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Variable Input and the Acquisition of Plural Morphology

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The present article examines the effect of variable input on the acquisition of plural morphology in two varieties of Spanish: Chilean Spanish, where the plural marker is sometimes omitted due to a phonological process of syllable final /s/ lenition, and Mexican Spanish (of Mexico City), with no such lenition process. The goal of the study is to determine whether variable input for grammatical morphology affects the acquisition process. Does the ambiguous nature (sometimes present and sometimes absent) of a form affect acquisition? To address this question, Experiment 1 examines the production of the plural marker in Chilean- and Mexican Spanish-speaking children, and Experiments 2 and 3 examine children's use of plural and singular indefinite noun phrases in comprehension. The results indicate that variable input affects acquisition, with Chilean children taking longer to acquire the plural marker than Mexican children.

1. INTRODUCTION

Although there is an important connection between language acquisition, sociolinguistic variation, and language change (Labov 1994; Lightfoot 1999; Lightfoot & Westergaard 2007), most language acquisition research has focused on the acquisition of invariant categorical properties of particular linguistic systems and not on variable rules. The comparatively few studies on the acquisition of variable input focus mainly on how and when children acquire the adult-like variability and not when the categorical components associated to the variable rules are acquired (Roberts 1994, 1997; Smith, Durham & Fortune 2007, 2009). In fact, there is virtually no acquisition work examining the effect of variable rules in the acquisition of categorical properties of the linguistic system.

In principle, there is nothing wrong with this methodological split. However, the fact is that children must learn how to extract categorical properties of the system they are acquiring from an input that is sometimes simultaneously the output of sociolinguistic variable rules, which may have masked the underlying categorical component of the rules.

In this article, we examine the role of variable input in the acquisition of grammatical morphology. In particular, we ask what impact sociolinguistic variation has on children's production and comprehension of grammatical morphology. To answer this question we focus on the acquisition of plural morphology in two varieties of Spanish: Chilean Spanish and Mexican Spanish. In Chilean Spanish, the plural /-s/ is sometimes produced and sometimes omitted due to a phonological process that variably weakens syllable-final /s/. In Mexican Spanish, no such variability exists, and the plural /-s/ is categorically produced. To experimentally compare the acquisition of a particular property by children exposed to language varieties that differ with respect to sociolinguistic variation is a novel experimental paradigm. This allows us to keep the linguistic property under examination and the experimental procedures constant across subject groups and to measure the effect of naturally occurring variation in a controlled way.

Sociolinguistic variation (Labov 1969) is a pervasive feature in natural language. It involves the use of alternative forms in the same linguistic environment to express the same meaning.¹ The use of the variant forms is not random but determined probabilistically by both linguistic factors (e.g., phonological context, syntactic category, or position) and extra-linguistic factors (e.g., speech style, social class). Importantly, each of these factors cannot by itself predict the rate of use of a particular variant: each factor can only favor or disfavor a particular variant. The overall frequencies of the different forms, both within and across speakers, are the result of a complex interaction among various factors. If the learner recognizes only a subset of the factors that play a role in accounting for the variability, she may have a difficult time identifying what favors and disfavors the rule. In other words, the input may be perceived as less transparent and noisier than it actually is, and misanalyses due to apparent inconsistencies may be sustained for longer periods of time, delaying acquisition of both categorical and noncategorical properties.

The extensive work focusing on the effects of input frequency has not focused on variable input. Instead, overall frequency rates for particular categorical/discrete properties of the input have been examined and correlated with rate of acquisition or the tendency to overregularize the input. The picture that emerges from these studies is quite mixed and suggests that the role of input frequencies is more complex than an intuitive perspective could predict: sometimes what is most frequent in the input is acquired earlier but sometimes it is not (Klecha et al. 2008; Anderssen & Westergaard 2010). In the same way, it is now quite clear that overall frequencies cannot always predict the form that children will overregularize to (Marcus et al. 1992; Marcus et al. 1995; Marcus 2000).

To better understand the relation between input frequencies and grammar acquisition, we may need to use more fine-grained measures for frequencies, such as type frequency (in addition to token frequency) (Marcus et al. 1995; Bybee 2007); frequency of only subsets of the input data (for example, frequency of unambiguous data for parameter setting) (Legate & Yang 2002; Yang & Legate 2007; Pearl & Lidz 2009); frequencies in child-directed speech vs. adult-directed speech

¹Sociolinguistic variation should not be confused with the variability that is inherent in any linguistic system in use, such as, for example, variation in the use of argument structure frames discussed by Gahl & Garnsey (2004). As Newmeyer (2006) points out, differences in argument structure reflect differences in meaning. The choice of a particular sociolinguistic form does not affect the semantics of an expression, although a particular choice may allow an inference on the social status, education level, ethnic background of a speaker, etc.

(Gleitman et al. 1988; Cameron-Faulkner, Lieven & Tomasello 2003) and/or frequencies within different extra-linguistic contexts (Smith, Durham & Fortune 2009).

Studies focusing on the impact of noncategorical/variable input on the acquisition of grammatical morphology are rare. However, in recent years, studies using artificial languages have tested children's ability to handle inconsistent input. Inconsistent input is arguably similar to that produced by nonnative speaking parents to their children. What has emerged from these studies is that children tend to regularize the inconsistencies they are confronted with (Hudson Kam & Newport 2005, 2009). For example, Hudson Kam & Newport (2005) taught children an artificial language and then presented them with an input for that language that showed either consistent use of the determiner (i.e., nouns occurred with the same determiner 100% of the time) or inconsistent use (i.e., nouns occurred with different determiners at different frequencies). Children seem to regularize the language as they acquire it and do not generally produce the different forms variably (see also Singleton & Newport [2004]). Similar findings, reminiscent of this, have been shown in the emergence of new languages, where learners change their pidgin input, showing less unpredictability in their usage of the language than their late-learning models (Sankoff 1979; Romaine & Wright 1987; Sankoff 1994; Senghas 1995; Jourdan & Keesing 1997). However, one drawback of this research, as noted by Hudson Kam & Newport, is that inconsistent input is unusual and not typically found in the input to children.

In this article, we follow the spirit of Hudson Kam & Newport's work aiming at understanding the effect of input consistency in the acquisition of grammatical morphology, but we do that in a natural setting with variation being the result of the work of variable rules and not the result of an experimental manipulation of the input. It is possible that an input with sociolinguistic type variation may initially contain much higher levels of ambiguity than a homogeneous and categorical input and therefore may cause acquisition to happen at a slower pace than occurs when a learner is exposed to a less homogeneous input.

What we know from how and when children acquire variable rules is very little, as the research in this area is still quite small. There seems to be an ordering in the acquisition of variable rules, with phonological constraints being acquired before grammatical constraints and extra-linguistic constraints, and some work shows, much like the study with artificial languages, an initial regularization of forms (Roberts 1994; Smith, Durham & Fortune 2009) and/or a reanalysis of the input data (Henry 1997). Furthermore, at least for some phenomena, social constraints are learned late, sometimes as late as seven years of age (Miller 2007), which suggests that children do not have complete knowledge of the constraints governing the use of the variant forms when they are making decisions about the grammatical morphology at play in the target language. Importantly, but not surprisingly, variable rules start to be acquired at the same time as categorical rules (Smith, Durham & Fortune 2009). After all, the child must use the input she is given, and there is no way to determine a priori which patterns in the input reflect constraints on language use and which parts reflect the categorical properties of the grammar.²

²As pointed out by a reviewer, a strict separation between categorical properties of the grammar and usage (probabilities and frequencies of particular forms) is not accepted unanimously by researchers. In this article, we will remain agnostic as to what the exact representation of the variants is and how/where the probabilistic properties should be encoded (see Nevins & Parrott [2007]; Parrott [2007]) for a view in which some agreement variation can be accounted for by impoverishment rules applying probabilistically. For an alternative view in which the distribution of the forms follows from the structure of the lexicon, see Adger & Smith 2005). Ultimately, acquisition of morphology involves the acquisition of both the categorical properties and also their distributional/variable properties.

Not all work on the acquisition of sociolinguistic variation, however, points toward a stage of regularization of the input. Smith, Durham & Fortune's (2007) work suggests that children do not overregularize sociolinguistically variable input, at least in production of 3rd-person singular morphology in a dialect of English. It seems that from the beginning they know the categorical syntactic constraints for 3rd-person singular (obligatory cases) and also in which cases there can be variation (see also Westergaard [2003, 2008]). Could the attempt to regularize the input arise in contexts of sociolinguistic variation if the forms never appear categorically in the input?

In Chilean Spanish, children are exposed to variable input for plural morphology, and these children will constitute our test case. Unlike the case studied by Smith, Durham & Fortune (2007), in Chilean Spanish there is no context in which [-s] is categorically produced. Instead, what we have is variability in the rates of plural marker omission across all contexts. Working-class Chilean speakers omit the plural marker more often than middle-class speakers, and this causes the input to working-class Chilean children to include more omissions than the input to middle-class children, allowing us also to examine the effect of frequency, within the context of variable input, on language acquisition.

Mexican Spanish (Mexico City), on the other hand, constitutes our control case, since it has a consistent input for plural morphology independent of social class, as plural marker omissions do not exist in this variety of Spanish. Given this context, we start small by asking the following two research questions:

- (i) Does variable input for plural morphology affect children's ability to associate the plural marker to an interpretation of "more than one"?
- (ii) In the context of variable input, what role does frequency play?

Our article is set up as follows: in Section 2 we lay out the contexts of variable vs. consistent input and provide an overview of adult production of plural morphology in Chilean and Mexican Spanish, respectively. In Section 3, we review previous research on the acquisition of plural morphology and on the acquisition of variable input. In Sections 4, 5, and 6 we show through experimental data that variability involving a zero form affects acquisition of plural morphology. Section 7 addresses the broader issue of how research investigating the acquisition of variable input provides a window for understanding language acquisition more generally.

2. THE LINGUISTIC BACKGROUND

In this section, we discuss the characterizing properties of the two varieties of Spanish in light of what we take to be the learner's acquisition task. In general terms, the acquisition of any piece of morphology requires a mapping between form and meaning. On the one hand, the learner must associate a form (or forms) in the input to a syntactic feature (or bundle of features), and, on the other hand, the learner must associate this syntactic feature (or set of features) to an interpretation (i.e., semantic feature/s). The task appears daunting, as the correspondence between form and meaning is not always one-to-one,³ and there may be forms in the input that are not

³For example, pluralia tantum terms (such as *scissors*, *pants*, and *glasses*) trigger plural agreement yet are semantically singular.

the spell-out of an interpretable feature at all but rather exist because of a morpho-phonological requirement. One goal of language acquisition research is to determine the extent to which the input provides evidence for the mappings between form and meaning that children must acquire and how that might affect their acquisition of the target grammar. We can address this question for plural morphology by examining its distribution in the adult grammar.

Languages vary as to whether they mark number grammatically or not (Mithun 1999; Corbett 2000). Thus, the first step of acquiring plural morphology is to determine whether the target language has grammaticalized number (as in English and Spanish) or not (as in Mandarin, Halkomelem Salish, Japanese, and Korean) (Corbett 2000; Wiltschko 2008). When number is not grammaticalized, it is not required for grammatical processes such as agreement, and the interpretation of noun phrases with respect to number depends on other sources of information. In such languages, pluralities can be distinguished by a variety of noninflectional expressions that crucially are not obligatory for a plural interpretation of a noun phrase.⁴

As noted above, the acquisition of plural morphology requires mapping a form in the input (e.g., /-s/) to an interpretation (e.g., pluralities), and this mapping involves several components. First, the learner must observe co-occurrences between different forms in the input. Specifically for the Spanish case, the learner must note that nouns, determiners, and adjectives occur both with and without a final /s/ (which is the most common form associated to the plural).⁵ Starting with nouns, once the learner realizes that a noun marked with /s/ is compositional (i.e., made up of a noun plus a grammatical morpheme /-s/), she must decide exactly which morpho-syntactic feature is related to the presence vs. absence of that form (whether it is number, gender, case, for example). Assuming she determines that it is number, she needs to decide which form(s) are associated to singular and which are associated to plural (assuming a system without dual) and whether number morphology obligatorily triggers overt agreement within the noun phrase or not (i.e., whether she is acquiring a language such as English or Spanish). Furthermore, since the meaning of particular morphemes is part of the knowledge of speakers, the learner must map the syntactic features (in this case, [PL]) to some interpretation (pluralities), whenever necessary.

The interpretation of plurals is a very complex issue. Plural morphology on bare nominals behaves differently than plural morphology in DPs with overt determiners. While Spanish bare plurals, much like bare plurals in English, receive a weak plural interpretation (“at least one”)

⁴These “pluralizers” however have a very complex distribution, tend to be truly optional, and when present, they impose very tight and still ill-understood discourse restrictions. Acquisition wise, they tend to be acquired very slowly, much like infrequent classifiers are learned (Munn, Zhang, & Schmitt 2009; Nakano, Park, & Schmitt 2010).

⁵As pointed out by a reviewer, the principle of contrast (Clark 1987) may help the learner determine that in a language such as English there is a systematic contrast *dog* and *dogs*, and therefore they must have different interpretations, while in Chilean Spanish such a contrast may not be as obvious because plural nouns (variably) and singular nouns (consistently) both occur with zero marking. However, the contrast between forms like *perro* (dog-SG) and *perros* (dog-PL) is arguably just as systematic in Chilean Spanish as in English. Both forms (*perros* v. *perro*) occur in the input. We should therefore predict that, given the principle of contrast, children would attempt to associate different interpretations to them. However, a consistent contrast in the input between marked and unmarked nouns is not enough to determine that [s] is plural and [] singular, or to determine that number morphology is obligatory, even in a language with categorical marking. In Mandarin and Japanese, there is also a distinction between noun phrases with and without a pluralizer, but noun phrases without a pluralizer are not necessarily interpreted as singular.

(Laca 1996; Lois 1996; Martí 2008), the plural marker /-s/ on plural indefinite noun phrases headed by *unos/unas* (some-M-PL/some-F-PL) has a strong plural (“more than one”) interpretation. The examples below, adapted from Martí (2008), illustrate the weak and the strong readings:

- (1) a. John: Viste niños jugando en el patio?
Saw-2SG children playing in the garden?
‘Did you see children playing in the garden?’
Mary: Sí, vi uno. / #No, vi uno solo.
Yes, saw-1SG one. / #No, saw-1SG one only.
‘Yes, I saw one. / #No, I saw only one.’
- b. John: Viste a unos niños jugando en el patio?
Saw-2SG ACC some-UNOS children playing in the garden?
‘Did you see some-UNOS children playing in the patio?’
Mary: #Sí, vi uno. / No, vi uno solo.
‘#Yes, I saw one/ No, I saw only one.’

While *unos* forces a “more than one” interpretation of the noun phrase in (1b), the plural marker on the bare plural in a question (1a) has a weaker interpretation. For the purpose of this article, we examine whether children have acquired the strong plural interpretation associated to plural morphology on indefinite noun phrases. In other words, we ask whether they associate plural indefinite noun phrases to an interpretation of “more than one.”⁶

Chilean Spanish presents an interesting problem for the acquisition of plural morphology. That is because Chilean Spanish is subject to a phonological process of syllable final /s/ lenition that reduces all syllable final /s/ to an aspiration or to an omission (Lipski 1994).⁷ Because this phonological process affects the production of morphological /-s/, Chilean children are exposed to an input where the morphological form /-s/ is sometimes absent and sometimes present on plural nouns, determiners, and/or adjectives. When the plural marker is absent on noun phrases that are interpreted as plural, we have evidence against mapping /-s/ to number. Information about number is then expressed in some other way, by quantifiers or cardinal numbers, for example.⁸

⁶This will become important when we examine cases of production of bare plurals in Experiment 1. Clearly, as already has been noted by Carlson (1977), the bare plural is not simply the counterpart of the singular indefinite.

⁷Lenition appears in parts of Spain and is common in Latin American Spanish (except for the interior highlands of Mexico, Bolivia and Peru, and Central America) (Canfield 1982; Lipski 1994). The beginnings of /s/ lenition are difficult to determine but they appear to date back at least to the 16th century (Terrell 1981; Lipski 1985) and were first reported for Chilean Spanish around the 19th century (Cepeda 1995). Lipski (1985) suggests that /s/ lenition may have been inherited from Latin, as evidenced by parallel developments in French several centuries earlier.

⁸We make a distinction between grammatical number and quantity information, following Borer (2005) and references therein. Number morphology provides a distinction between singular and plural, which is not the result of a counting operation. Cardinal numbers, quantifiers, and some indefinites, which may or may not carry number morphology as well, carry quantity information and are associated to counting, rather than parceling out. In a noun phrase with the indefinite (*unos/unas*), number morphology determines whether the noun phrase is singular or plural. In this case, the plural has a strong interpretation (“more than one”), contrasting with the weak interpretation of the bare plural. The role of plural morphology in noun phrases is part of a speaker’s knowledge of their native language and must be acquired.

Nevertheless, the input provides some evidence that in the Chilean (and Mexican) target grammar noun phrases carry an interpretable number feature as it triggers verbal agreement in both dialects, as illustrated in (2).

- (2) a. la vaca está comiendo
 the-FEM-SG cow-FEM-SG be-3SG eating
 b. las vacas están comiendo
 the-FEM-PL cows-FEM-PL be-3PL eating

Other evidence comes from the fact that in both dialects [PL] has two allomorphs: /-s/ and /-es/. These have a categorical distribution: /-s/ is affixed to nouns, adjectives and determiners that end in an unstressed vowel and /-es/ attaches to nouns that end in consonants and stressed vowels⁹ (see 3–6). Because the majority of Spanish nouns end with an unstressed vowel, /-s/ is the most common allomorph.

- (3) vaca vacas
 cow-FEM-SG cows-FEM-PL
 (4) gato gatos
 cat-MASC-SG cats-MASC-PL
 (5) ratón ratones
 rat-MASC-SG rats-MASC-PL
 (6) maní maníes
 peanut-MASC-SG peanuts-MASC-PL

When lenition reduces an underlying /s/ to zero, the plural and singular nouns overlap in form, as show in (7) and (8); however, this is not true for the allomorph /-es/, as the epenthetic [-e] could still be produced when final /s/ is omitted.¹⁰

Chilean Pronunciation of Plural Marker

- (7) vacas [bakas], [bakah], [baka]
 cows-FEM-PL
 (8) vaca [baka]
 cow-FEM-SG

It is very important to keep in mind that, while the /-s/ and /-es/ allomorphs have a categorical distribution, the distribution of the phonological variants [s], [-h], and zero is not categorical. Production of /s/ lenition varies both within individual speakers and across groups of speakers. Individual speakers tend to have more omissions in casual speech than in careful speech, and overall working-class adults tend to omit more than middle-class adults (Cepeda 1995; Miller 2007). Importantly, the division between working-class and middle-class speech correlates with the *frequency* of the omissions, not to whether omissions occur or not, nor to qualitative differences in the distribution of the omissions.

⁹There are a small number of exceptions to this rule that will not be discussed here.

¹⁰We will come back to this point since we can use the production of [-e] by child and adult speakers as evidence of lenition, but not as evidence of lack of plural morphology.

TABLE 1
Percentage of Plural Marker Production in Adult-Directed Speech

	[s]		[h]		∅	
	%	N	%	N	%	N
ChWC Adults	13	(34/257)	43	(110/257)	44	(113/257)
ChMC Adults	15	(95/646)	52	(338/646)	33	(213/646)
MexWC Adults	98	(425/433)	1	(5/433)	0.7	(3/433)
MexMC Adults	98	(332/338)	0.9	(3/338)	0.5	(3/338)

Adapted from Miller 2007.

Miller & Schmitt (2010) (see also Miller 2007) report the frequency of plural marker production as [-s], [-h] and zero¹¹ in adult-directed speech¹² (spontaneous speech of parents as they talked with a research assistant) by both working-class and middle-class Chilean speakers, which we present in Table 1.

In Spanish, all elements inside the noun phrase agree in number and gender. Therefore, omission of the plural marker on the noun does not always guarantee complete lack of number marking in the noun phrase, as the plural marker can occur on the determiner and not on the noun (9), similar to languages like French, and also on the noun and not on the determiner (10), similar to a language like English. Moreover, plural morphology can be completely absent, especially when the noun phrase is headed by a cardinal number or a quantifier, as shown in (11) and (12). Plural marking on the determiner is more common than marking only on the noun (Cepeda 1995).

Possible Pronunciations of Plural Marker

- (9) las vacas la[h] vac[0]/ la[s] vaca[0]
the-FEM-PL cows-FEM-PL
'the cows'
- (10) las chicas la[0] chica[h]/ la[0] chica[s]
the-FEM-PL girls-FEM-PL
'the girls'

¹¹Because there are so few instances of the [-es] allomorph in the data set, it was not treated separately.

¹²For ChWC, Child Directed Speech plural production appears to be slightly different. In a sample of 370 tokens from five adult speakers who were playing with their own children (children's age ranged from 2;05 to 5;09), we found 42.7% for [h], 22.2% for [s], and 35.1% for zero marking. As such, the percentage of [s] appears to increase while the percentage of zero marking decreases in Child Directed Speech (CDS) (see (Schmitt & Miller, 2012) when compared to Adult Directed Speech (ADS) production. This is to be expected for three reasons. First, lenition correlates with speech rate. The faster the speech, the more lenition (File-Muriel & Brown 2010), and CDS tends to be slower than ADS. Second, [s] is prevalent utterance final in comparison with [h], and CDS utterances tend to be shorter; therefore there are more utterance-final contexts per sample. Third, it is possible that adults speaking to children attempt to produce more "standard" forms (Foulkes, Docherty & Watt, 2005; Smith, Durham & Fortune 2007); and references therein). We also find that within CDS, mothers produce varying amounts of /s/ depending on speech style (e.g. scolding, playing, teaching, and puppet voice), with scolding showing a much higher level of omissions (50%), and puppet voice (e.g., the mother uses a puppet to talk with the child) showing production of [-s] up to 80% of the time (see Miller & Schmitt, 2012).

- (11) dos libros do[0] libro[0]
 two books-MASC-PL
 ‘two books’
- (12) hartos libros harto[0] libro[0]
 many-MASC-PL books-MASC-PL
 ‘many books’

While the examples in (9)–(12) illustrate that omission of the plural marker does not always result in a complete lack of number information inside the noun phrase, these examples also illustrate that /s/ lenition substantially weakens the evidence for agreement inside the noun phrase. In other words, because overt agreement inside the noun phrase is not a universal in language, but something to be learned, we cannot assume that agreement relations within the noun phrase will help Chilean children acquire plural morphology. In fact, this seems unlikely. The percentage of plural omissions on Chilean Spanish determiners and nouns, taken from data in Miller (2007), is presented in Table 2.

Table 2 also provides a division within determiners between the indefinite plural, the definite plural, and other determiners such as quantifiers and cardinal numbers, which inherently convey quantity information. Examples of the determiners are given in (13) with their singular counterpart, whenever possible.

- (13) a. el/un libro¹³ b. los/unos libros
 the-SG/a-SG book-SG the-PL/some-PL books-PL
- c. la/una niña d. las/unas niñas
 the-SG/a-SG girl-SG the-PL/some-PL girls-PL
- e. *mucha niña f. muchas niñas
 many-SG girl-SG many-PL girls-PL
- g. cada niña h. *cadas niñas
 each-SG girl-SG each-PL girls-PL

Table 2, which reflects adult-directed speech, shows that Chilean Spanish speakers omit the plural marker more often on nouns than on determiners, and that the level of omissions is higher in

TABLE 2
 Percentage of Omission of Plural Marker in the Noun Phrase in Adult-Directed Speech

	<i>Indef. Det. ‘unos’</i>	<i>Def. Det. ‘los’</i>	<i>Lexicalized Quantity Information¹</i>	<i>Noun</i>
ChWC Adults	0 (0/12)	34 (21/61)	38 (9/24)	52 (78/151)
ChMC Adults	19 (5/27)	14 (22/158)	29 (19/65)	39 (131/337)

Adapted from Miller 2007.

¹This label includes cardinal numbers and quantifiers whose lexical root (independent of plural morphology) guarantees a “more than one” interpretation.

¹³Although there is a difference between the singular and plural definite and indefinite masculine determiners beyond /-s/, we need to remember that *uno* and *lo* also appear in the input, as the pro-form for “one” and as the pronoun for 3rd-person masculine singular, respectively. Moreover, we have found that two- to three- year old Mexican children sometimes use *uno* (*uno elefante* ‘one-SG elephant-SG’) as the masculine indefinite determiner.

working-class than in middle-class speakers. Moreover, the data show that up to 52% of plural nouns do not carry number marking, a finding that suggests that noun phrases with number agreement occur less than 50% of the time in the input.¹⁴

Unlike Chilean Spanish, in Mexican Spanish no such syllable final /s/ lenition process takes place. The plural marker is consistently pronounced as /-s/ in both working-class and middle-class speech (Canfield 1982), which means that there is also strong evidence for number agreement inside the noun phrase.

If we go back to the acquisition task that was outlined above, we can say that in Mexican Spanish the systematic contrast between plural and singular forms guarantees that that number will be treated as obligatorily marked. Given that, children will quickly figure out that there is agreement/concord in the noun phrase, since it is impossible to treat each occurrence of /-s/ in the noun phrase (on the determiner, noun, and adjective) as an independent plural syntactically and semantically, since [PL] is interpreted only once within a DP.¹⁵ In Chilean Spanish, on the other hand, determining whether that number is obligatory will require more exposure to the input over time, as the input is arguably more complex. There are two types of misanalysis we can foresee for Chilean children that we do not expect for Mexican children:

- (i) Chilean children may not map the form /-s/ to [PL] and will instead rely on other sources of quantity information to determine whether the noun phrase refers to a plurality or not.
- (ii) Chilean children may map zero to [PL] (in cases where adults would not), if they have learned that zero marking can also be associated to pluralities.

3. ACQUISITION BACKGROUND

Slobin (1973) proposes that the earliest grammatical markers to be acquired should be those that express meaning consistent with the child's cognitive development. Recent work on the acquisition of plural morphology in English-speaking children support this proposal by showing that young toddlers begin using the plural marker in comprehension at 22 months of age, the age at which toddlers also start to succeed at nonlinguistic tests assessing their ability to distinguish "one" v. "more than one" (Barner et al. 2007; Wood, Kouider & Carey 2009). However, Slobin also notes that there is a point in which formal linguistic complexity also plays a role in acquisition. As an example, he reports that because of the complexity of Egyptian Arabic plural marking (most nouns take irregular forms of the plural, there is a special dual form, only numerals 3–10 take the noun in the plural while numerals above 11 take singular, etc.), it is one of the last grammatical morphemes to be mastered by children in that language (Omar 1973). These findings suggest that there is an interaction between input type and acquisition. In what follows, we will review the research on the acquisition of grammatical morphology, especially plural morphology, given different levels of complexity in the input.

¹⁴In the sample of child-directed speech with 370 tokens mentioned in footnote 12, we find that 42% of the nouns appear with no plural morphology, and 20% of determiners occur without plural morphology.

¹⁵For concreteness, we assume a syntax much like the one proposed by Zamparelli (2000). For simplicity we will continue to use [SG] and [PL] features, remaining agnostic to the semantic markedness status of [PL] (see Sauerland, Anderssen & Yatsushiro [2005] and Bale, Gagnon & Khanjian [2010] on alternative views as to the markedness status of [PL]).

For languages such as Spanish or English, where there is only one plural morpheme to be learned (/s/) and it is binary in form (/s/ v. zero), research has shown that children who are exposed to a consistent input associate the plural marker to an interpretation of “more than one” in both production and comprehension at a very early age (Brown 1973). In production, they begin producing the plural marker on semantically plural nouns, but not on singular nouns, by approximately two years of age (Cazden 1968; Mervis & Johnson 1991; Ferenz & Prasada 2002; Kvaal, Shipstead-Cox, Nevitt, Hodson & Launer, 1988; Marrero & Aguirre 2003; Zapf 2009). In comprehension, children can associate plural forms to an interpretation of “more than one” by at least three years of age (Kouider et al. 2006; Munn, Miller, & Schmitt 2006; Wood, Kouider & Carey 2009).

For languages such as German, which have a more complex inflectional system for marking plurality, children appear to take longer than English-speaking children in acquiring the forms of the plural marker (Laaha et al. 2006). Plural marking in German differs from English since it involves four overt plural suffixes (-s, -(e)n, -e, -er) and a zero form, in addition to stem alternations (umlaut of the last full vowel or diphthong), with no clear dominant form (Kopcke 1998; Laaha et al. 2006). Nevertheless, German children begin producing plural markers by the second year of life (Behrens 2001; Szagun 2001); however, they aren’t adult-like in their usage of the variant forms, even at five years of age (Laaha et al. 2006; Kauschke, Kurth & Domahs 2011).

The main difference between the input to German children and the input to Chilean children is that in the former, the use of the plural marker with a particular noun (or set of nouns) is categorical and consistent. In other words, German adult speakers *always* produce a particular form of the plural morpheme with the same set of nouns. This is not the case in the context of Chilean Spanish, where the same noun phrase, which has a feature [PL] (e.g., *perros* ‘dog-PL’), can occur with or without a plural marker, depending on social contexts, such as the speech style and the gender of the speaker. While it may turn out that the acquisition of plural morphology in Chilean Spanish shows similar delays to that in German, it is important to understand that the input for plural morphology, while arguably complex in both languages, is nonetheless quite different. In German it is categorical, while in Chilean Spanish it is variable.

As we said before, there is very little work on the acquisition of variable input. The existing studies have focused on how children acquire variation in their own speech; however, as far as we know, research examining the effect of variable input on children’s acquisition of grammatical morphology is nonexistent. Roberts (1997) and Smith, Durham & Fortune (2009) have addressed the first question, and their findings suggest that there is an order in which variable rules are acquired: phonological constraints are acquired before grammatical and social constraints (but see Labov [1989]).

However, Smith, Durham & Fortune’s (2009) data also speak to the second question, as their study indicates that the acquisition of variable rules and grammatical morphology occurs simultaneously.¹⁶ If this is the case, then until the acquisition of the variable rules is complete, the variation in the input could influence children’s initial hypotheses about the target grammar. In particular, variation in the input may initially mask the underlying categorical component of the categorical rules.

¹⁶See also Henry (1997) and, to a certain extent, Foulkes, Docherty & Watt (2005).

It is very difficult to ascertain whether children's early nontarget behavior is related to not having yet learned the categorical rules or to not having yet learned the variable rules by only looking at production. Smith, Durham & Fortune (2009) found that three-year-old children, while showing indications of having acquired some of the variable rules of *-t/-d* deletion in their own production, still omitted *-t/-d* much more often than the older children and adults in their study. The question remained as to whether their children showed nontarget omissions of *-t/-d* because they had not yet acquired past tense morphology (i.e., *-ed* [t]) or because they had not yet acquired the variable rules of *-t/-d* deletion.

There is some evidence that children's acquisition of grammatical morphology takes longer when the morphology is variably produced in the input. This has been reported for children's production of the auxiliary *do* in a context where the input contained variable usage of non-agreeing *don't* (Miller, 2012). It has also been noted that */s/* lenition may be responsible for children's late production of plural morphology in Spanish. In particular, Marrero & Aguirre (2003) report a delay in plural marker production for a Canary Island Spanish-speaking child exposed to */s/* lenition. This child did not produce any plural marking until one year after Spanish-speaking children who were exposed to consistent input.¹⁷

There is a recent body of research examining the effect of input type on children's acquisition. The focus has been primarily on the acquisition of inconsistent input, an input much like that found in the production of second language speakers to their children. Inconsistent input is different from variable input, in that the distribution of the variant forms in the former is not probabilistically determined by social and linguistic constraints. Hudson Kam & Newport (2009) show that children exposed to an artificial language with an inconsistent input for determiners tend to overregularize (26 out of 30 children overregularize) in their own production to one of the variant forms (i.e., to the overt variant or to zero), unlike what was found for variable input by Smith, Durham & Fortune (2007) and Henry (2005).

One difference between past research on inconsistent input and research on variable input that could account, in part, for differences in results may have to do with the amount of exposure to the input. In the case of variable input, children had been exposed for about two to five years before testing (i.e., they were two to five years of age), while children tested in Hudson Kam and Newport's (2009) artificial language study had only been exposed to the input for at most two hours (i.e., 6 sessions of 10 to 20 minutes each) before testing.

There are very few studies that have examined the effect of variable input on comprehension. One such study was carried out by Johnson (2005), who examined African American English (AAE)-speaking children's acquisition of 3rd singular *-s* when they were exposed to an input where the marker was sometimes omitted in adult speech. Johnson found that AAE-speaking children were unable to associate 3rd singular *-s* to subject number when they were compared to mainstream English-speaking children. However, these results are difficult to interpret as even mainstream English-speaking children, children who do not receive a variable input for 3rd singular *-s*, had difficulty with their task (see Johnson [2005]).

¹⁷The goal of Marrero & Aguirre's article was not to examine input type on acquisition; for this reason, the results were from only one child and there was little information provided about how often the plural marker was omitted in the input.

As stated in the introduction, we now set out to answer the following two research questions, using Mexican working-class children exposed to consistent input as the control group and Chilean children as our test group:

- (i) Does variable input for plural morphology affect children's ability to associate the plural marker to an interpretation of "more than one"?
- (ii) In the context of variable input, what role does frequency play?

4. EXPERIMENT 1: PRODUCTION OF PLURAL INDEFINITES

Experiment 1 set out to determine what effect variable input has on children's ability to associate the plural marker to an interpretation of "more than one" by examining whether Chilean children could use the plural marker on indefinite noun phrases as an indication that the referent is a set with "more than one." We will call this a "more than one" interpretation. To this end, we compare Mexican Spanish-speaking and Chilean Spanish-speaking children's use of the plural marker when describing plural sets. In addition, we address the role of frequency in the context of variable input by comparing Chilean working-class children's and Chilean middle-class children's use of the plural marker in this task, as working-class children are exposed to an input with more omissions of the plural marker than middle-class children.

4.1. Method

4.1.1. *Participants*

Eighty-one children participated in this study. Twenty-nine Mexican working-class children (MexWC) (3;00–4;07, Mean 3;07), 25 Chilean middle-class children (ChMC) (4;02–7;00, Mean 5;05), and 27 Chilean working-class children (ChWC) (4;02–6;4, Mean 5;03). The age range was greater for the Chilean children than for the Mexican children, and the Chilean children were also on average older than the Mexican children. These two decisions were made because past work has shown that at least by three years of age, the youngest age in our Mexican working-class group, Spanish-speaking children exposed to input categorically and consistently marked for plural produce the plural marker consistently in their own speech, although they still show difficulty with the [-es] allomorph (Kvaal, et al. 1988; Marrero & Aguirre 2003; Grinstead, Cantú-Sánchez & Flores-Avalos 2008).

Chilean and Mexican children were matched for social class. Middle-class children attended tuition-based preschools and had parents who worked in business or were nurses, lawyers, or high-ranking military officials. Working-class children attended free preschools and had parents who worked in the fishing industry or were secretaries, janitors, taxi-drivers, or store clerks.

There were 8 Mexican adult controls and 14 Chilean adult controls who were from the same local area as the children. Child participants were recruited from local preschools and adult participants were undergraduates at the local university.

Because the age range of the children in this study varied from three to seven years of age, we divided children into three age groups so that we could better compare Chilean and Mexican children of the same age. The age groups are shown in Table 3.

TABLE 3
Experiment 1: Division of Children by Age Group

<i>Group</i>	<i>Mean Age</i>	<i>Number</i>
MexWC Children		
3;00–3;11	3;04	18
4;00–4;07	4;01	11
ChMC Children		
4;02–4;11	4;04	7
5;01–5;11	5;07	11
6;01–7;00	6;05	7
ChWC Children		
4;02–4;11	4;07	12
5;03–5;10	5;05	11
6;00–6;04	6;02	4

4.1.2. Procedure

An Elicitation task was used. A native Spanish-speaking research assistant from the same local area as the children presented children with pictures of plural and singular sets of animals, one at a time. Upon seeing each picture, the child was asked: ¿*Qué hay acá?* (What's here?). The first author was present during all testing to ensure that procedures for Chilean children and Mexican children were identical.

The experimental prompt, ¿*Qué hay acá?* 'What's here?', contains the existential verb *hay*, which carries no agreement morphology and can occur with both plural and singular subject noun phrases. For this reason, noun phrases that are elicited from children can be understood as directly related to the number of objects in the display and not to agreement with the verb.

All children were tested individually in a quiet room away from the class. Each child was given three pretest trials where they had to name or point to objects in a display so that they felt comfortable with talking and interacting with the researcher. The three pretest items were

- (i) identifying a circle,
- (ii) identifying the colors blue and red, and
- (iii) choosing the larger or smaller of two objects.

After the pretest, children were presented with 16 additional pictures: 8 pictures of plural sets of animals and 8 pictures of singular sets of animals. Adult subjects were tested in the same way as children.

Child and adult responses were audio-recorded with a Marantz PMD 222 Analog Recorder and a Shure Cardioid Condenser Lapel Microphone that was attached to the participant's shirt, to the left of their mouth. Recordings were later coded perceptually for pronunciation of the plural marker as [-s], [-h], or [0] (omission) by the first author of this article.

In order to examine whether children used only the plural marker to distinguish plural from singular, we coded the data not only by whether or not a plural marker was produced in plural noun phrases in the plural condition, but also by the type of noun phrase that children produced

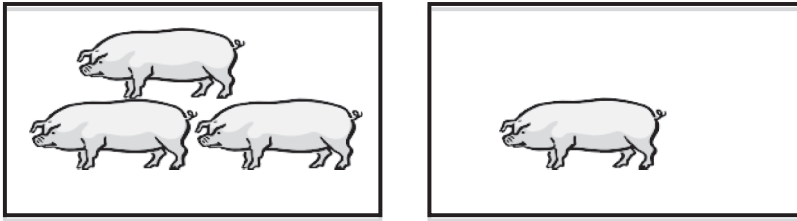


FIGURE 1 Sample displays for Experiment 1.

(e.g. bare nouns, indefinite noun phrases). We coded any occurrence of the plural marker, whether on the noun, determiner, or both, as production of the plural marker and both [-h] and [-s] were counted.

4.1.3. Materials

There were two experimental conditions: the Singular Condition, which contained eight color pictures with singular sets of animals, and the Plural Condition, which contained eight color pictures of plural sets of the exact same animals (Figure 1). All pictures in the Plural Condition contained three or four animals that were identical in size and appearance to each other and also to the corresponding animal in the Singular Condition. Both the size of the set and the identical nature of the animals in the plural condition is important, as recent work by Zapf & Smith (2008) has shown that young children produce the plural marker more often when presented with sets of four than when presented with sets of two. Moreover, they show that children produce the plural marker more often when the objects in the plural condition are identical to each other. Pictures were pseudo-randomized and assembled in a binder. The plural and singular picture of the same animal never occurred back-to-back. There were always at least two trials in between any plural and singular pair.

The plural allomorph was also controlled for. Six nouns required the /-s/ allomorph (pronounced as [-s], [-h], or omission, due to /s/ lenition): *vaca-vacas* ('cow'), *abeja-abejas* ('bee'), *chancho-chanchos* ('pig'), *perro-perros* ('dog'), *gato-gatos* ('cat'), *elefante-elefantes* ('elephant'), and two nouns required the /-es/ allomorph (pronounced as [-es], [-eh] or [-e], due to lenition): *pez-peces* ('fish'), *ratón-ratones* ('mouse').

4.2. Results

Two analyses were carried out. The first focused on the type of noun phrase that participants produced in both the Singular and Plural conditions, and the second focused on the production of the plural marker only in the Plural Condition.

The first important finding is that Chilean children and Mexican children produce different types of noun phrases in the Plural Condition, but not in the Singular Condition. In the Singular Condition both Mexican and Chilean adults produced singular indefinite noun phrases (e.g. *una vaca* 'a-SG cow-SG') 100% of the time. Like the adults, most children also produced singular indefinite noun phrases in this condition; however, some ChWC children produced bare singular

noun phrases (e.g. *vaca* ‘cow-SG’). There were also some very infrequent response types that we will group together and call “other responses.” These included other types of noun phrases (e.g. *otra vaca* ‘another-SG cow-SG’) and responses that were unintelligible in the recording.¹⁸ These other responses were rare, making up only 4% (29 out of 664 child responses) of the data.

In the Plural Condition, there was much more variation in the type of noun phrases produced by children. The most notable difference is that while Mexican children showed an overall preference for plural indefinite noun phrases (*unas vacas* ‘some-PL cows-PL’), creating minimal pairs with the indefinite singular in the Singular Condition, Chilean children did not. Instead, Chilean children produced bare plural (*vacas* ‘cows-PL’) and also bare singular noun phrases¹⁹ (*vaca* ‘cow-SG’) in the plural condition. While the bare plural is grammatical in this context, an actual bare singular is not. Bare singulars only appear in a very restricted set of contexts and are not actually semantically singular in Spanish (Bosque 1996; Laca 1996, 1999). In the contexts in which they are grammatical, they are numberless noun phrases and function as predicates of sorts. As such, they are consistent with both an interpretation of “one” and also an interpretation of “more than one.” Therefore, there is no contrast between bare plurals and bare singulars in the adult grammar that corresponds to the distinction between *una niña* (a-SG girl-SG) vs. *unas niñas* (some-PL girls-PL). Furthermore, much like the fact that the English bare plural is not the plural form of the indefinite singular “a girl” (see Carlson [1977]), the bare plural in Spanish also does not behave like the indefinite *unos/unas* (Martí 2008). In other words, the bare plural and the indefinite singular noun phrases are not minimal pairs.

Adults behaved differently from both groups of children in that they overwhelmingly produced noun phrases headed by a numeral (e.g. *tres vacas* ‘three cows-PL’). It was impossible to control for the overabundance of numerals produced by adults without having to create two different sets of stimuli, one for children and one for adults. For this reason, while we report the adult data, we do not include it in the statistical analyses. The types of noun phrase produced in both the Singular Condition and the Plural Condition is shown in Table 4. Note that when the epenthetic ‘e’ was produced *without* [-s] or [-h] on bare nouns in either the *ratón* or *pez* plural condition (e.g. [pese] or [ratone]), it was coded as “other” in Table 2, as we did not want to impose an analysis of lenition for this case but not for the case of the bare singular nouns. We will discuss nouns with an [-es] allomorphy later in this section.

In addition to the differences found between Chilean and Mexican children’s production of noun phrase types in the Plural Condition, the data also show developmental patterns. For Mexican children, the percentage of plural noun phrases increases with age. Likewise, Chilean children show higher production of bare plurals at six years of age than at four and five years of age.

¹⁸Two MexWC children (3;00 and 3;04 years of age) produced the singular indefinite in some of the masculine trials as *uno* (‘one’) (the child age 3;00 in 2 trials and the child age 3;04 in 4 trials). For example, in the Singular Condition these children gave the nontarget response #*uno elefante*, instead of *un elefante*. In adult speech [uno] is unacceptable. Instead, *un* is the form of the determiner when followed by a noun phrase with an overt noun. We counted these errors (for these two children) as indefinite singulars in Table 4.

¹⁹It is important to note that the distinction we are making between bare singulars vs. bare plurals is purely descriptive, in the sense that we are reporting whether children produced the plural form or not. Of course it could be that what we are calling bare singular is a bare plural with lenition of /s/ to zero.

TABLE 4
Experiment 1: Percentage of Noun Phrase Types

	<i>MexWC</i>		<i>ChMC</i>			<i>ChWC</i>		
Singular Condition								
Age	3;00	4;00	4;00	5;00	6;00	4;00	5;00	6;00
Indef.Sg	76%	93%	89%	95%	93%	83%	68%	59%
'una vaca'	110/144	82/88	50/56	84/88	52/56	80/96	60/88	19/32
Bare.Sg	6%	1%	7%	5%	7%	13%	23%	32%
'vaca'	8/144	2/88	4/56	4/88	4/56	12/96	20/88	10/32
Other	18%	6%	4%	0%	0%	4%	9%	9%
	26/144	5/88	2/56			4/96	8/88	3/32
Plural Condition								
Age	3;00	4;00	4;00	5;00	6;00	4;00	5;00	6;00
Indef.Pl	60%	77%	1%	1%	5%	7%	1%	0%
'unas vacas'	86/144	68/88	1/56	1/88	3/56	7/96	1/88	
Bare.Pl	8%	10%	53%	55%	80%	46%	49%	72%
'vacas'	12/144	9/88	30/56	48/88	45/56	45/96	43/88	23/32
Bare.Sg	5%	0%	18%	3%	4%	38%	28%	19%
'vaca'	7/144	0/88	10/56	3/88	2/56	36/96	25/88	6/32
Q + N	13%	5%	25%	33%	9%	0%	16%	0%
'muchas/2 vaca(s) ¹	18/144	4/88	14/56	29/88	5/56		14/88	
Other	15%	8%	2%	8%	2%	8%	6%	9%
	21/144	7/88	1/56	7/88	1/56	8/96	5/88	3/32

¹Responses that involved a quantifier or numeral sometimes occurred with a noun without a plural morpheme (e.g. *tres vaca* 'three cow'). In adult language, determiner and noun agree in number and the noun carries number morphology, although it is subject to lenition.

While producing a bare plural in the plural condition is not an incorrect response, producing a true bare singular is not consistent with the adult grammar. When the data are examined more closely, we find that two 4-year-old ChMC children are responsible for most of the bare singular noun phrases produced in the plural condition, and they produce both bare singulars and bare plurals variably. For the ChWC children, we find that only four children (4;06, 4;06, 5;03, 6;02) produced the plural marker consistently on all plural nouns. The rest of the ChWC children produce bare singulars and bare plurals variably, which may indicate that their omission of /-s/ is due to the phonological process of syllable final /s/ lenition.

The second analysis examined children's production of the plural marker in the Plural Condition. The first observation was that [-h] was virtually unattested in the data (i.e., occurred only 4% of the time). We believe that this is most likely due to the fact that in Chilean adult speech, speakers rarely aspirate the /s/ before a pause, but instead either omit it or produce it as [-s] (Cepeda 1995).²⁰ Because of the few tokens produced, we have not divided the data in Table 5 in terms of [-h] v. [-s]. Additionally, it should be noted that in the two trials requiring the

²⁰The differences found between Experiment 1 and Table 1 in the amount of [-h] produced is most likely due to methodology. The data in Table 1 represent spontaneous speech, which involve many more tokens of sentence medial /-s/. The data in Experiment 1 represent single noun phrases produced in isolation, resulting in many more tokens of /-s/ before a pause.

TABLE 5
Experiment 1: Proportion (Standard Deviations) of Plural Nouns Marked with the Plural Marker

	<i>MexWC</i>		<i>ChMC</i>			<i>ChWC</i>		
Age	3;00	4;00	4;00	5;00	6;00	4;00	5;00	6;00
[-s]/[-h]	80.56	95.45	76.30	88.64	96.43	48.96	50.00	65.63
	(31.27)	(8.42)	(29.15)	(22.67)	(6.09)	(31.28)	(24.36)	(21.34)

[-es] allomorph (i.e., *ratón* and *pez*), many children produced other nouns that did not require the [-es] allomorph. These responses included the diminutive form (e.g., *ratoncitos* ‘mousies’) or an alternative noun (e.g., *pescado* ‘fish,’ *rata* ‘mouse’)²¹. For this reason, in Table 5 the [-es] and [-s] data were combined. If children produced the [-es] allomorph and omitted the [-s] (e.g. /pese/ for ‘peces’), the noun was counted as having a plural marker.

Table 5 shows that Mexican working-class children are at ceiling in their production of the plural marker by four years of age. On the other hand, only ChWC children, but not ChMC children, produce substantially less plural marking than Mexican children.

An ANCOVA (between-subjects factor: group [ChWC, ChMC, MexWC]); covariate: age; and within-subjects factor: plural marking (Plural Condition, Singular Condition) and plural marking as the dependent variable revealed a main effect of group, $F(2, 77) = 4.102, p = .02, \eta^2 = .096$, and also a main effect of age, $F(1, 77) = 4.973, p = .029, \eta^2 = .061$. There was a significant interaction between plural marking and group, $F(1, 77) = 5.102, p = .008, \eta^2 = .088$, but no interaction between plural marking and age, $F(1, 77) = 2.500, p = .118, \eta^2 = .031$.

To determine whether Chilean and Mexican children of the same age perform the same in the plural condition or not, planned comparisons were carried out on the 4-year-old children. To this end, we entered the proportion of noun phrases marked with a plural marker in the Plural Condition (i.e., either on the noun or determiner, or both) into a one-way ANOVA. The results showed significant differences between the three groups, $F(2, 28) = 5.888, p < .01$. Independent samples *t*-tests revealed significant differences between MexWC children and ChWC children, $t(1, 20) = 3.841, p < .001$, and also ChMC children, $t(1, 16) = 2.120, p < .05$. There were no differences between ChMC children and ChWC children, $t(1, 16) = -.992, p = .336$.

A final analysis was carried out to determine children’s systematicity of plural marking in the Plural Condition across the six trials that required the [-s] allomorph. The two trials that attempted to elicit the [-es] allomorph were not included because of the variability in the nouns that children produced. The goal of this analysis was to determine whether children always produced the plural

²¹ Only 55.17% MexWC children, 64.28% of ChMC children, and 17.39% of ChWC children produced the noun *pez* in its plural form with a plural marker (i.e., [peses]). Producing *pez* as [pese] (i.e., with only epenthetic –e) was virtually absent. Instead, all three groups either produced a different noun (e.g., *pescado* ‘fish’) or they produced *pez* with no plural marker at all (i.e., [pes]). MexWC children produced [pes] with an indefinite plural determiner (i.e., *unos pez* [unos pes]) 13.79%. ChMC and ChWC children produced a bare noun (i.e., [pes]) 20% and 25.92% of the time, respectively. The results were different for the noun *ratón*, where 68.96% MexWC children, 80% ChMC children, and 55.55% ChWC children produced *ratón* as [ratones]. Children who did not produce the full form [ratones], produced either a different noun (e.g. *rata* ‘rat’) or they produced *ratón* without the plural marker. Producing *ratón* as [ratone] (i.e., with only epenthetic –e) was absent in MexWC and ChMC children; however, ChWC children produce [ratone] 29.62% of the time.

TABLE 6
Experiment 1: Percentage of Children Showing Systematic Plural Marking

<i>Group</i>	<i>Age</i>	<i>Systematic Plural Marking</i>	<i>Systematic Omission</i>	<i>Systematic Total</i>	<i>Variable Plural Marking</i>
MexWC Children	3;00	94% (17/18)	6% (1/18)	0%	0%
	4;00	100% (11/11)	0%	0%	0%
ChMC Children	4;00	71% (5/7)	29% (2/7)	100% (7/7)	0%
	5;00	91% (10/11)	9% (1/11)	100% (11/11)	0%
	6;00	100% (7/7)	0%	100% (7/7)	0%
ChWC Children	4;00	25% (3/12)	33% (4/12)	58% (7/12)	42% (5/12)
	5;00	18% (2/11)	18% (2/11)	36% (4/11)	64% (7/11)
	6;00	75% (3/4)	0%	75% (3/4)	25% (1/4)

marker across all trials or whether they showed variable production of the plural marker. This type of analysis provides a way of determining whether Chilean children are overregularizing in their own speech or whether they are producing the plural morpheme variably, like adult Chilean speakers.

Following procedures similar to those used in Hudson Kam & Newport (2005), we classified children into three categories: systematic producers were children who produced the plural marker in the plural condition in five or six of the six trials. Systematic omitters were children who only produced the plural marker in the plural condition in zero to one of the six trials. Variable producers were classified as those who produced the plural marker in two, three, or four of the six trials. Table 6 shows the results of this analysis.

The data in Table 6 show that MexWC children and ChMC children are systematic in their production or omission of plural marking, while ChWC children are split between systematic production and variable production at four and five years of age and becoming more systematic in their production at six years of age.

In summary, Experiment 1 reveals the following results:

- (i) Chilean children differ from Mexican children in the type of plural noun phrase they use to describe plural sets. In particular, Chilean children produced bare plurals and bare singulars in the plural condition, while Mexican working-class children produced indefinite plurals.
- (ii) Both Chilean working-class and Chilean middle-class children produce less plural marking when describing plural sets than Mexican working-class children, which is apparent at four years of age. It also appears that ChWC produce less plural marking than ChMC, which suggests that frequency within the context of variable input affects production. However, these differences did not reach significance.

- (iii) Chilean middle-class children and Mexican working-class children are systematic in their production of plural marking, either always omitting it or always producing it, while Chilean working-class children showed both systematic and variable production of the plural marker.
- (iv) For the plural noun *ratones* ('rat-PL') that required the [-es] allomorph, ChWC children, but not ChMC nor MexWC children, sometimes produced only epenthetic [-e]. However, overall very few children produced only the epenthetic [-e] in the Plural Condition.

4.3. Discussion

Does variable input for plural morphology affect children's ability to associate the plural marker to an interpretation of "more than one"? One notable difference found between Chilean and Mexican children is that Chilean children overwhelmingly produced bare plurals and bare singulars in the plural condition, while Mexican working-class children produced indefinite plurals. The results provide clear evidence that Mexican children have acquired plural morphology by three years of age, a finding that is consistent with past studies (Grinstead, Cantú-Sánchez & Flores-Avalos 2008); however, we believe that based on this experiment we cannot conclude the same for Chilean children, even for the six-year-olds. This is because the Chilean children produced very few plural-singular indefinite minimal pairs, which makes it difficult to conclude that they associate [-s] or [-h] alone to "more than one." Instead, Experiment 1 suggests that Chilean children use indefinite singulars to express singularity but bareness (i.e., bare plural or bare singular) to express plurality. We hypothesize that it is possible that the lexical similarity between the plural indefinite determiner *unas/unos* and the word for "one" in Spanish *una/uno*, may cause Chilean children to avoid using the indefinite if they have not associated the plural marker /-s/ to "more than one." In other words, if the child ignores the /-s/ in *unos/unas*, the indefinite determiner becomes identical to the word for "one."

However, we must be careful in drawing the conclusion that Chilean children do not have plural morphology based solely on Experiment 1. Although the differences in the types of noun phrases produced by Mexican and Chilean children is striking, the type of noun phrase produced only indicates a preference. After all, the Mexican and Chilean adults did not produce plural-singular minimal pairs either, yet we assume that they must have plural morphology.

The second important finding is that four-year-old Chilean children produce the plural marker significantly less often than Mexican children, a finding that may provide stronger evidence for a difference in acquisition between children exposed to a variable input and those exposed to consistent input. In fact, because Chilean children overwhelmingly produce bare noun phrases in the plural condition, when the plural marker is omitted there is no plural marking whatsoever in the noun phrase. Again, we have to be careful in our interpretation of the results because omission of the plural marker by Chilean children may simply be a result of having acquired the phonological process of /s/ lenition. This may be especially true for the ChWC children, who show more variability in their production. Nevertheless, as pointed out above, producing a bare singular in the plural condition is not an adult-like response. As such, even if these omissions are an instance of /s/ lenition in the child's production, this would indicate that the child has not yet acquired /s/ lenition in an adult-like way. This leaves us in a similar situation as past research on acquisition of variable rules: is child production of bare singulars in this task due to not having acquired the variable rules for /s/ lenition in an adult-like way or is it due to not having acquired

the categorical rules of plural morphology in an adult-like way? Further work in comprehension may allow us to shed light on this question.

5. EXPERIMENT 2: COMPREHENSION OF PLURAL INDEFINITES

If the production of bare noun phrases in Experiment 1 is solely a preference and if the production of bare singulars is simply an instance of /s/ lenition, then Chilean children should be able to associate the plural indefinite to “more than one” in comprehension. The goal of Experiment 2 is to test Chilean and Mexican children’s comprehension of indefinite noun phrases.

5.1. Method

5.1.1. Participants

Sixty-four children participated in this study. The data for three children (one MexWC child, age 5;03; two ChWC children, ages 4;04 and 4;06) were discarded from the study due to their poor performance on the control condition *muchos* (‘many-PL’) and the practice trial *todos* (‘all-PL’). After the data from these children were removed, the target group contained 50 ChWC children (4;01–6;01, Mean 5;00) and the control group contained 11 MexWC children (3;09–5;11, Mean 4;07). There were also 25 ChWC adult controls and 12 MexWC adult controls, who were the parents of the children tested in this experiment.

Children were matched for social class and were classified as children of working-class parents. Social class was determined in the same way as for children in Experiment 1. Unlike Experiment 1, we did not include Chilean middle-class children. There are two reasons for this decision. First, Miller & Schmitt (2010) showed no significant differences between a different set of working-class and middle-class Chilean children in an identical task that tested only the allomorph [-s], neither group reaching adult levels. Moreover, Experiment 1 showed that, unlike Mexican children, neither working-class nor middle-class Chilean children produced plural indefinites. The goal of Experiment 2 is to determine whether the lack of plural indefinites in Chilean children’s production represents a preference or whether Chilean children do not associate the plural indefinite to “more than one.” We will look more closely at ChMC children in Experiment 3. Table 7 shows the distribution of child participants in Experiment 2.

TABLE 7
Experiment 2: Distribution of Child Participants

<i>Child Group</i>	<i>Number</i>	<i>Age</i>
Younger		
ChWC	25	4;01–4;11 (Mean 4;05)
MexWC	8	3;09–4;11 (Mean 4;04)
Older		
ChWC	25	5;00–6;01 (Mean 5;05)
MexWC	3	5;01–5;11 (Mean 5;03)

5.1.2. Materials

An Act-out task was used. For comparative purposes, the task was modeled closely after the one used in Miller & Schmitt (2010), but in addition to nouns that took the [-s] allomorph, we also included nouns that ended with a consonant and thereby took the [-es] allomorph.

All Chilean and Mexican participants were tested by native Spanish-speaking adults who were from the same local area as the children. For all children, the plural marker was pronounced as [-s] on both the noun and the indefinite determiner, as this was the most frequent overt variant produced by both Chilean and Mexican adults and children in Experiment 1. A subset of the Chilean children (15 of the 50 children) was later tested in the exact same experiment except that in this second version of the experiment, the plural marker was always pronounced as [-h] on both the indefinite determiner and noun. This follow-up study occurred between one and two months after testing on [-s]. The goal of the follow-up experiment was to compare, in individual children, their ability to associate the two overt variants (i.e., [-s] and [-h]) to “more than one.”

Children were tested on their interpretation of sentences like (14a) and (14b).

- (14) a. Pon unas flores en la caja.
Put some-FEM-PL flowers-FEM-PL in the box
'Put some flowers in the box'
- b. Pon una flor en la caja.
Put a/one-FEM-SG flower-FEM-SG in the box
'Put a/one flower in the box'

To test children, the experimenter placed two sets of miniature toys (e.g., six flowers and six muffins) on the table and asked children to put a certain quantity of one of the sets of toys into a box. The following nouns were used: *flor* → *flores* ('flower.FEM'), *pan* → *panes* ('muffin.MASC'), *pera* → *peras* ('pear.FEM'), and *pato* → *patos* ('duck.MASC'). Both *flor* and *pan* require epenthetic 'e' for their plural form, while *pera* and *pato* do not.

There was one target condition, *unos/unas* ('some-PL') and two control conditions, *un/una* ('a/one-SG') and *muchos/muchas* ('many-PL'). The control conditions ensure that children will place “only one” item in the box and also “more than one” item in the box. Experiment 1 and also past work by Miller & Schmitt (2010) and Munn, Miller & Schmitt (2006) indicate that Spanish-speaking children associate the singular indefinite to “one” by three years of age (but see Barner, Chow & Yang [2009] for differences found with English-speaking children).

5.1.3. Procedure

The experiment was administered in the following way. The experimenter started by placing two sets of miniature toys (e.g., six flowers and six muffins) on the table. She next stated *Te voy a decir la cantidad que tienes que poner en la caja. Escucha bien y pon la cantidad que yo te diga* 'I'm going to tell you how many toys you must put in the box. Listen carefully and put the amount that I say.' The experimenter then presents three practice trials, one at a time, where she asks the child to place two items in the box, followed by three items and then all of the items (e.g. *Pon dos/ tres /todas las flores en la caja* 'Put two/ three/ all the flowers in the box'). After these three initial practice trials, the experimenter begins the experiment. Children are asked to place

un/una ('one-SG'), *unos/unas* ('some-PL'), and *muchos/muchas* ('many-PL') of one of the sets of items into the box (e.g. *Pon una/ unas/ muchas flor(es) en la caja* 'Put a-one-SG/ some-PL/ many-PL flowers-SG/PL into the box'). The plural quantifier *muchos/muchas* ('many-PL') was always presented at the end of each block.

5.2. Results

The dependent measure was the proportion of correct responses, calculated across the four trials in each experimental condition. For the indefinite plural target condition putting more than one item in the box would indicate that participants associate the plural marker to "more than one." Adults provided this response 100% of the time. Placing only one item in the box for the indefinite singular condition was considered the correct response; however, it should be noted that if a child puts more than one object in the box in the singular condition, she has still placed one item in the box, and so it is not completely incorrect. She could be interpreting "a dog" as "at least one dog." Nevertheless, adults put only one item in the box 100% of the time in the singular condition, which indicates that our predictions of the target behavior are accurate.

Both groups of children were at ceiling in the two control conditions, associating *un/una* ('a/one-SG') to "one" over 90% of the time and *muchos/muchas* ('many-PL') to "three or more" 100% of the time. However, the two groups differed in the target condition, which tested them on their interpretation of the indefinite plural *unos/unas* ('some-PL'). Importantly, while the order of presentation of the plural indefinite and the singular indefinite was counterbalanced, presenting the plural indefinite first or the singular indefinite first had no effect on child performance in the plural condition ($t(1,49) = .814, p = .420$). Moreover, although the masculine form of the plural indefinite (*unos*) differs from the singular indefinite (*un*) not only with respect to the plural marker [-s], but also by an additional vowel [o]—while this is not true for the feminine indefinite, which only differs with respect to the plural marker (*una* v. *unas*)—the results showed that there were no significant differences between children's comprehension of the masculine plural form (*unos*) and their comprehension of the feminine plural form (*unas*) ($t(1,49) = .903, p = .371$). The proportion of correct responses in the plural and singular condition is shown in Table 8.

In order to determine whether there were differences in comprehension depending on the allomorph used ([-s] v. [-es]), an ANCOVA [between-subjects factor: group (ChWC, MexWC); covariate: age; and within-subjects factor: plural allomorph ([-es], [-s])] was run and revealed no main effects of group, $F(1, 58) = 2.827, p = .098, \eta p^2 = .046$, or age, $F(1, 58) = .070, p = .793, \eta p^2 = .001$, and no interaction between plural allomorph and group, $F(1, 58) = 2.128,$

TABLE 8
Experiment 2: Mean Correct (and Standard Deviations) on Plural and Singular Condition

	<i>MexWC Children</i>	<i>ChWC Children</i>
<i>unos/unas</i> (some-PL)	84.09 (30.15)	58.50 (45.34)
<i>un/una</i> (a/one-SG)	100 (0)	92 (25.97)
<i>muchos/muchas</i> (many-PL)	100 (0)	100 (0)

$p = .150$, $\eta^2 = .035$, nor plural allomorph and age, $F(1, 58) = .582$, $p = .306$, $\eta^2 = .005$. For this reason, the plural allomorph data were combined for further analyses.

An ANCOVA [between-subjects factor: group (ChWC, MexWC); covariate: age; and within-subjects factor: plural morphology (plural condition, singular condition)] revealed a main effect of group, $F(1, 58) = 5.013$, $p = .029$, $\eta^2 = .080$, but not age, $F(1, 58) = .018$, $p = .894$, $\eta^2 < .001$, and no interaction between plural morphology and group, $F(1, 58) = .732$, $p = .396$, $\eta^2 = .012$, nor plural morphology and age, $F(1, 58) = .287$, $p = .594$, $\eta^2 = .005$. These results show that Mexican children associated the singular indefinite to “one” and the plural indefinite to “more than one” more often than Chilean children.

In order to determine whether there were any developmental differences in Chilean children,²² an independent t -test with a proportion of plural responses (i.e., putting more than one object in the box) as the dependent variable was carried out. The results showed no difference in performance on the plural condition between the older (58% correct, $SD = 46.05$) and younger (59% correct, $SD = 45.57$) Chilean child groups ($t(1,48) = .077$, $p = .939$).

We next examined whether hearing the plural pronounced as [-h] increased children’s ability to associate the plural indefinite to “more than one.” Fifteen of the Chilean children who participated in this experiment were invited to participate in the follow-up study, where the plural marker was pronounced as [-h] on the determiner and noun. Behavior on both the plural and singular indefinite was compared across the two versions of the experiment. Paired samples t -tests showed no difference in performance neither when the plural was pronounced as [-h] (20% correct, $SD = 36.83$) as compared to [-s] (35% correct, $SD = 47.99$) in the plural condition ($t(1,14) = -1.457$, $p = .167$). We should note that of the 15 children tested on both [-s] and then [-h], almost all children behaved the same on both variants except for three children. Two of these children associated [-s] to “more than one” 100% of the time but never associated [-h] to “more than one.” The third child associated [-s] to “more than one” 100% of the time and [-h] 50% of the time (i.e., variable behavior on [-h]).

Finally, in order to determine whether children were consistent or not in their interpretation of the plural indefinite, we coded children as being either systematic or variable responders. Systematic responders are those who always gave either a singular or plural response in at least three out of the four trials in the plural condition. Variable responders are participants who gave a plural response in half of the trials (two out of four) and the singular response in half of the trials in the plural condition. Table 9 shows the percentage of systematic responders and variable responders for the plural indefinite condition.

The data in Table 9 is interesting in light of the production data from Experiment 1. While many ChWC children were variable in their production of the plural marker in Experiment 1, they were not variable in their comprehension. Instead, most children were systematic in their responses, either systematically choosing a plural set or choosing a singular set in the plural condition, which suggests that children either associate the plural marker on the plural indefinite noun phrase to “more than one” or they do not. These findings indicate that while almost all of

²²We thank an anonymous reviewer for suggesting that we examine developmental differences in Chilean children. Only Chilean children were examined for developmental differences; Mexican children serve as a control in this experiment and there are far too few of them to determine if differences exist between the younger and older groups. However, past work by Miller & Schmitt (2010) has shown developmental differences in 3–5 year old Mexican children on a similar task.

TABLE 9
Experiment 2: Systematic Responses for Plural Indefinite ('unas/unos')

	<i>Systematic Plural Responders</i>	<i>Systematic Singular Responders</i>	<i>Systematic Total</i>	<i>Variable Responders</i>
ChWC				
Younger	56% (14/25)	36% (9/25)	92% (23/25)	8% (2/25)
Older	60% (15/25)	36% (9/25)	96% (24/25)	4% (1/25)
Total	58% (29/50)	36% (18/50)	94% (47/50)	6% (3/50)
MexWC	91% (10/11)	9% (1/11)	100% (11/11)	0%

the Mexican working-class children associate plural indefinites to “more than one” by four years of age, only a little over half of Chilean working-class children do.

In summary, Experiment 2 reveals the following:

- (i) Chilean Spanish-speaking children differ from Mexican Spanish-speaking children in their ability to associate the plural marker /-s/ on plural indefinites to “more than one.” Mexican Spanish-speaking children are adult-like while many Chilean Children are not.
- (ii) Both Chilean and Mexican children are systematic in their interpretation of plural indefinites. They either know how to use the plural marker in comprehension or they do not.

5.3. Discussion

Does variable input for plural morphology affect children’s ability to associate the plural marker to an interpretation of “more than one”? Unlike what was found for production in Experiment 1, Experiment 2 showed very little variability in response types. Chilean children either always associated the plural indefinite to “more than one” or never did. This finding suggests that producing a form does not always guarantee the adult-like analysis. If we go back to the production results, most of the plural morphology produced by ChWC children was on bare plurals that do not contrast in this context with a bare singular. In both cases the weak interpretation of “at least one” is possible.

An alternative account of Chilean children’s performance in Experiment 2 is that the formality of the experimental task may have played a role in children’s interpretation of the plural marker. Smith, Durham & Fortune (2009) show that adult speakers tend to use less local variants in more formal contexts, like book-reading activities. If Chilean children understand the effect of style on /s/ omission, they may also produce more [-s] in tasks of this sort (i.e., Experiment 1) and they may have been confused by Experiment 2, which arguably is a less formal task. In other words, Experiment 2 may have created an unnatural context where the more formal variant [-s] was being used in a less formal task (i.e., a game-like task of putting items in a box). To control for this possibility, in Experiment 3 we use a book reading activity to test children’s comprehension of plural indefinite noun phrases.

6. EXPERIMENT 3: COMPREHENSION OF PLURAL INDEFINITES

The goal of Experiment 3 is to test Chilean children on their interpretation of plural indefinite noun phrases in the more formal context of book reading, to determine whether the formality of the context will affect children's use of plural marking (especially [-s]) in comprehension. Moreover, we test both working-class and middle-class children on both plural variants [-s] and [-h] in order to assess how, within the context of variable input, different levels of frequency (i.e., frequency of omissions and frequency of the overt variants relative to each other) play a role.

6.1. Method

6.1.1. *Participants*

Seventy-two children participated in this study. The target groups consisted of 20 ChWC children (5;01–8;02, Mean 6;04), and 20 ChMC children (5;00–7;03, Mean 6;00) who participated in the version of the study where the experimenter pronounced the plural marker as [-s]. In addition, 11 ChWC (4;06–5;11, Mean 5;01) and 9 ChMC children (4;06–6;01, Mean 5;05) were tested on [-h]. The control group consisted of 12 MexWC children (4;07–5;07, Mean 5;01). In addition, 20 adults (10 Chilean and 10 Mexican) participated in Experiment 3. Chilean adults were undergraduates at a university in Chile, and the Mexican adults were undergraduates at a university in Mexico City. Table 10 shows the distribution of child participants in the study.

6.1.2. *Procedure*

A Picture Matching Task was used. Children were read a story about a group of children who were taking a trip together. Throughout the storybook, the characters were given gifts, and children were asked questions about the gifts that the characters received. Some questions contained singular indefinite noun phrases, like (15a), and other questions contained plural indefinite noun phrases, like (15b) below. The goal of our design was to create a more formal task that was similar to typical book-reading activities that children may encounter either in school or at home with their parents. It is in these sorts of activities that past research has shown higher usage of the

TABLE 10
Experiment 3: Distribution of Child Participants

<i>Child Group</i>	<i>Number</i>	<i>Age</i>
Younger [-s]		
ChWC	10	5;01–5;06 (Mean 5;03)
ChMC	10	5;00–5;04 (Mean 5;02)
MexWC	12	4;07–5;07 (Mean 5;01)
Younger [-h]		
ChWC	11	4;06–5;11 (Mean 5;01)
ChMC	9	4;06–6;01 (Mean 5;05)
Older [-s]		
ChWC	10	6;07–8;02 (Mean 7;04)
ChMC	10	6;00–7;03 (Mean 6;07)

standard, less stigmatized, variants by adult speakers (Miller & Schmitt, 2012; Smith, Durham & Fortune 2009). Hence, it could be argued that children would expect more of the [-s] variants in these contexts.

The experimenters were from the same local area as the children tested, and in Mexico the plural marker was always pronounced as [-s] in the experiment. Chilean children were split into two groups, and for some of them the plural marker was pronounced as [-s], while for others it was pronounced as [-h]. Importantly, unlike Experiment 2 that tested the same children on their interpretation of both [-s] and [-h], in Experiment 3 we tested different groups of children on the two variants. Experiment 2 showed that only two children performed differently on the two variants. It may be that the subset of children tested were at a stage where they had already acquired plural morphology or they had not. By testing different groups of children on the two variants, we can examine whether one variant is associated to “more than one” more often than the other.

Figure 2 shows three sample pages of the storybook, which contains two plural indefinite trials. All pictures in the storybook were in color. For half of the trials, the characters holding the plural set of items were on the left, and for the other half the characters holding the plural set of items were on the right.

The experiment was administered as follows. Children were told that they would be read a story about a group of children going on a trip and that during the story we would ask them some questions about what happened. Then the researcher began reading the story. On each page of the story, children were asked two questions, both with either a plural indefinite noun phrase *unos monos* (‘some-MASC-PL monkeys-MASC-PL’) or with a singular indefinite noun phrase *un mono* (‘a/one-MASC-SG monkey-MASC-SG’). The middle question, *¿Cuál niña no tiene nada?* ‘Which girl has nothing?’, occurred on every page and was used to draw children’s attention back to the center of the display.

6.1.3. Materials

There were two target conditions, the Singular Indefinite Condition (15a) and the Plural Indefinite Condition (15b), which both contained four trials. There were also two control conditions, which were identical to the target conditions except that they contained *un solo* (‘only one-SG’) and *muchos* (‘many-PL’) (e.g. *¿Cuál niño tiene un solo libro?* ‘Which boy has only one book?’ and *¿Cuál niño tiene muchos libros?* ‘Which boy has many-PL books-PL?’). There were four trials in each control condition. In addition, there were ten filler items that tested comprehension of the Spanish copulas *ser* and *estar*.

- | | | | |
|------|----|--|--------------------|
| (15) | a. | ¿Cuál niño tiene un burro?
Which boy has a/one-SG donkey-SG
‘Which boy has a donkey?’ | Singular Condition |
| | b. | ¿Cuál niño tiene unos burros?
Which boy has some-PL donkeys-PL
‘Which boy has some donkeys?’ | Plural Condition |

Both target conditions were presented first, followed by 10 fillers and then the 2 control conditions. Control conditions were presented last to ensure that *un solo* (‘only one’) would not bias children’s interpretation of *un* (‘a/one-SG’) and that children would not be biased to pick the singular picture in the *unos* (‘some-PL’) condition after hearing *muchos* (‘many-PL’). In other words,




	<p><i>Estos niños son muy buenos amigos. Un día decidieron salir de paseo. ¿A ver, a dónde fueron? ‘These boys are very good friends. One day they decided to go for a walk. Let’s see, where did they go?’</i></p>
	<p><i>Primero los niños fueron a mirar a los animales que había en el campo. Había _____ y _____ (child names the objects). Así es que los niños jugaron con los animales. A ver, veamos que tiene cada niño. ‘First the boys went to see the animals that were in the countryside. There were _____ and _____ (child names the objects). So the boys played with the animals. Let’s see what each boy has.’</i></p>
	<p><i>¿Cuál niño tiene unos monos? Which boy has some-PL monkey-PL ‘Which boy has some monkeys?’</i></p> <p><i>¿Cuál niño no tiene nada? Which boy NEG has nothing ‘Which boy doesn’t have anything?’</i></p> <p><i>¿Cuál niño tiene unos burros? Which boy has some-PL donkey-PL ‘Which boy has some donkeys?’</i></p>

FIGURE 2 Experiment 3 sample trial.

if children were comparing their behavior across trials, they could be biased to choose fewer items in the *unos* (‘some-PL’) condition if they had just been tested on *muchos* (‘many-PL’), especially if they wanted to make clear, for example, that *some* was less than *many*. The character with a plural set of objects was considered the target answer in the plural indefinite condition and the *muchos* ‘many-PL’ control condition, and the character with only one object was considered the target answer in the singular indefinite condition and the *un solo* ‘only one’ control condition.

The gender of the noun was also controlled for. Half of the trials contained feminine noun phrases and half contained masculine noun phrases. In the plural feminine condition, the correct answer was always on the right side of the display, and in the plural masculine condition, it was always on the left side of the display. The same was true in the singular condition.

6.2. Results

The dependent variable was the proportion of adult-like responses for each condition. The results show that our estimate of target-like behavior is correct as both adult groups performed at ceiling on both controls and target items. For this reason the adult data were combined. Children also performed at ceiling in the control conditions, but they did not perform the same in the target conditions, as shown in Table 11.

An ANCOVA [between-subjects factor: group (ChWC, ChMC, MexWC); covariate: age; and within-subjects factor: plural marking (plural condition, singular condition)] revealed a main effect of group, $F(2, 48) = 12.283, p < .01, \eta^2 = .339$, and age, $F(2, 48) = 28.167, p < .001, \eta^2 < .370$, an interaction between plural marking and group, $F(2, 48) = 5.279, p = .008, \eta^2 = .180$, and plural marking and age, $F(1, 48) = 11.368, p = .001, \eta^2 = .191$. This indicates that the three groups differed in one of the conditions and that age also played a role in children's ability to associate the plural indefinite to "more than one." Importantly, the results showed that whether the correct response was on the right side (feminine nouns) or left side (masculine nouns) of the display had no effect on Chilean children's ability to associate the plural indefinite to "more than one" ($t(1,39) = -.443, p = .660$).

Focusing first on only the younger children who heard the plural pronounced as [-s], post-hoc independent t -tests revealed that in the Plural Indefinite Condition, MexWC children differed significantly from ChMC children ($t(1,20) = -2.119, p < .05$) and also from ChWC children ($t(1,20) = -6.333, p < .001$). There was a marginal difference between ChWC children and ChMC children in the plural indefinite condition ($t(1,18) = 2.090, p = .051$).

TABLE 11
Experiment 3: Percentage of Target-Like Responses

	<i>Plural Indefinite</i>	<i>Singular Indefinite</i>
Younger Children		
Plural Pronounced as [-s]		
MexWC	87.50 (13.05)	91.67 (16.28)
ChMC	60 (42.81)	97.50 (07.90)
ChWC	25 (31.18)	77.50 (36.22)
Plural Pronounced as [-h]		
ChMC	75 (35.35)	90.50 (12.92)
ChWC	55 (38.73)	87.50 (13.17)
Older Children		
Plural Pronounced as [-s]		
ChMC	92.50 (12.07)	97.50 (7.90)
ChWC	97.50 (7.50)	97.50 (7.90)

While we found that many Chilean children did not associate [-s] to “more than one,” it may be possible that they associate [-h] to “more than one,” as [-h] is the most frequent variant in the spontaneous speech of adults. For this reason, we compared Chilean children’s interpretation of the plural marker when it was pronounced as [-h] to when it was pronounced as [-s]. While there was a increase in the proportion of correct responses in the plural condition, independent *t*-tests revealed that these differences did not reach significance for neither the ChMC children ($t(1,16) = -.796, p = .438$) nor the ChWC children ($t(1,16) = -1.908, p = .073$). This last statistic must be interpreted with caution, as it could be the result of too few subjects; in fact, Table 11 shows that ChWC children systematically treat [-h] as associated to “more than one” much more often than [-s].

Finally, we examined how systematic children were in their response patterns. We define systematicity in the same way as in Experiment 2 above. Examining the data in this way will allow us to determine whether children are overregularizing toward one grammar (e.g., one with plural morphology) or another (e.g. one without plural morphology). Table 12 shows the percentage of children who were systematic in their responses.

Table 12 shows that overall all children were systematic in their responses. They either always associated the plural indefinite to “more than one” or they always associated it to a singular interpretation.

TABLE 12
Experiment 3: Systematic Responses for Plural Indefinite ('unas/unos')

	<i>Systematic Plural Responders</i>	<i>Systematic Singular Responders</i>	<i>Systematic Total</i>	<i>Variable Responders</i>
Younger				
Plural Pronounced as [-s]				
ChWC	20% (2/10)	70% (7/10)	90% (9/10)	10% (1/10)
ChMC	60% (6/10)	40% (4/10)	100% (10/10)	0%
MexWC	100% (12/12)	0%	100% (12/12)	0%
Plural Pronounced as [-h]				
ChWC	64% (7/11)	34% (4/11)	100% (11/11)	0%
ChMC	78% (7/9)	11% (1/9)	89% (8/9)	11% (1/9)
Older				
Plural Pronounced as [-s]				
ChWC	90% (9/10)	10% (1/10)	100% (10/10)	0%
ChMC	100% (10/10)	0%	100% (10/10)	0%

In summary, Experiment 3 reveals the following results:

- (i) Chilean Spanish-speaking children differ from Mexican Spanish-speaking children in their ability to associate the plural marker /-s/ on plural indefinites to “more than one.” While Mexican children are adult-like, many Chilean children are not.
- (ii) Both Chilean and Mexican children are systematic in their interpretation of plural indefinites. Again, children either used plural morphology in comprehension or they did not. Only one child (ChMC) had variable behavior.
- (iii) There is some evidence that more ChWC children associate [-h] to “more than one” than they do [-s].

6.3. Discussion

Does variable input for plural morphology affect children’s ability to associate the plural marker to an interpretation of “more than one”? The results replicate those in Experiment 2. Most Mexican children associate the plural marker [-s] on plural indefinite noun phrases to “more than one,” while many Chilean children do not. Moreover, increasing the formality of the task by presenting the experimental questions within the context of storybook reading did not appear to have an effect on children’s overall ability to associate [-s] to “more than one.” These findings are consistent with the hypothesis proposed above that Chilean children are paying more attention to the lexical nature of the indefinite determiner (i.e., *uno/una*), which is identical in form to the word for “one” in Spanish, and ignoring the plural marker.

However, Experiment 3 also suggests that many more ChWC children associate [-h] on indefinite noun phrases to “more than one” than they do [-s], a finding that appears to be inconsistent with Experiment 2. One major difference between the two experiments is that Experiment 2 used a within subjects design while Experiment 3 used a between subjects design for testing [-s] and [-h]. While Experiment 3 indicates that more ChWC children associate [-h] to “more than one,” the differences were not statistically significant, and so we have little evidence whether children initially map one of the forms (i.e., [-s] or [-h]) earlier than the other. Furthermore, for reasons we do not understand completely, the more informal Act-out task was the context in which the variant [-h] did not help children at all. These results suggest that more research is needed on child perception and production of lenition.

7. CONCLUSION

By examining the acquisition of plural morphology in Mexican and Chilean Spanish, we were able to hold the linguistic feature constant while varying the input type in order to examine the effect that variable input has on the acquisition of grammatical morphology. We set out to address two questions:

- (i) Does variable input for plural morphology affect children’s ability to associate the plural marker to an interpretation of “more than one”?
- (ii) In the context of variable input, what role does frequency play?

Focusing first on question (i), the results indicate that when plural morphology is variably produced in the input, children take longer to associate the plural marker to an interpretation of “more than one” in contexts in which this interpretation is the only available one. By four years of age, Mexican children, but not Chilean children, are adult-like in their use of the plural marker in comprehension and also are adult-like in the production task. However, it is not until six years of age that the Chilean children are able to associate the plural indefinite to “more than one” at adult levels in comprehension. In production, they are also very different than adults and Mexican children, showing mainly bare nominals (plural and singular) in the plural condition.²³

There are two ways we can think about the learning task for acquiring plural morphology in Chilean Spanish under a view that language acquisition involves parameter setting. As we have established before, it is necessary for the child to determine

- (i) if number is grammaticalized or not in the language; and
- (ii) if there is agreement in the language.

It could be that as long as the child is exposed to plural marking on plural nouns for a certain amount of time, variability in the input would not affect acquisition. After all, every time a noun phrase with an overt determiner is produced with the plural marker /-s/ in the Chilean input, it receives a strong plural reading. This should allow mapping of /-s/ to a [PL] feature and that, in turn, should lead to an interpretation of “more than one.” This view seems to be consistent with a triggering-type model, which requires a certain amount of exposure before a parameter is set (i.e., before the child decides that her language has grammatical number). Once enough evidence is gathered, the parameter is set and a form is mapped to a syntactic feature, and that feature may then be automatically linked to an interpretation.

An alternative view, which allows for a competition between different parameter settings, is Yang’s (2002) Variational Model. Under this model, language acquisition is viewed as a probabilistic competition process among possible grammars. Like the triggering model, Yang’s model also takes a parameter setting view of acquisition, assuming an innate set of parameters that is unique to language. Throughout the course of development, the grammar that is most closely aligned with the input will win out, as the model gradually eliminates any hypothesis that is only compatible with a portion of the input data. However, it is also possible under Yang’s model that the evidence for the two grammars can remain stable and become part of the explanation for sociolinguistic variables.

If we adapt Yang’s model to the case at hand, then the competing hypotheses about the grammar would not involve core parameters (V2, for example) *per se*, but instead it would involve determining whether the target grammar has grammaticalized number in the noun phrase or not. If we take UG to make available to the learner a universal set of morphosyntactic features from the outset and represent acquisition as a mapping of these features to forms in the input, then we can schematize the acquisition of grammaticalized number in the following way. First, the learner is presented with a phonological form, which occurs in a variety of linguistic contexts, and acquisition involves determining which morphosyntactic feature, if any, this form might be associated to and mapping it accordingly. More specifically, imagine the child has decided that the language

²³If children are adult like in their production of bare nominals, then all the cases of what we have called bare singulars are in fact bare plurals with lenition of [-s]. If they are not, then there could be cases of true bare singulars as well.

does have number. The learner of Spanish must map the values of the feature number [PL and SG] to several forms in the input. Plural will take the form of *-n* on verbs, *-s* on nouns, not to mention the different plural pronominal forms. Yang's model predicts that the more consistent the evidence in the input for a particular mapping (i.e., the more the form surfaces when a particular meaning is expressed), the more quickly it is acquired, as the model consistently rewards this mapping. Likewise, an input with a more complex distribution (i.e., one that also involves omission of the form, like with the plural in Chilean Spanish) will take longer to acquire, as the mapping of */-s/* to [Plural] is sometimes rewarded and also sometimes punished when a plural noun phrase surfaces without the plural marker (i.e., when */-s/* has been omitted).

In the acquisition of Mexican Spanish, however, the evidence for constructing a grammar with grammaticalized number in the noun phrase is stronger, as semantically plural nouns always occur with a plural marker in the input to Mexican Spanish-speaking children. As such, Yang's model captures very nicely the difference found between Mexican Spanish-speaking children (i.e., consistent input) and Chilean Spanish-speaking children (i.e., variable input) in their acquisition of plural morphology. With respect to agreement/concord, again the Mexican children would receive much more consistent evidence for agreement than the Chilean children.

We now turn to question (ii): what role does frequency play in the context of variable input? Our data suggest that frequency plays a role. We found that Chilean middle-class children were more target-like than Chilean working-class children of the same age, a finding which we believe is related to the fact that Chilean working-class adult speakers omit final */s/* more often than Chilean middle-class speakers (Cepeda 1995). By target-like we mean that adults interpret */s/* as plural 100% of the time. Additionally, frequency seems to determine which overt variant [*-s*] or [*-h*] is more often associated to "more than one." We found in Experiment 3 (but not in Experiment 2) that while Chilean children take longer to associate the plural marker to "more than one," more Chilean children associated the variant [*-h*] to "more than one" than [*-s*].

However, frequency alone cannot account for all of the results. While [*-h*] is by far the most frequent variant in the input (i.e., [*-h*] is more frequent than [*-s*] and [zero]), many Chilean children appear to initially ignore it in comprehension. In other words, in Experiments 2 and 3, many Chilean working-class children were unable to associate [*-h*] (or [*-s*]) to "more than one." Furthermore, we cannot say that [*-h*] is treated by the child as the only marker of plural, since in Experiment 1 they almost never produced [*-h*] in the plural contexts.

It is also interesting that, while [*-s*] is the most infrequent variant in the input to children, there were two Chilean children who performed better on [*-s*] than on [*-h*], yet the opposite pattern was never found. Moreover, in Experiment 1, we found that, when the plural marker was produced by children, [*-s*] and [zero] were the most frequent variants used, which suggests that overall frequency counts of corpus data, without taking into account the social and linguistic contexts in which forms are produced, may not explain patterns in language development.

Finally, when we compare these results cross-linguistically, we find that in languages like English, where the plural marker occurs consistently in the input on the noun, acquisition occurs by two years of age. In Spanish, if frequency alone was the only explanation, we should find children acquiring the plural by around the same age or earlier, even in Chilean Spanish. After all, the plural marker can occur on all elements inside the noun phrase, and not just on the noun. In Chilean Spanish omission of the plural marker on the noun does not always guarantee absence of plural morphology, as the marker can surface on the determiner or on adjectives. Moreover,

unlike English, the Spanish plural marker occurs on pronouns (e.g. *les* ‘them-PL’ v. *le* ‘him/her-SG’) and also on quantifiers (*muchos* ‘many-PL’, *todos* ‘all-PL’). This suggests that while plural morphology is variably produced, the input to Chilean Spanish-speaking children may still show overall more tokens of plural marking than the input to English-speaking children. Yet, English children acquire plural morphology much earlier than Chilean children. While more comparative work is needed, this initially suggests that while input-frequency is important, input-type may be more crucial for determining acquisition paths.

Up to this point we have focused mainly on the comprehension results, ignoring for the moment the production data in Experiment 1. Nevertheless, what we have thus far proposed about the acquisition of plural morphology in the context of variable input requires a discussion of how our production data fits with our comprehension results.

Does the absence of plural marking in Chilean children’s production of plural noun phrases represent an omission due to /s/ lenition or does it indicate that they have not yet acquired plural morphology? To address this question, we believe the most important finding of Experiment 1 is that Chilean children almost never produced plural indefinite noun phrases in the plural condition, which means that they produced virtually no plural-singular minimal pairs. This is interesting in light of the fact that Mexican children, who served as the control group, overwhelmingly produced plural indefinites in the plural condition. In other words, they created perfect minimal pairs in comparison with the singular condition. This difference suggests that input type also affects children’s production of plural morphology. Specifically, we propose that because of the variable nature of the input, Chilean children do not initially map /-s/ to [Plural] and instead rely on the lexical nature of the determiner to assign number to the noun phrase. Because the form of the indefinite is similar to the numeral “one” in Spanish, Chilean children initially associate the indefinite determiner with “one” and, hence, do not use it to express plurality in production. In production, they seem to prefer bare nouns (with or without a plural marker) as a way to describe plural sets. However, it is only by examining comprehension along with production that we can make this argument.

One final question that must be addressed is how we reconcile our results with those that report that children show optionality in their own production when exposed to a consistent input. One well-known example is with the Optional Infinitive Stage, a stage that occurs between two and three years of age, where children optionally produce verbal inflection (Schutze & Wexler 1996; Wexler 1998, 2000), even though in the input to these children verbal inflection is consistently produced. Both an input driven account (Legate & Yang 2007) and a maturational account of the Optional Infinitive Stage (Wexler 1994, 1998) have been proposed. However, even at this early stage, when the input is robust, children quickly arrive at the target language and the other grammars are quickly dismissed, as they are not rewarded. When the input is noisier, it takes longer to reach the target if the input forces the entertainment of various alternative grammatical options (Legate & Yang 2007). We suggest that regularization arises when children cannot understand why the input is variable, in other words, when they cannot make sense of the variation because they have not yet acquired all of the constraints (linguistic and/or extra-linguistic) governing the distribution of the variant forms. And this is, of course, the interesting question: how much and what kind of variability will trigger regularization of a particular grammatical property? What is surprising in our study is the fact that children at age four are still entertaining a nontarget option, suggesting, under this analysis, that the input to ChWC is very complex, perhaps even as complex as inconsistent input.

At the beginning of this article we suggested that by ignoring variability, we take away from the analysis a potential source for explaining different acquisition paths. The results of the three experiments presented here indicate that variability in the input plays a major role in the acquisition of grammatical morphology. Without considering differences in the input type for plural morphology (i.e., variable v. consistent input), we have no explanation for the differences found in the production and comprehension of plural marking by children acquiring these two varieties of Spanish. We propose that an understanding of the effects of variable input on development is essential for understanding how language is acquired more generally, and we believe that by examining the effect of input type on the acquisition of a particular feature in two varieties of a language that are similar in most ways but vary in their production in a very specific way (i.e., in their production of a particular form in the input) will help to shed light on this question.

We must leave for further research two important issues: issues of alternative explanations for the results and issues associated to the mismatch between production and comprehension. In this article, we explored the hypotheses that variability in the input affects the time-course of acquisition of number morphology. It affects both the decision between a grammar with and a grammar without grammatical number and the decision between a grammar with concord/agreement and a grammar without concord. With respect to comprehension, we argued that our results were consistent with some children lacking grammatical number morphology and consequently lacking concord. In other words, some children may have a grammar where all quantity information comes from determiners and quantifiers. However, another possibility is that children have a parsing difficulty. More specifically, they hear the lexical root for the number one, commit to a singular interpretation, and have a hard time revising this analysis. If that is the case, then it must be that the variability is affecting the retrieval of the forms associated to [PL], since the Mexican children had no problem linking [-s] to plural in indefinite noun phrases. Here, as pointed out by a reviewer, there may be alternative explanations associated to the strength of the link between particular forms and a particular feature. We leave this issue for further research.

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