 3pl in the second session, and the 2sg in the final session. The three sessions occurred on three different days within a two-week period. Each session contained 4 target trials only. The same four verbs were used in each session. These verbs were *saltar* 'jump', *dibujar* 'draw', *dormir* 'sleep', *aplaudir* 'clap'.

5.2.2. Results and discussion

Sixteen Chilean children (3;06–5;09, Mean: 4;08) participated in this study. One Chilean child was removed from the study because s/he did not complete all of the 3 sessions, leaving fifteen Chilean children. In addition, twelve Mexican children (3;04–5;01, Mean: 4;06) were also tested for comparison.

A one-sample *t*-test comparison with chance performance (chance = 33% because there were three response types: 2sg, 3sg, and 3pl) revealed that Chilean children were more accurate than chance in the third plural condition ($t(14) = 4.528$, $p < .001$), in the second singular condition ($t(14) = 7.307$, $p < .001$), and in the third singular condition ($t(14) = 2.704$, $p < .05$). On the other hand, Mexican children were only above chance in accuracy in the third plural condition ($t(11) = 6.498$, $p < .001$) and the second singular condition ($t(11) = 13.766$, $p < .001$), but not in the third singular condition, where they showed at chance behavior ($t(11) = .449$, $p = .662$).

Following procedures used in Experiments 1 and 2, we carried out three analyses that examined children's accuracy, bias, and sensitivity. Bias refers to whether there was a tendency to choose a third singular subject (e.g. child-doll), a third plural subject (e.g. parent-dolls or parent-dolls and child-doll), or a second singular subject (e.g. child does action him/herself) across all conditions. Because there are four trials and three conditions, the range is from 0 to 12. Sensitivity is the proportion of times children chose the subject matching the spoken stimulus over the proportion of times they chose that subject in the third plural + third singular + second singular target conditions combined. The results are shown in Table 6

To determine whether children were sensitive or not to the verbal affixes 'sensitivity' was compared to chance behavior (33%). The results revealed that Chilean children were sensitive in the third plural condition ($t(14) = 2.445$, $p < .05$) and the second singular condition ($t(14) = 3.109$, $p < .01$) but were at chance in the third singular condition ($t(14) = -.100$, $p = .922$). On the other hand, Mexican children performed above chance only in the second singular condition ($t(11) = 11.060$, $p < .001$) but not in the third plural condition ($t(11) = 1.684$, $p = .120$) nor the third singular condition ($t(11) = -1.978$, $p = .074$).

One explanation for low performance on the 3sg form in both Chilean and Mexican children could be related to the 2sg polite form of address *usted*. Although *usted* is functionally a second person pronoun, formally it is a third person pronoun and agrees with verbs inflected for third person. In Experiment 3 one of the possible responses was for the participant to carry out the action him/herself. It may be that children interpreted the 3sg form of the verb as having a null subject *usted*.[8] This is not true for Experiment 1 as the 2sg response was not an option given to children. To address this possibility, we report the error types in Table 7.

[8] It should be noted the research assistant always addressed children with the pronoun *tú* and the 2sg form of the verb during the instructions preceding the target prompts.

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Table 6
Accuracy, response bias, and sensitivity in children for Experiment 3.

	N	Accuracy			Bias (out of 12)			Sensitivity (out of 1)		
		3sg	2sg	3pl	3sg	2sg	3pl	3sg	2sg	3pl
Chilean	15	42*	80***	63***	3.9	5.3	2.8	.32	.63**	.63*
M = 4;08; R = 3;06–5;09		(49)	(42)	(47)	(2.5)	(2.9)	(2.3)	(.39)	(.37)	(.48)
Mexican	12	10	88***	73***	1.7	3.8	6.5	.16	.94***	.40
M = 4;06; R = 3;04–5;01		(17)	(20)	(35)	(1.9)	(.9)	(2.0)	(.30)	(.19)	(.15)

Note: Scores are compared to chance behavior (33%).
* Significant at the $p < .05$ level.
** Significant at the $p < .01$ level.
*** Significant at the $p < .001$ level.
M = Mean Age; *R* = Age Range; SD in parentheses.

Table 7
Percent error types for each condition in Experiment 3.

	3rd singular condition	2nd singular condition	3rd plural condition
Chilean children			
Single doll	(42)	13	0
Plural dolls	7	7	(63)
Child	51	(80)	37
Mexican children			
Single doll	(10)	6	23
Plural dolls	85	6	(73)
Child	5	(88)	4

Note. Percentages in parentheses indicate the target/correct response. All other percentages (not in parentheses) were considered errors in children's responses.

The data presented in Table 7 indicate that Chilean Spanish-speaking children – but not Mexican Spanish-speaking children – overwhelmingly provide a 2sg response (i.e. carried out the action themselves) when presented with the 3sg form of the verb.

This difference in error-type does not support the idea that children interpreted the 3sg form as linked to an *usted* null subject since only the Chilean children, but not the Mexican children, showed this pattern. Since *usted* occurs with 3rd singular verbs in both varieties, the expectation is that both groups would show this pattern of behavior.[9] Instead, a more feasible explanation is that the variable input to Chilean children is affecting their interpretation of the 3sg form. Chilean children – but not Mexican children – are exposed to an input where the 2sg affix /-s/ is sometimes omitted, as illustrated in (12). This results in an input where the 3sg and 2sg forms sometimes overlap. As such, it appears that Chilean children, but not Mexican children, sometimes infer a 2sg subject even when the 2sg -s is omitted.

			Possible Pronunciations
(12)	a.	Tú vas primero you go-2SG first 'You go first'	va[s], va[h], va
	b.	Ella va después she go-3sg next 'She goes next'	va

Mexican children show a different pattern for the 3sg form of the verb in that they overwhelmingly infer a plural subject (85% of the time). This may indicate that Mexican children have not yet acquired the use of the 3pl affix in comprehension

[9] It should be noted that it is not common to use the *usted* form to address children in Mexican Spanish (confirmed through personal communication with Antoinette Hawayek) or in Chilean Spanish. In fact, this is not found in our corpus data. However, in some varieties of Spanish adult speakers address children with the *usted* form and it is also sometimes used with children in story-books.

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and instead are showing a response bias for plural subjects. It is not clear why Chilean children outperform Mexican children on the 3pl affix. However, it may be that this difference is due to the fact that the Chilean children were slightly older than the Mexican children in Experiment 3.

6. Discussion and conclusion

This paper set out to answer the following questions.

i. Does the richness of verbal morphology and the presence of null subjects in Spanish impact children's ability to use the verbal affix in offline tasks measuring comprehension?
ii. Does variable input (due to sociolinguistic variation) for the 2sg marker in Chilean Spanish affect acquisition?

The answer to the first question depends on the affix being tested. For the 4-year-old Spanish-speaking children, performance was above chance only on the 2sg affix. With respect to the 3sg and 3pl forms of the verb, past work has indicated that 4-year-old English-speaking children are unable to use verbal inflection to interpret number on subject noun phrase. We suggested that this finding may be related to the less robust verbal morphology of English and that by testing Spanish-speaking children we could address this question more directly. The results of the present study on Spanish-speaking children, however, suggest that rich verbal morphology or the availability of null subjects in the target language does not increase children's ability to use in comprehension the 3sg and 3pl forms of the verb. In both Experiments 1 and 3 Spanish-speaking children performed at chance on their interpretation of 3sg and 3pl verbs occurring with null subjects. We believe that the better performance on the 3pl form in Experiment 3 by Chilean children is related to the fact that those children were older.

However, if Spanish-speaking children are unable to use 3sg and 3pl verbal inflection in comprehension, why do Chilean children show better performance in Experiment 2 when an overt subject is paired with a 3sg or 3pl inflected verb, than when they are tested only on plural and singular subject noun phrases as in Miller (2007)? We suggest that multiple, redundant markings may increase performance by providing cumulative evidence for a plural or singular subject. Similar findings have been reported for younger English-speaking children (Kouider et al., 2006). While plural morphology on the subject noun phrase alone may be a weak cue to nominal number in Chilean Spanish because number morphology is variably produced in the input (and hence arguably less reliable for interpreting number on the subject noun phrase), it may be the case that when paired with an inflected verb, it becomes a more reliable cue. In this sense, it is the combination of the plural marker and the agreeing verb that allows children to perform at higher levels in Experiment 2.

Nevertheless, the results of Experiment 2 differ from those reported for Dominican Spanish-speaking children. Pérez-Leroux (2005) found that Dominican Spanish-speaking children of the same age were at chance in their interpretation of overt subjects occurring with agreeing verbs. For these children the presence of multiple redundant cues was not helpful in increasing performance. While the difference in results could be due to methodological differences, it is also possible that the difference in results arises from dialectal differences between Chilean Spanish and Dominican Spanish. In particular, Dominican Spanish-speakers omit the plural marker in the noun phrase, as in Chilean Spanish, and in addition, they show variable omission of the third plural verbal affix /-n/, producing instead a nasalized vowel (e.g. *canta* 'sing-sg' [kantan] alternates with [kantã]) (Toribio, 2000). However, variable production of final /n/ is not found in Mexican and Chilean Spanish. As such, we would like to suggest that the variable production of the plural marker in the noun phrase and of verbal affix /-n/ may make both of them weak cues in Dominican Spanish, which may account for the differences found in performance. This suggestion is directly related to the second research question.

The second question that we set out to address is whether variable input for verbal morphology affects acquisition in children. The answer to this question appears to be yes in that we found that Chilean children did not reach the same level of performance on the 2sg affix as Mexican Spanish-speaking children. Nevertheless, it still appears that Chilean children perform better on the 2sg verbal affix than they do on the plural marker in the noun phrase (as shown in past work by Miller, 2007; Miller and Schmitt, 2009, 2012). The difference between the 2sg affix and nominal plural marker may be related to how the variability affects the evidence in the input for constructing a grammar with plural morphology in the noun phrase or verbal morphology. In the case of plural morphology, deciding whether the target language has grammatical number encoded in the noun phrase requires attention to the distribution of /-s/ on either the determiner or the noun. Because elements inside the plural noun phrase sometimes occur with a plural marker (either /-s/ or /-h/) and sometimes occur without a plural marker (omission) and because the distribution of the plural marker varies (sometimes it occurs on the noun, sometimes on the determiner, sometimes on the quantifier, or sometimes omitted on all elements in the noun phrase), there is evidence both for and against encoding grammatical number in the noun phrase. As such, Chilean children may take longer to acquire plural morphology than children exposed to consistent input.

The effect of variable input on acquisition for the verbal affix /-s/ in Chilean Spanish may be different. Because the 2sg affix is part of a larger verbal paradigm, the learner can still determine that both second person features and number

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features are encoded in the verbal domain, even when the 2sg affix /-s/ is omitted variably. This is because Spanish verbs are inflected for second person and singular/plural independently of the 2sg verbal form. In particular, Spanish has a 2pl form of the verb and both 1sg/1pl and 3sg/3pl forms of the verb that do not show reduction of the morphophonological forms. For this reason, Chilean children may determine early in development what features are encoded in the verbal domain (even if they are unable to use them in comprehension tasks early on). We attribute lower performance on the 2sg affix to the fact that it is not a reliable cue in comprehension as it is variably produced. As such, Chilean children rely less on this marker than Mexican children, who are exposed to consistent input.

In conclusion, by examining comprehension of verbal agreement in languages with rich verbal morphology and null subjects, like Spanish, we have provided further evidence that agreement is difficult for children to use in comprehension before 5 years of age, regardless of the language they are acquiring. Moreover, by adding the component of variable vs. consistent input to the experimental paradigm, we find that variability in the input due to sociolinguistic variation results in differences in performance on the experimental tasks, a finding that indicates that variable input affects acquisition.

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