Interrelations between Phonological and Morphological Development in the First Language Acquisition of Spanish Phonology: A Longitudinal Case Study

by

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Abstract

This longitudinal case study analyzes the interaction between phonology and morphology in the development of medial, final lexical and final inflectional codas of Irene, a Spanish-learning child from Asturias, Spain. I observe the child's order of segmental development in light of Polo's (2013) line of investigation, which shows that nasals are favoured over any other phonological category, as well as the fact that phonological development occurs first, while morphology lags behind. On the other hand, this thesis sheds new light regarding the role of stress in the three coda positions (medial, final lexical and final inflectional), suggesting that this prosodic factor does not have an effect on medial codas; however, its role on final codas cannot be independently verified due to the lack of relevant contexts in the dataset. These observations highlight a possible correlation between stress and word finality, which may be potentially applicable for additional languages.

Summary

This study is a detailed analysis of how the phonology (sounds and sound patterns) and morphology (meaning units of language) interact during a child's acquisition of Spanish. The investigation is organized into five chapters, namely, the introduction, background studies, the methodology used in the current study, a description of the results and, finally, a discussion of the most central findings. Through a systematic approach at describing both the phonological and the morphological factors involved in the data, I obtained a new perspective on the main research. In a nutshell, I uncovered a relationship between syllable stress and the acquisition of consonants at the end of words, in line with researchers working in other areas of phonology and phonological acquisition. This new perspective in turn offers a basis for future research, based on an additional child language learners of Spanish and similar languages.

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Chapter 1: Introduction

1 Introduction

The current longitudinal study seeks to uncover the potential interaction between phonology and morphology in the acquisition of Spanish codas. It mainly follows the line of investigation of Polo (2013), who analyses the development of codas across different lexical and morphological contexts in Spanish L1 learners. I also base this research on Lleó (2003), Prieto & Bosch-Baliarda (2006), Ettlinger & Zapf (2011), and Arias-Trejo et al. (2014), whose studies shed light on how the child's phonological and morphological systems work together, and focus on syllable codas in relation to morphological inflection. I summarize this background literature in Chapter 2.

This case study, conducted longitudinally based on data from one Spanish-speaking child named Irene, combines segmental, prosodic and morphological development. A detailed description of the methodology is provided in Chapter 3. I classify codas according to their morpho-phonological status in medial, final lexical and final inflectional positions, and I also pay special attention to their placement relative to both stressed and unstressed syllables. Chapter 4 highlights Irene's developmental patterns for syllable codas across each of the three positions listed above during the period covered by the corpus, which documents the child's speech productions from age 1;01.25 to 2;06.12.

As we will see, Irene's segmental development concurs with Polo's (2013) observations that nasal codas are preferred over any other category in all three positions. Also, the child's morphological development shows similarities with previous investigations which argue that phonology must be mastered before morphemes requiring specific phonological structures can be produced. Lleó (2003) and Polo (2013) claim that stress accelerates the acquisition of codas in Spanish, as stressed syllables are more perceptible and thus easier for the child to replicate. This

observation is also applicable for Catalan codas (Prieto & Bosch-Baliarda 2006). However, the current thesis offers a different account, introducing the paradox that while stress may potentially influence the development of final codas (either lexical or inflectional), however in ways which cannot be independently verified from the available data, this prosodic factor plays no evident role in the development of medial codas. This suggests the possibility of a correlation between stress and word finality in the acquisition of final codas, which I address in my discussion in Chapter 5.

Chapter 2: Background

1 Introduction

In this chapter, I introduce the literature background relevant to the current investigation. I begin with a recent study by Polo (2013) which sets the stage for the discussion to follow. I then summarize the research conducted by Arias-Trejo et al. (2014), Lleó (2001, 2003), Prieto & Bosch-Baliarda (2006), and Ettlinger & Zapf (2011), whose findings are also pertinent for the current thesis.[1]

2 Interaction Between Phonological and Morphological Development in the Acquisition of Spanish: Development of Codas in the First Language[2] (Polo 2013)

2.1 Research Summary

Polo (2013) argues that the study of Spanish phonology should not be separated from other linguistic components of the child's linguistic system, especially its morphology. This claim supports the findings summarized below, where an interrelation between phonology and morphology was found to have an effect on children's language development. For example, Demuth (2007) highlights the importance of looking into the interaction between phonology and morphology in children's acquisition of morphemes. In the same vein, Lleó (2003) argues that the relationship between prosody and morphology has a significant impact on language development. Hence, Polo's study seeks to explain how phonology and morphology operate together during the development of Spanish as first language.

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1 This survey is by no means exhaustive, but does cover the key findings on the topic. For additional information, the reader is invited to consult Aguirre & Marrero (2009), and Marrero & Aguirre (2003) on the acquisition of Spanish morphology. The findings highlighted in both of these articles are fully compatible with the general observations about morphological development documented by the current work.

2 This is my own translation from the original title in Spanish: *Interacción del Desarrollo Fonológico y Morfológico en la Adquisición del Español: El Desarrollo de las Codas en la Lengua Materna*.

Polo's longitudinal analysis was based on two monolingual Spanish-speaking children, named Andrea and Magín, whose production of nasal /n/, rhotic /ɾ/, lateral /l/, and fricative /s/ in coda position was evaluated through *Phon* (Rose et al. 2006). Specifically, Polo was interested in finding whether a child is not able to produce the Spanish morpheme /s/ because of phonological restrictions, or whether the child should be able to produce this phoneme, given that the development of the syllable structure has already been reached but, due to morphological reasons, the child does not produce it.

This study observes the development of codas across different lexical and morphological contexts, i.e. as part of the lexical base, the nominal plural or the verbal morphology (2nd person singular or 3rd person plural) of different verbal tenses in Spanish, located in stressed or unstressed syllables, in word medial or word final position. Table 1 contains some of the words produced by the children during this research.

Table 1: Examples of Spanish words produced by Andrea and Magín (adapted from Polo 2013)

Consonant	Word form	IPA	Gloss
/n/	*están* *vienen* *ventana* *camión*	[es.ˈtan] [ˈbje.nen] [ben.ˈta.na] [ka.ˈmjon]	They are They come Window Truck
/ɾ/	*beber* *barco* *tortuga* *señor* *azúcar*	[be.ˈβeɾ] [ˈbaɾ.ko] [toɾ.ˈtu.ɣa] [se.ˈɲoɾ] [a.ˈθu.kaɾ]	To drink Boat Turtle Sir Sugar
/l/	*soldado* *bolsa* *azul* *el*	[sol.ˈda.ðo] [ˈbol.sa] [a.ˈθul] [el]	Soldier Bag Blue The
/s/	*estás* *pisas* *nubes* *castillo* *fiesta* *adiós* *lunes*	[es.ˈtas] [ˈpi.sas] [ˈnu.βes] [kas.ˈti.ʎo] [ˈfjes.ta] [a.ˈðjos] [ˈlu.nes]	You are You step on Clouds Castle Party Good bye Monday

Polo also intended to find whether production errors were linked to prosodic factors and whether there are parallels between the acquisition of verbal morphology and nominal plural, based on the hypothesis that phonology and morphology interact in the development of the first language.

Polo describes the development of /n/, /ɾ/ and /s/ in word-medial and word-final position, in different morphological contexts, as a lexical base or as a grammatical morpheme, and in relationship to prosody. Lateral /l/ is also analyzed in terms of prosody and word position, but this segment does not represent a grammatical morpheme in Spanish. This research observes the way each segment behaves during the acquisition of Spanish as native language, as well as the hypothesized relationship between prosodic and morphological development.

2.2 Theoretical Frameworks

Polo (2013) describes several theories and models of phonological and morphological acquisition, from 1990 to 2012, which have intended to explain children's production of codas. In the following sections, I only summarize the theories adopted by the researcher in her analysis, which supports her hypothesis on the interaction between phonology and morphology.

2.2.1 The Principles and Parameters Model

Fikkert (1994) proposed a Principles and Parameters Model of phonological development, in order to analyze phonological development from a generative perspective. Fikkert suggested that children acquire syllable structure and stress by learning the parameters of their language. Children set the correct parameter values, which are language-specific, after being exposed to the relevant input from their language. Table 2 exemplifies four developmental stages in the acquisition of rhymes, which were proposed by Fikkert after evaluating 12 children learning Dutch as a first language. At each stage, a new parameter of Dutch is acquired. The Principles and Parameters Model accounts for the progressive improvement of child production.

Table 2: Developmental stages in the acquisition of rhymes (adapted from Polo 2013)

Stage	Acquired Parameter	Example
Stage I	The core syllable: Only CV. No codas are produced.	Child production: [kɑ] Adult production: /klɑːr/ Word form: *klaar* Gloss: prepared
Stage II	The appearance of final obstruents: There is branching of the rhyme.	Child production: [puːs] Adult production: /puːs/ Word form: *poes* Gloss: cat
Stage III	The appearance of final sonorants and vowel length.	Child production: [bom] Adult production: /boːm/ Word form: *boom* Gloss: tree Child production: [tuː][3] Adult production: /buːk/ Word form: *boek* Gloss: book
Stage IV	Mastering vowel length and extra-rhymal consonants: Complex codas are produced.	Child production: [hɑnt] Adult production: /hɑnt/ Word form: *hand* Gloss: hand

2.2.2 Prosodic Phonology

According to the theory of Prosodic Phonology, children must acquire the different components of the prosodic hierarchy in a gradual manner. Fee (1995) and Demuth (1995) were among the first researchers to study language acquisition from this perspective. Demuth (1995) argued that language acquisition is a gradual developmental process which starts from acquiring the first element of the prosodic hierarchy: the foot. It is also expected that children produce the least marked components of the prosodic hierarchy first.

3 Even thought the child deleted coda /k/ from the Dutch word *boek* /buːk/ 'book', he accurately produced the long vowel /uː/, since vowel length is expected to emerge at this stage.

Demuth (1996) provided an explanation for different types of patterns and variation in children's production, and described learners' progressive acquisition of grammatical morphemes. Demuth suggested that prosodic development occurs along four stages. However, unlike Fikkert's (1994) four stages of parameter setting, Demuth based language acquisition on the progressive development of the prosodic hierarchy. Table 3 shows the four prosodic stages of the production of the Dutch word *olifant* /ˈoːliːˌfɑnt/ 'elephant'. The child started by producing only one syllable composed of a consonant and a vowel (CV), without a specific vowel length. On the second stage, minimal words of one binary foot or syllables with two moras start to emerge in the child's production. The third stage shows that prosodic words of more than one foot are allowed and, on the fourth stage, the child is able to properly produce the adult form of the prosodic word.

Table 3: Stages of prosodic development (adapted from Polo 2013)

Stage	Acquired Prosodic Structure	Examples
Stage I	Core syllables: CV	['fɑ]
Stage II	Minimal words or binary feet: (C)VCV (2 syllables) CVC (2 moras) CVV (2 moras)	['hoːtɑ] [fɑut]
Stage III	Prosodic words: More than one foot	['oːfɑ'fɑn]
Stage IV	Prosodic words: Adult-like production	[ˈoːliːˌfɑnt]

2.2.3 Prosodic Morphology

Wijnen, Krikhaar & den Os (1994) argue that even though the semantic and syntactic components are key in the acquisition of morphemes, the interaction between morphology and phonology is

highly important as well. In fact, the prosodic characteristics of morphemes are considered to have an impact on first language acquisition. According to Menn & Stoel-Gammon (1995), morphological development starts even before the phonological development is completed. Polo claims that there is a lack of studies on morphological acquisition from a prosodic perspective.

Polo concurs with Demuth's (2007) Prosodic Licensing Hypothesis, which claims that children's production of morphemes is shaped by the limitations of their phonological competence, rather than the lack of morphological and syntactic development. Morgan & Demuth (1996) claim that there are phonological and prosodic differences between morphemes and lexical bases, and that these differences might have an impact on the first stages of learners' morphological development.

Following the Prosodic Licensing Hypothesis, Song, Sundara & Demuth (2009) found that the English 3rd person singular morpheme /s/ is preferred in verbs with simple codas, e.g. *goes* [ˈgoʊz], rather than in verbs with complex codas, e.g. *looks* [ˈlʊks]. Also, the fricative /s/ is more easily produced as a coda when it is located in final position of the word or utterance. Polo applies the Prosodic Licensing Hypothesis to her research, as she proposes that it should explain the varieties within and between participants in the acquisition of morphemes.

2.3 Method

Polo used a longitudinal approach to observe Andrea and Magín, two monolingual Spanish-speaking children from Madrid, Spain, who were recorded in spontaneous contexts while interacting with their parents at home. The analysis of data started at age 1;7, when both participants produced their first codas, and ended at age 2;7, when they had already reached an advanced level of phonological and morphological development. Magín's recording sessions were conducted fortnightly, and Andrea was recorded weekly. For this research, Polo made a

more narrow selection of both children's recordings. Table 4 provides detailed information of the participants' ages, recordings, number of recording sessions, and number of records documented for each participant during the study.

Table 4: Ages, recordings, sessions and records (adapted from Polo 2013).

	Magín	**Andrea**	**Total**
Ages	1;7-2;7	1;7-2;7	12 months
Minutes of recording	1230 (20.5 hours)	480 (8 hours)	1710 (28.5 hours)
Total sessions	24	12	36
Total records	7069	2716	9785

Polo's research team converted all the recordings to a digital format, as they were originally made in audio cassette and VHS tapes. The team also made their corresponding phonetic transcriptions on *Phon* (Rose et al. 2006). Polo then analyzed the corpus through *Phon*'s query functions, which are specifically designed for phonological analysis. *Phon* allowed the researcher to find the most frequent segments in syllable structures, types of syllable, and stress pattern. Polo followed Costa's (2010) criteria, which suggests that codas are acquired when their production is higher than 80% during two continuous sessions, and not lower than 50% in the sessions thereafter.

2.4 Results

2.4.1 Development of Nasal /n/ in Coda Position

There was no uniformity in Andrea and Magín's acquisition of medial nasal codas within stressed or unstressed syllables. As illustrated in Figure 1, Andrea's performance was not significantly better at producing medial codas in either stressed or unstressed syllables. There are only a few ages when a noticeable difference was seen, but no clear pattern emerges: at age 1;7, 100% of unstressed medial codas were produced, against 50% in stressed syllables; at age 1;10, 12% of

unstressed codas against 50% of stressed codas; and at age 1;11.21, 55% of unstressed codas against 9% of stressed codas. Andrea's production of medial codas thus fluctuates across different stages, which suggests that prosody does not play a significant role in the acquisition of medial codas. Magín performed similar to Andrea in his production of medial codas. As seen in Figure 2, from age 1;9 to 2;2, his unstressed medial codas were sporadic. Later at 2;2.10, medial codas in unstressed syllables kept increasing until they reached the same percentage as stressed medial codas at age 2;6.20. Therefore, there is not an evident pattern which determines whether Magín preferred word-medial codas in stressed or unstressed syllables.

Figure 1: Andrea's lexical and morphological medial nasal codas in unstressed (blue) and stressed (red) position (reprinted from Polo 2013, page 174, Graph 6.27)

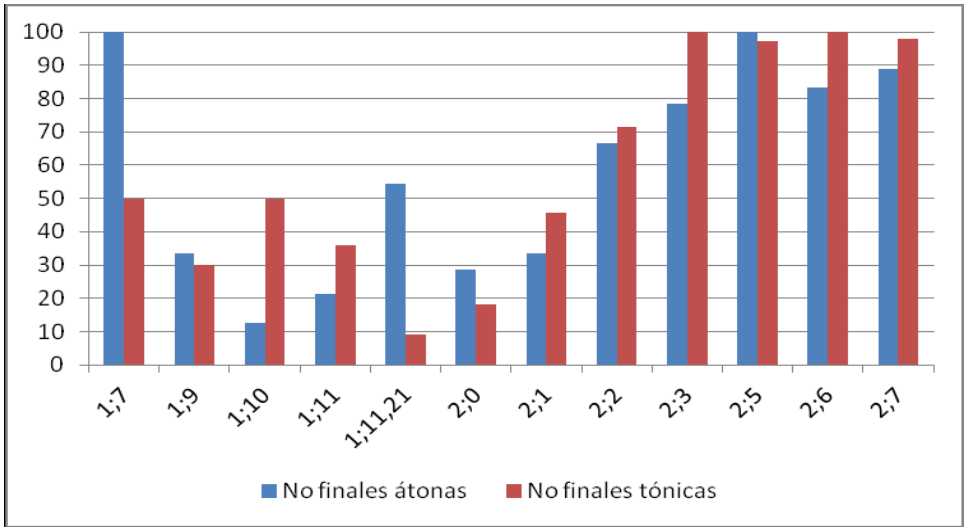
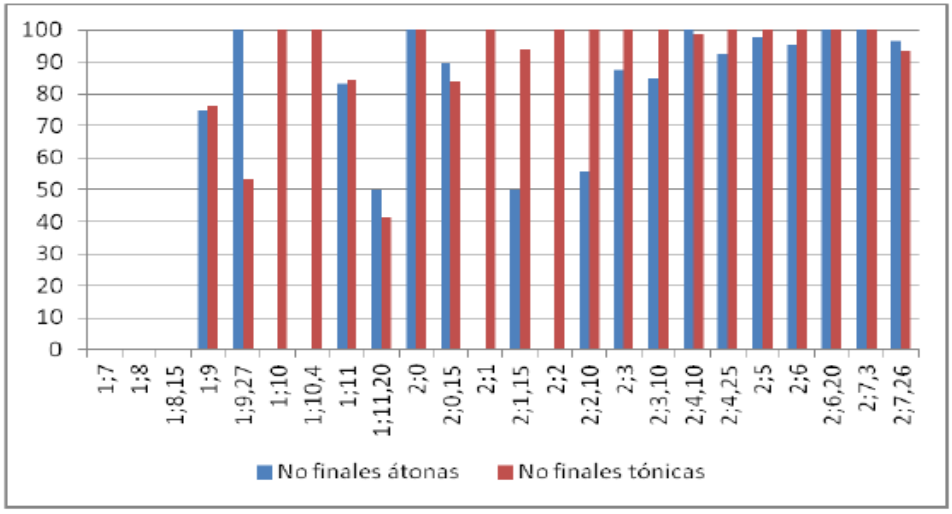


Figure 2: Magín's lexical and morphological medial nasal codas in unstressed (blue) and stressed (red) position (reprinted from Polo 2013, page 175, Graph 6.28)



On the other hand, both children showed a clearer preference for final codas in stressed position. Figure 3 illustrates that the number of stressed final syllables was higher in almost all the sessions. In fact, Andrea's production of unstressed final codas only started at age 1;10, three months after the first recording session. Unstressed final codas were absent for a few months between ages 1;11.21 and 2;0. Later, they continued to gradually increase until 2;6. Figure 4 shows that Magín also preferred final codas in stressed syllables through all the documented period. It was at age 2;3.10 when his production of final codas in unstressed syllables reached more than 80%, and it kept increasing until his last recording session, while his final stressed codas went up to 80% (and higher thereafter) at 2;1.15. This performance was predicted by Borràs-Comes & Prieto (2010), who claimed that position alone is not the crucial variable in the acquisition of codas. According to them, position according to stress pattern offers a better predictor for the realization of syllable codas.

Figure 3: Andrea's lexical and morphological final nasal codas in unstressed (blue) and stressed (red) position (reprinted from Polo 2013, page 176, Graph 6.29)

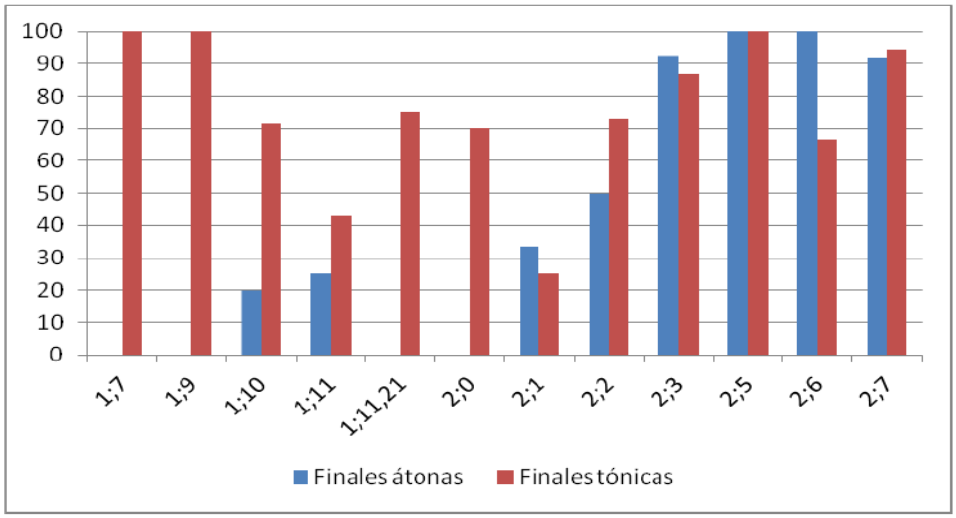
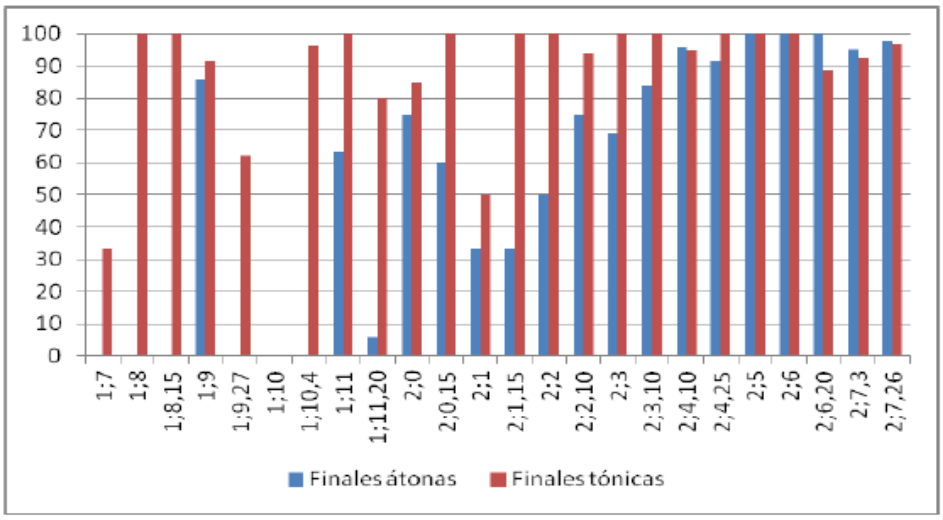


Figure 4: Magín's lexical and morphological final nasal codas in unstressed (blue) and stressed (red) position (reprinted from Polo 2013, page 176, Graph 6.30)



Polo also found that coda position and stress work together with morphological content, given that the latter has an impact on nasal coda acquisition: Morphological nasal codas in stressed position are acquired before morphological nasal codas in unstressed syllables.

On the other hand, frequency alone does not seem to be important, since unstressed syllables are more frequent than stressed syllables in Spanish. Andrea and Magín's performance suggests that some prosodic development is required for the production of morphological codas, and stressed codas appear earlier. Therefore, stress is the relevant variable in the acquisition of nasal morphemes, rather than frequency.

2.4.2 Development of Rhotic /ɾ/ in Coda Position

Rhotic codas had a high number of substitutions: 30% to 40% of the codas produced by Andrea and Magín were substituted. Medial rhotic codas, both stressed and unstressed, were replaced by other liquids or glides. Stressed final codas, either morphological or not, were substituted by aspirated or nasal segments. Given that Andrea prefers medial rhotic codas, and Magín prefers final rhotic codas throughout the longitudinal study, a general conclusion of preference cannot be established, as the participants show different patterns.

It seems that the higher perceptibility of stressed syllables helps children in acquiring stressed rhotic codas, given that there was a higher number of them, even though many stressed rhotic codas underwent substitution earlier than unstressed codas. Adult-like production of codas appeared much later.

Rhotic codas with morphological content indicate the infinitive form in Spanish, as verbs in Spanish have three terminations: *ar* (80% of verbs) and *er*, *ir* (6% of verbs each) (Real Academia Española 2009). The results do not suggest that morphological content is determining in the production of rhotic codas, given that the production percentages are low until the participants reach an advanced linguistic development, at age 2;5 for Andrea, who produced 60% of grammatical codas, and at age 2;1.15 for Magín, with a production of 50%. The results show

that the production of rhotic codas in Spanish is more influenced by segmental and prosodic characteristics of the segment, rather than by frequency or morphological content.

2.4.3 Development of Fricative /s/ in Coda Position

The fricative alveolar segment /s/ is the most frequent coda in Spanish. It appears in medial and final codas as part of the lexical word, or as a morpheme in final position, representing nominal plural in nouns, adjectives, determiners and pronouns, or as part of verbal inflections. Table 5 exemplifies the use of the fricative /s/ in a few Spanish codas:

Table 5: Examples of fricative /s/ in Spanish codas

	Lexical /s/	**Morphological** /s/
Medial Word Position - Stressed	*pa<u>s</u> ta* ˈpas.ta pasta	-------
Medial Word Position - Unstressed	*ba<u>s</u> tón* bas.ˈton cane	-------
Final Word Position - Stressed	*a dió<u>s</u>* a.ˈðjos bye	*es tá<u>s</u>* es.ˈtas you are (sg.)
Final Word Position - Unstressed	*en ton ce<u>s</u>* en.ˈton.θes therefore	*mu ñe ca<u>s</u>* mu.ˈɲe.kas dolls

As a nominal morpheme, /s/ appears in determiners: *lo<u>s</u>* ‘the (mc.)’, adjectives: *amable<u>s</u>* ‘kind (pl.)’, nouns: *silla<u>s</u>* ‘chairs’, and pronouns: *ella<u>s</u>* ‘they (fm.)’. Verbal inflections include the second person singular of present indicative: *juega<u>s</u>* ‘you play’, first person plural of present indicative: *cantamo<u>s</u>* ‘we sing’, second person singular of present perfect: *ha<u>s</u> dormido* ‘you have slept’, and second person singular of the negative form of present subjunctive: *no salte<u>s</u>* ‘do not jump’.

As shown in Figure 5, Andrea starts the acquisition of fricatives with stressed lexical codas at age 1;11 with a 60% accuracy rate. There is a low percentage (<10%) of plural codas produced at this same age. Nominal plural codas increase at age 1;11.21, reaching more than 10%. At 2;6, Andrea produces 90% of plural nominal codas, as well as unstressed lexical codas. However, there is no clear preference over morphological codas, since there is also a significant production of stressed non-morphological codas. Figure 6 illustrates that Magín's production of plural nominals begins at 1;11.20. His morphological codas go up to 80% at 2;4.10, and they continue to go higher until age 2;7.26. Magín's percentage of morphological codas and final lexical codas in stressed syllables is similar since his first session, with unstressed lexical codas lagging behind during the developmental process.

Figure 5: Andrea's production of unstressed (blue) and stressed (red) lexical /s/, and plural nominal /s/ (green) (reprinted from Polo 2013, page 298, Graph 6.140)

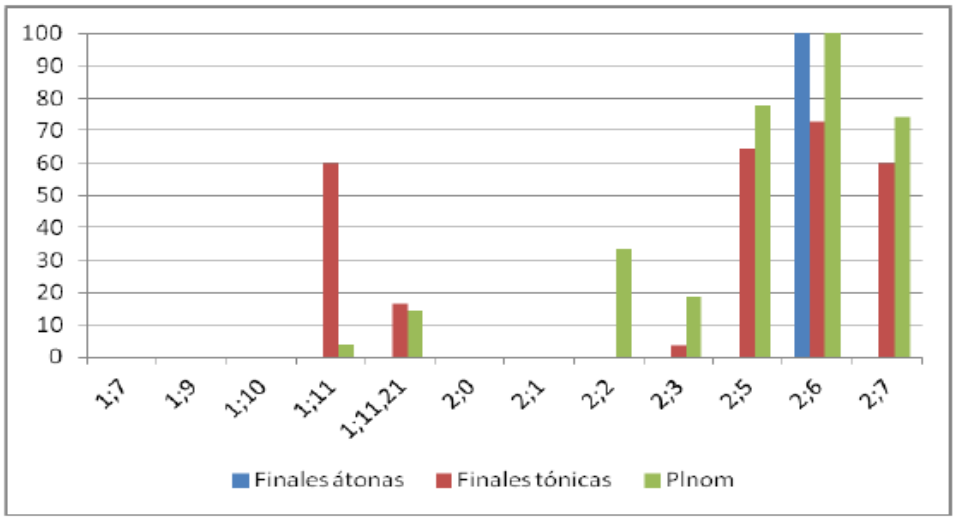
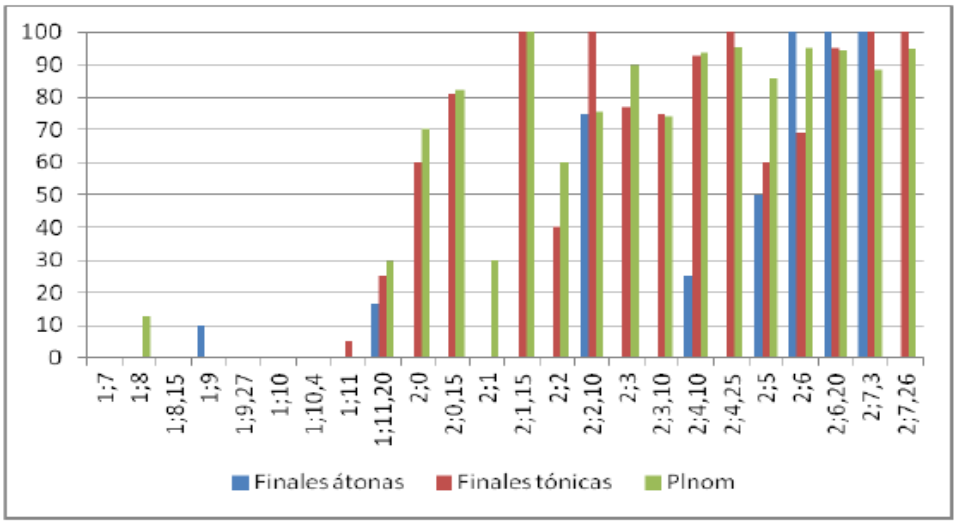


Figure 6: Magín's production of unstressed (blue) and stressed (red) lexical /s/, and plural nominal /s/ (green) (reprinted from Polo 2013, page 300, Graph 6.142)



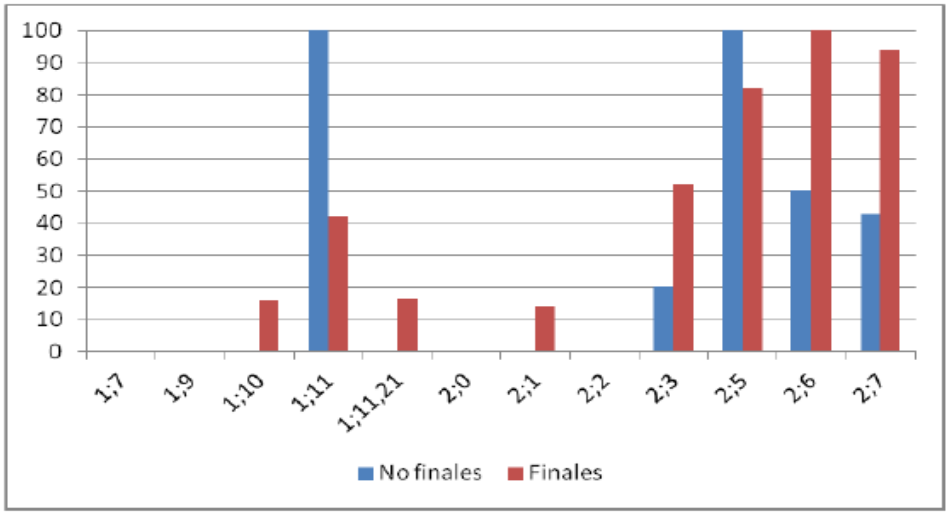
Polo found that both Andrea and Magín produce stressed lexical codas earlier than unstressed ones, since this type of coda is more perceptible than unstressed codas. Months later, nominal plural codas in unstressed syllables are produced. This suggests that prosody is key in the process of acquisition of plural codas, given that plural unstressed codas are more frequent in Spanish than stressed ones.

A similar pattern is found in verbal inflections, since the first codas produced are stressed, followed by unstressed inflections. Between ages 1;11 and 2;3, both children substitute unstressed codas with the aspirated /h/ or the glide /j/. Conversely, substitution rates are much lower in stressed codas. After Andrea and Magín have reached an advanced level of prosodic development, their morphological development, as well as frequency, establish the order of acquisition of the nominal plural and verbal inflections. When comparing the production of nominal plurals with verbal inflections, the former are slightly preferred. According to Polo (2013), this preference is due to the higher frequency of plural inflections in Spanish.

2.4.4. Development of Lateral /l/ in Coda Position

As already mentioned, lateral codas in Spanish are not inflectional. Although they may be part of derivational morphemes, for the purpose of this study, /l/ is only considered as a lexical coda. Laterals are present in word medial position, e.g. *fa<u>l</u>da* 'skirt', and word final position, e.g. *azu<u>l</u>* 'blue'. As seen in Figure 7, Andrea started the production of final lateral codas at age 1;10. One month later, the production of medial codas reaches 100%. From 1;11.21 to 2;2, there is a low production of lateral codas. In fact, they are not attempted at all in some of the recording sessions. Only final codas are produced in two out of four sessions. At 2;3, Polo found an increase in accuracy of final codas and a decrease in medial codas.

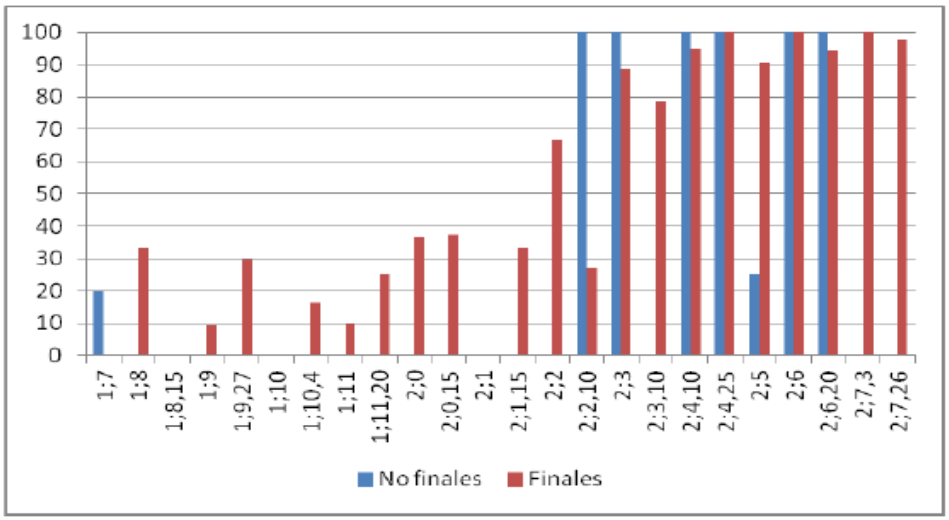
Figure 7: Andrea's production of medial (blue) and final (red) lateral codas in Spanish (reprinted from Polo 2013, page 244, Graph 6.92)



By comparison, Figure 8 shows that Magín has a slight preference for final over medial codas. Even though his first production of lateral codas is in medial position at age 1;7, his production of final codas goes from 30% at age 1;8, to 88% at age 2;7.26, in his last session. Magín does not

attempt to produce medial codas until age 2;2.10, and he produces 100% of medial codas at 2;6.20. His last two recording sessions show no attempts at medial codas.

Figure 8: Magín's production of medial (blue) and final (red) lateral codas in Spanish (reprinted from Polo 2013, page 245, Graph 6.93)



According to Polo's findings, Magín acquired lateral codas earlier than Andrea. This segment was produced for the first time at an early age by both participants. Nevertheless, they reach high percentages of production when their phonological development is more advanced; at ages 2;2 for Magín and 2;3 for Andrea, the production of medial and final codas becomes significantly more frequent.

Polo's research highlighted the interaction between phonological and morphological development of codas in Spanish. The performance of both participants provides evidence of how these two grammar components interrelate in the production of codas: They first emerge as part of the development of syllable structure. Then the acquisition of each morpheme is necessary for the production of morphological codas. Stressed morphological codas are acquired first, given

that they are more perceptible. Therefore, according to Polo (2013), prosody has more influence in accelerating the acquisition of Spanish codas, whether they carry morphological content or not. Morphological codas emerged in the same order as lexical codas: First sonorants, then obstruents. Fricative morphological codas in nominal plurals are produced before verbal inflections; this is potentially due to the frequency of number agreement in Spanish.

3 Spanish-Speaking Children's Production of Number Morphology (Arias-Trejo, Abreu-Mendoza & Aguado-Servín 2014)

3.1 Research Summary

Arias-Trejo et al. (2014) claim that learners of languages like Spanish or French, whose determiners, adjectives, nouns and verbs contain morphological information, must acquire the rules required to form the grammatical number, and then generalize them to their speech. One of children's difficulties in producing the plural forms of words correctly concerns plural allomorphs, which are not acquired at once. For instance, learners of Palestinian Arabic tend to acquire feminine plurals earlier than masculine and broken plurals. Another linguistic constraint is the phonological shape of words. Previous studies (e.g. Polite 2011) have found that nouns in English which end in a vowel display final inflections before nouns ending in a consonant. However, given that Spanish only has two plural allomorphs: /s/ and /es/, Arias-Trejo et al. hypothesize that children might acquire plural forms earlier, compared to other languages such as English, German or Palestinian Arabic.

A study on Spanish plurals conducted by Pérez-Pereira (1989) found that children from three to six years of age had less difficulties with plural words formed with /s/, than with plurals formed with /es/. Arias-Trejo et al. provide three hypotheses for these results. The first hypothesis argues that there is a low frequency of nouns requiring the allomorph /es/ in

children's lexicon. Thus, frequency difference between the two plural allomorphs /s/ or /es/ in Spanish might explain the earlier production of plural nouns formed with the more common allomorph. The second hypothesis suggests that learners' preference for the allomorph /s/ might be due to the fact that the stems of nouns which require /es/ all end with a coda. Examples (1) and (2) show two singular nouns ending in a vowel, which require the allomorph /s/ to form their plural, whereas the singular nouns in (3) and (4) have a coda in word final positions, thus, they use the allomorph /es/ in their plural form.

(1)	*mesa (sg.)*	*mesas (pl.)*
	table	tables
(2)	*zapato (sg.)*	*zapatos (pl.)*
	shoe	shoes
(3)	*reloj (sg.)*	*relojes (pl.)*
	watch	watches
(4)	*televisor (sg.)*	*televisores (pl.)*
	television	televisions

The third hypothesis concerns word length, encoded through syllable count, given that adding an extra syllable to use the allomorph /es/ possibly involves a higher processing load, resulting in a more protracted developmental curve for these words. Hence, children might find it more difficult. Examples (3) and (4) also illustrate that nouns become one syllable longer when the plural allomorph /es/ is affixed to the word stem. The study by Arias-Trejo et al. (2014) intends to test the previous assumptions through the experiment described below.

3.2 Objectives

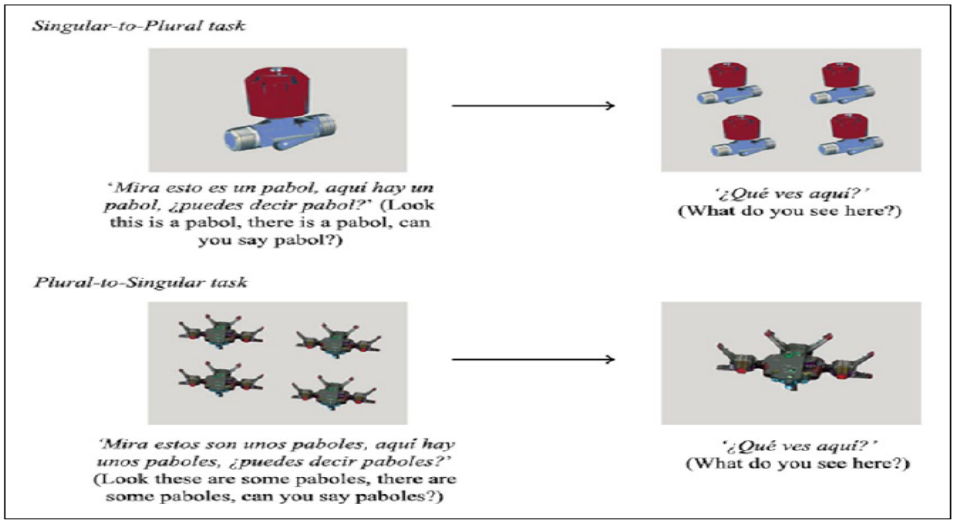
Arias-Trejo et al.'s research pursues two main objectives: (1) to analyze children's ability to produce the Spanish plural allomorphs /s/ and /es/; (2) to describe children's production of noun

phrases (NP) using number agreement. For the purpose of the current discussion, I will only focus on the first objective, about the acquisition of plural allomorphs.

3.3 Experiment

Arias-Trejo et al. (2014) conducted an experiment with a group of 38 Spanish-speaking three-year-old children, in which noun familiarity and the use of plural morphology were evaluated. More specifically, the researchers analyzed children's abilities to pluralize and singularize nouns, and to use plural allomorphs in their speech productions. In this experiment, as shown in Figure 9, children's tasks were to pluralize and singularize the nouns which belonged to the object(s) that they were shown in a picture.

Figure 9: Experiment of pluralization and singularization (reprinted from Arias-Trejo et al. 2014, page 378, Figure 1)



The experiment included real and pseudo words, each monosyllabic, disyllabic or trisyllabic in length, and whose plurals were formed by the allomorphs /s/ or /es/. Arias-Trejo et al. hypothesized that, should phonological properties of these words affect children's ability to

produce the correct plural form, it would be more difficult for them to acquire real and pseudo words requiring the plural allomorph /es/.

3.4 Results

As seen in Figure 10, Arias-Trejo et al. (2014) found that children had more difficulties at pluralizing than at singularizing. Even though children performed slightly better at using the correct allomorph in real words, word familiarity (represented as '*real nouns*' vs. '*pseudo-words*' in Figure 10) did not have an impact on children's preference for the allomorph /-s/, and neither did syllable count, shown in Figure 11 as '*disyllabic*' and '*trisyllabic words*'. Both figures show similar performance concerning both noun familiarity and length conditions. However, Figure 11 describes a clear preference for nouns formed by the plural allomorph /s/, compared to /es/, which had a lower number of correct productions. Arias-Trejo et al. argue that difficulties with plural forms requiring the allomorph /es/ are due to the fact that their singular nouns end in a consonant, which implies that children prefer to pluralize nouns ending in a vowel. It is not clear, however, whether this could relate to the shape of the allomorph /es/ or to its overall lower occurrence in the language.

Figure 10: Children's performance in word familiarity (reprinted from Arias-Trejo et al. 2014, page 379, Figure 3)

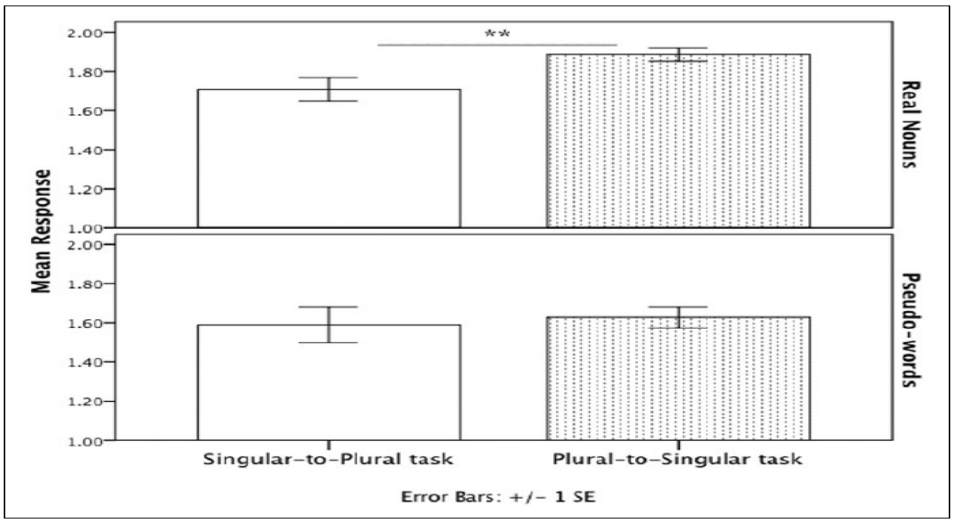
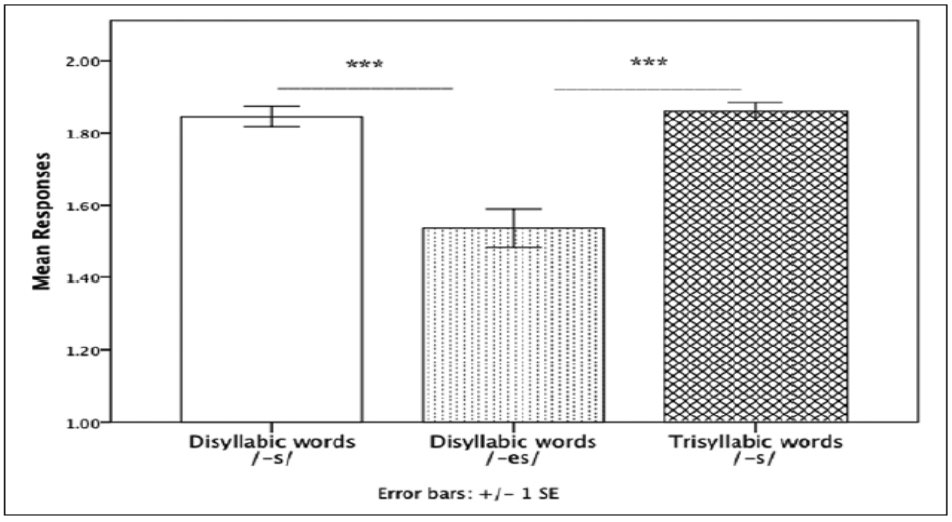


Figure 11: Children's performance in syllable count and allomorphs (reprinted from Arias-Trejo et al. 2014, page 379, Figure 2)



Arias-Trejo et al.'s research provides evidence for the effect that final codas in Spanish may have on three-year-old children's expression of grammatical number, in relation to the type of allomorph required in vowel- vs. consonant-final word stems. This suggests an interaction

between phonological and morphological development, attributed mainly to phonological factors.[4]

4 The Interface of Phonology and Syntax: The Emergence of the Article in the Early Acquisition of Spanish and German (Lleó 2001)

4.1 Research Summary

This study shows that not only do phonology and morphology interact in the process of language acquisition, as described in other studies above, but there is also an interrelation between phonology and syntax. Lleó analyzed this interrelation in order to provide evidence for the different components of grammar which work together in early speech production.

4.2 Participants and Method

Three Spanish children from Madrid and four German children from Hamburg between 1;5 and 2;3 participated in this longitudinal study. The participants were recorded in spontaneous contexts, playing with toys or interacting with their parents, as part of a larger corpus documenting these children's phonological development starting at age 0;9. The Spanish speakers' sessions occurred once a month for the duration of the study, while the German speakers were recorded twice a month until 1;8, and then on a monthly basis. Lleó evaluated their production of nouns, and their use of filler syllables, articles and proto-articles before nouns.

4.3 Findings

Lleó (2001) observed that Spanish children produced their first articles and proto-articles around age 1;4 at the one-word stage. However, the German children did not show any production of

4 See Zamuner, Kerkhoff & Fikkert (2012) for generally similar results in the development of word-final codas in Dutch.

these determiners alongside their isolated word productions; they produced their first articles between ages 1;7 and 1;8 in longer utterances.

Figure 12: Production percentage of articles and proto-articles before nouns in Spanish and German children (reprinted from Lleó 2001, page 28, Figure 2)

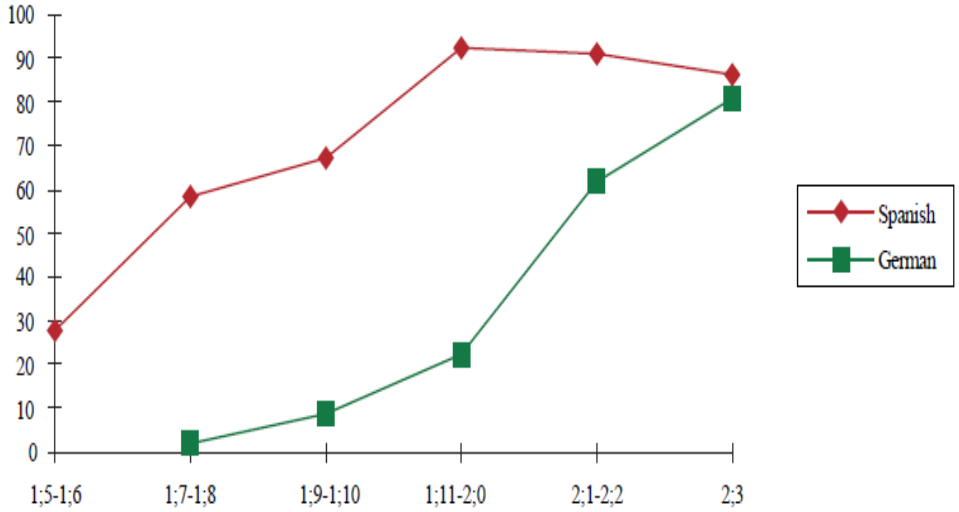


Figure 12 shows the mean percentage of both groups' productions for every two-month time period covered by the study. Lleó found a striking difference between the Spanish and the German group. Spanish children produced 26% of articles and proto-articles between 1;5 and 1;6, whereas German children only produced 2% at age 1;7-1;8. There is a constant increase in Spanish children's acquisition of determiners, until the interval of ages 1;11-2;0, where the performance appears to reach a plateau. On the other hand, German children's performance keeps improving until both groups reach similar percentages, at age 2;3.

Lleó intended to find an explanation for the fact that Spanish learners were able to produce determiners at the one-word stage for the first time, while German learners began to produce them within longer sentences. For this, Lleó analyzed the prosody of determiners in both languages through Optimality Theory (OT), the framework she used to capture the different

characteristics of determiners in Spanish and German. Table 6 contains a set of examples retrieved from Lleó's (2001) research, where she illustrates how both groups of children produced determiners.

Table 6: Examples of determiners plus nouns produced by German and Spanish learners (adapted from Lleó 2001, page 29)

Language	Sentence	Gloss	Child
German	(5) hier[dɐ] Feuer *das*	'here the fire'	Johannes (2;0.11)
German	(6) noch[ajm] Waggon *ein*	'one more waggon'	Johannes (2;1.9)
German	(7) hat [de:ɐ] Papa gesagt *der*	'daddy has said'	Britta (2;3.23)
Spanish	(8) mira [ɛh]guau guau *el*	'look at the dog'	María (1;10.17)
Spanish	(9) Tiene *una* (es)trellita	'(she/he) has a little star'	Miguel (1;10.18)

According to Lleó, in example (5), the German determiner was realized as an unstressed syllable, and it was attached to the previous word as an enclitic. Example (6) shows the determiner with a place-assimilated nasal, which is also attached to the previous word. In example (7), the determiner forms an independent stressed syllable before the noun. Regarding Spanish, Lleó claims that determiners are unstressed, constitute a weak syllable, and are usually proclitics, as seen in (8). When determiner + noun are produced in longer sentences, they usually follow a disyllabic word, such as *tiene* in (9); determiner + noun also form a different intonation curve. Finally, example (9) shows that the determiner *una* 'a' was used as a filler syllable for /es/ in *es*trellita 'little star'. Filler syllables were more common in Spanish than in German; while both groups produced a high percentage of filler syllables, German fillers decreased sooner than the

Spanish ones. This implies that German children were able to produce a higher number of full determiners earlier. Lleó claims that the difference in the production of articles and proto-articles can only be accounted for by their prosodic structure, according to their language. Spanish determiners are reduced because they are proclitics that form unstressed syllables, e.g. *[el [pato]$_F$]$_{PW}$*[5] 'the duck'. German determiners are better produced because they either form independent feet and are stressed, e.g. *[die]$_F$ [Klappe]$_F$* 'the lid', or they correspond to the target reduced form of the determiner when they are unstressed, e.g. *Mario [hat' n] Hund gesehen* 'Mario has a dog seen'.[6]

Lleó thus suggests that prosodic differences, rather than syntactic ones, can account for both groups' performance in the acquisition of articles and proto-articles. This study also shows that children are sensitive to prosodic units; thus, phonology is highly influential in the acquisition of other components of children's grammar, such as syntax.

5 Prosodic Licensing of Codas in the Acquisition of Spanish (Lleó 2003)

5.1 Research Summary

Lleó observed the longitudinal data obtained from two monolingual Spanish-learning children from Madrid, and analyzed their development of syllable codas. For this study, Lleó considered word position, stress pattern and the presence of codas in determiners, as she saw the need to relate the production of segments with prosodic and rhythmic development, as well as studying the link between prosody and morphology, given that, according to her previous study (Lleó 2001), prosody and syllable stress are highly influential in the development of Spanish phonology.

5 F: Foot. PW: Phonological Word.
6 Example retrieved from Kupisch (2007).

In this research, Lleó formulated two hypotheses about the acquisition of codas, based on word position. On the one hand, she hypothesized that children would produce medial and final codas simultaneously, since both require the acquisition of the branching rhyme parameter, proposed by Fikkert (1994) in her Principles and Parameters Model (explained in Table 2). However, considering that most final coda consonants in Spanish are coronals, and medial coda consonants may have other features, depending on the place of articulation of the adjacent onset, Lleó entertained another possibility for the acquisition of codas, that final codas are produced earlier because their place of articulation is predictable, and therefore potentially underspecified, and medial codas are acquired later, since they might pose a higher degree of representational difficulty. Also, Lleó predicted that children would intend to produce the lateral /l/ of the definite article *el*, the nasal /n/ of the indefinite article *un*, and the fricative /s/ which contains morphological information of plural nominal, at an earlier stage, with the purpose of being better understood, since these segments carry more grammatical content than any lexical coda.

5.2 Method

As mentioned already, the corpus analyzed in this research comprises recordings of spontaneous productions of two Spanish-speaking children. Their names are José and María. Both participants are monolingual, and the recording sessions were conducted at home, on a monthly basis, in the presence of the children's mother and one researcher. The participants were recorded since age 1;0. However, Lleó only included the sessions when the children tried to produce their first words with codas, until ages 2;2 (José) and 2;3 (María).

5.3 Results

In the first recording sessions, the participants produced virtually no codas at all. At age 2;2, José produced only 15%, and at 2;3, María produced only 21% of final codas, regardless of their stress pattern. As seen in Table 7, José produced only one unstressed final coda at 2;0. There were no other productions of unstressed final codas until the end of the documented period. José's overall percentages of production of stressed final codas were low, except at ages 1;9 (24%) and 2;2 (20%). In his last recording session, José reached 47% of stressed medial codas and 9% of unstressed medial codas. According to Table 8, María also produced a few stressed final codas at age 2;1 (16%), and two months later, in her last session, the percentage went up to 28%. She did not produce any unstressed final codas during the study. Regarding medial codas, María's performance was slightly better. She produced 26% of stressed and 17% of unstressed medial codas at age 2;3 (many of Maria's codas were substituted by glides).

Table 7: Codas produced by José according to word position and stress (adapted from Lleó 2003, page 265, Table 1b)

José	**Final Codas**				**Medial Codas**			
Age	**Stressed Target**	**Child**	**Unstressed Target**	**Child**	**Stressed Target**	**Child**	**Unstressed Target**	**Child**
1;5	1	0% (0)	1	0% (0)	-		1	0% (0)
1;6	1	0% (0)	-		5	40% (2)	-	
1;7	22	5% (1)	1	0% (0)	8	37% (3)	3	0% (0)
1;9	29	24% (7)	6	0% (0)	34	3% (1)	16	6% (1)
1;10	10	0% (0)	5	0% (0)	63	19% (12)	16	0% (0)
1;11	21	0% (0)	10	0% (0)	77	5% (4)	25	12% (3)
2;0	31	13% (4)	14	7% (1)	83	14% (12)	39	10% (4)
2;2	30	20% (6)	11	0% (0)	74	47% (35)	32	9% (3)

Table 8: Codas produced by María according to word position and stress (adapted from Lleó 2003, page 266, Table 2b)

María	**Final Codas**				**Medial Codas**			
Age	**Stressed Target**	**Child**	**Unstressed Target**	**Child**	**Stressed Target**	**Child**	**Unstressed Target**	**Child**
1;3	5	20% (1)	-		-		-	
1;4	6	0% (0)	-		2	50% (1)	3	67% (2)
1;6	16	0% (0)	1	0% (0)	8	50% (4)	4	75% (3)
1;7	37	0% (0)	6	0% (0)	1	0% (0)	4	50% (2)
1;10	37	0% (0)	7	0% (0)	9	0% (0)	8	38% (3)
2;0	19	0% (0)	4	0% (0)	5	20% (1)	9	22% (2)
2;1	19	16% (3)	1	0% (0)	23	39% (9)	9	44% (4)
2;2	13	8% (1)	6	0% (0)	13	23% (3)	12	17% (2)
2;3	36	28% (10)	11	0% (0)	23	26% (6)	12	17% (2)

Table 9 shows that José started to acquire codas in determiners at age 1;10, reaching 56% at 2;2. His epenthetic codas in final and medial word position were significantly low. According to Lleó (2003), *epenthetic codas* are glides added by the child as codas of target open syllables. For instance, *rana* /ˈrana/ ‘frog’ was produced as [ˈhajna] by María. In comparison, as seen in Table 10, María produced codas in determiners for the first time at 1;6. Between ages 1;4 and 2;0, María epenthesized a high number of sonorant medial codas (glides) in stressed syllables.

Table 9: José's codas of determiners and epenthetic codas (adapted from Lleó 2003, page 265, Table 1c)

José	**Codas of Articles**		**Epenthetic Codas**	
Age	**Target**	**Child**	**Final**	**Medial**
1;7	-		0	1
1;9	-		0	0
1;10	3	67% (2)	4	2
1;11	39	21% (8)	0	3
2;0	60	52% (31)	0	1
2;2	43	56% (24)	0	1

Table 10: María's codas of determiners and epenthetic codas (adapted from Lleó 2003, page 266, Table 2c)

María	**Codas of Articles**		**Epenthetic Codas**	
Age	**Target**	**Child**	**Final**	**Medial**
1;3	-		0	1
1;4	2	0% (0)	0	13
1;6	8	25% (2)	0	17
1;7	5	40% (2)	0	39
1;10	4	50% (2)	0	10
2;0	3	33% (1)	0	14
2;1	10	40% (4)	0	1
2;2	4	0% (0)	0	4
2;3	8	38% (3)	0	2

These results show that medial codas appeared earlier than final codas, and stressed codas were preferred over unstressed codas. The plural morpheme /s/ was not realized in any session. Also, María produced nasal and lateral codas in determiners earlier than in other words, while José produced both nasal and lateral codas simultaneously in determiners and lexical words.

Lleó's hypothesis on the order of acquisition of codas, based on word position, suggested that final codas would appear first, due to their underspecified place of articulation. Likewise,

final /s/ was expected to emerge at an early stage, because of its significant morphological content. However, this research failed to validate Lleó's hypotheses. Instead, Lleó claims that codas in stressed syllables were produced before unstressed codas, due to the fact that stressed syllables are heads of feet, and a higher prosodic profile makes it easier for learners to replicate segments in coda position. Lleó also evaluated the interaction between phonology and morphology in the acquisition of codas. Regarding codas of plural nominals (fricative /s/) in particular, they were not acquired earlier, contrary to what Lleó had anticipated, because plural nominal /s/ is typically located within unstressed syllables. Thus, children's prosodic development needs to allow for the correct production of codas in unstressed syllables, so that morphology can properly manifest itself.

6 The Development of Codas in Catalan (Prieto & Bosch-Baliarda 2006)

6.1 Research Summary

Prieto & Bosch-Baliarda (2006) analyzed the acquisition of codas in Catalan, and the interaction of stress, within-word position, minimality effects, morphology, and segmental content, in the process of development. Their objective was to evaluate whether the acquisition of codas in Catalan is governed by markedness or language-specific properties. In this study concerning segmental content in particulars, Prieto & Bosch-Baliarda evaluated segmental complexity of coda production, as they expected some segments to be more difficult to acquire than others.

6.2 Participants

Four Catalan-speaking children between age 1;5 and 2;8 participated in this longitudinal study. Catalan was the exclusive language at home for two of the participants, whereas the other two had some contact with Spanish at home through their baby sitters. Recordings were made on a

monthly basis. The following table provides more detail about these participants and their records.

Table 11: Data used for the research (adapted from Bosch-Baliarda 2006, page 241, Table 1)

Name	Number of Sessions	Age Range
Gisela	12	1;8.3-2;8
Guillem	15	1;1.29-2;8
Laura	12	1;7.20-2;8
Pep	13	1;1.28-2;8

6.3 Catalan Codas

Prieto & Bosch-Baliarda argue that Catalan codas allow a maximum of two consonants in word-medial position, and three consonants in word-final position; however, codas with more than one consonant occur only at relatively low frequency. Just like Spanish, some word-final codas in Catalan carry morphological information, i.e. /s/ indicates nominal plurals, and /s/, /m/, /w/, /n/ indicate verbal inflections. Some examples are shown below.

Table 12: Examples of Catalan codas (adapted from Prieto & Bosch-Baliarda 2006, page 241)

	Nominal plural /s/	**Verbal inflection** /s/	**Verbal inflection** /m/	**Verbal inflection** /w/	**Verbal inflection** /n/
Catalan word	*case<u>s</u>*	*cante<u>s</u>*	*cante<u>m</u>*	*cante<u>u</u>*	*cante<u>n</u>*
IPA	ˈkazəs	ˈkan̪təs	kən̪ˈtɛm	kən̪ˈteu	ˈkan̪tən
Gloss	Houses	You sing	We sing	You.pl sing	They sing

Likewise, codas are more frequent in stressed syllables than in unstressed syllables. Therefore, Prieto & Bosch-Baliarda expected for the participants to prefer codas in stressed position, rather than in unstressed position. They predicted this preference due to the high perceptibility of

stressed syllables, which might facilitate the acquisition of codas in this prosodic context. Previous studies of Spanish (Lleó 2003) and European Portuguese (Freitas, Miguel & Hub Faria 2001) provide evidence to support this hypothesis, since they found that the percentage of codas produced in stressed syllables was higher than that in unstressed syllables (see also the other studies summarized throughout this chapter).

6.4 Findings

Prieto & Bosch-Baliarda (2006) did not obtain significant results to support their hypothesis about segmental complexity (i.e. language-specific constraints that govern the order of emergence of segments), given that two of the children were able to produce one segment in coda position only when this segment was located in a stressed syllable, while the same segment underwent deletion in unstressed syllables.

Table 13: Production of codas in stressed syllables (adapted from Prieto & Bosch-Baliarda 2006, page 248)

Catalan Word	Adult Form	Child Form	Gloss	Child
*pantalo**n**s*	pəntəˈlo**n**s	pətəˈlo**n**s	Trousers	Gisela 2;4.25
*áne**c***	ˈanə**k**	ˈana_	Duck	Laura 2;11.17
*porque**t***	purˈkɛ**t**	puˈkɛ**t**	Piglet	Laura 2;11.17

Table 13 shows how Gisela and Laura have already acquired the ability to produce sonorant /n/ or obstruent /t/ in stressed codas, while the same consonants were deleted in unstressed syllables, as in the first /n/ in ‘trousers’ or the final /k/ in ‘duck’ (the same behaviour was observed in the other two participants; however, in the previous table and in the following figures of this section, I am only showing the results from two specific children in an attempt to be brief.) The examples in Table 13 provide clear evidence for the role of stress in the acquisition of codas.

As seen in Figure 13 and Figure 14, the percentage of codas produced in unstressed syllables is always lower than that in stressed syllables, except for Guillem at age 3, for whom both productions reach the 100% accuracy mark. This shows that, through time, the development of unstressed codas appears to systematically lag behind that of stressed codas.

Figure 13: Frequency of coda production in stressed vs. unstressed syllables (Guillem) (reprinted from Prieto & Bosch-Baliarda 2006, page 251, Figure 4)

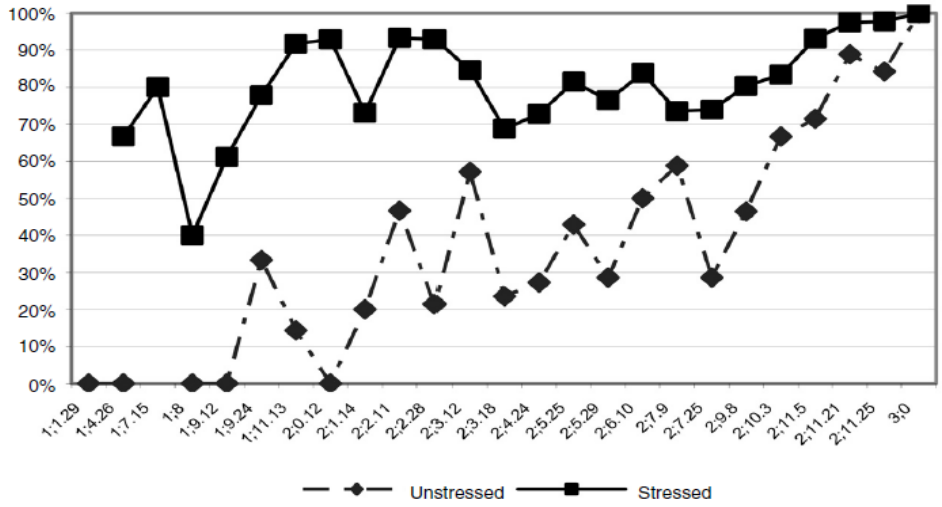
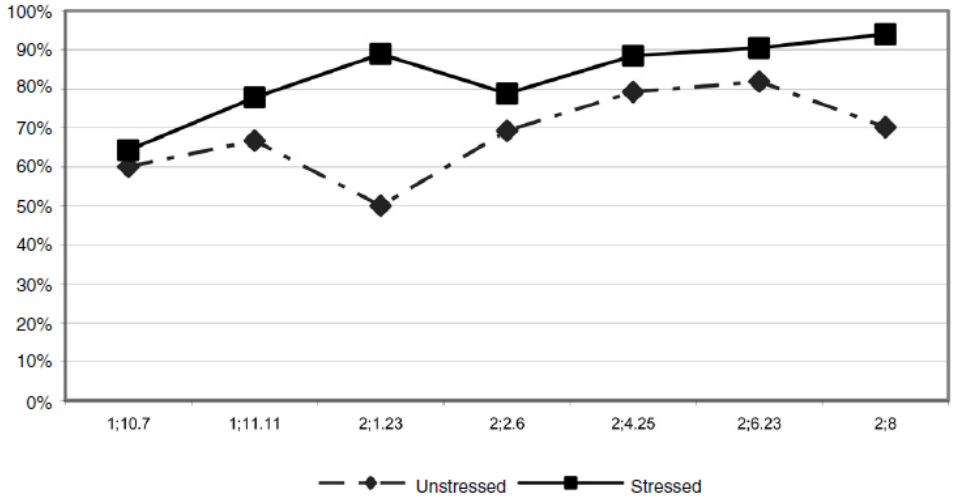


Figure 14: Frequency of coda production in stressed vs. unstressed syllables (Gisela) (reprinted from Prieto & Bosch-Baliarda 2006, page 250, Figure 4)



The figures above provide a clear depiction of both children's development in the production of coda consonants in stressed and unstressed syllables. In stressed syllables, Guillem reaches 100% of production at age 3;0, and Gisela reaches 95% at age 2;8. However, codas in unstressed syllables show a different pattern, as they are generally produced at a lower frequency. In fact, Guillem does not produce any such codas between 1;1.29 and 1;9.12.

In tune with these several observations, Prieto & Bosch-Baliarda also found that codas in monosyllabic words were acquired earlier than in polysyllabic words, since the former are always stressed, while the latter often fall within unstressed syllables. The better performance at producing monosyllables and stressed codas suggests that prosody plays an important role in coda acquisition in Catalan.

This pattern has also been found in French (Rose 2000) and English (Goad & Brannen 2003). Both studies reinforced Piggott's (1999) claim that word-final codas are acquired more easily because they enjoy a privileged prosodic status. However, one study on Spanish conducted

by Lleó (2003) found the opposite; children performed slightly better at producing word-medial codas and had more difficulties with codas in word-final position. These apparently contradictory results may, in fact, relate to the stress systems of these three languages, since French has an iambic stress pattern, which should facilitate coda production in word-final position; English displays a high number of monosyllables, which also facilitates word-final coda production; while Spanish shows a higher number of words with non-final stress.

As mentioned above, Prieto & Bosch-Baliarda evaluated how the acquisition of morphology may affect coda production in Catalan learners. They anticipated that codas carrying morphosyntactic information should be easier to acquire. They based their hypothesis on results from previous studies in European Portuguese (Freitas, Miguel & Hub Faria 2001), which found that there was an earlier acquisition of the morphological fricative [ʃ] in word-final codas of nouns and verbs, rather than in word-medial codas, since this fricative segment carries morphological information in word-final position. In this Portuguese study, the effect of prosody in the acquisition of codas contradicts most of the observations above, as the codas which were acquired earlier were located in unstressed syllables. This is why Prieto & Bosch-Baliarda predicted that morphology should accelerate the acquisition of codas in Catalan. Figure 15 and Figure 16 illustrate the researchers' findings.

Figure 15: Production of morphological and non-morphological codas (Gisela) (reprinted from Prieto & Bosch-Baliarda 2006, page 264, Figure 9)

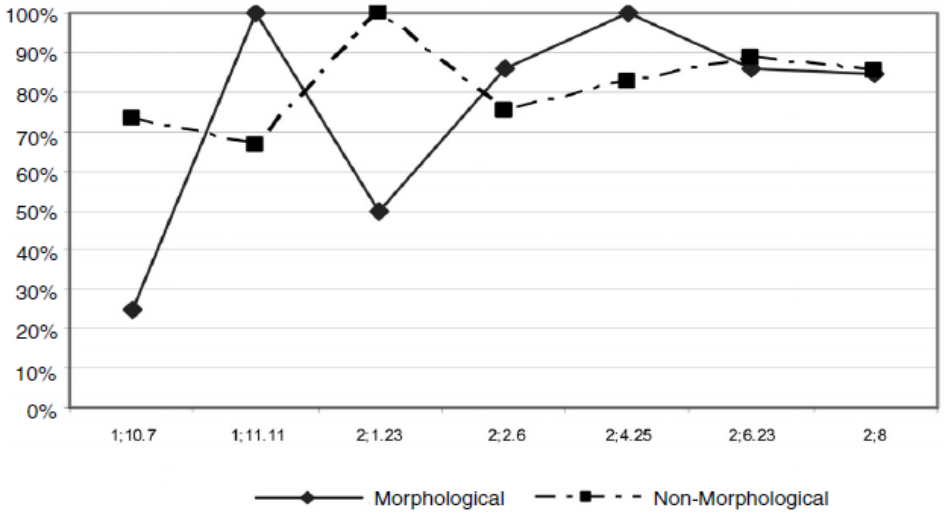
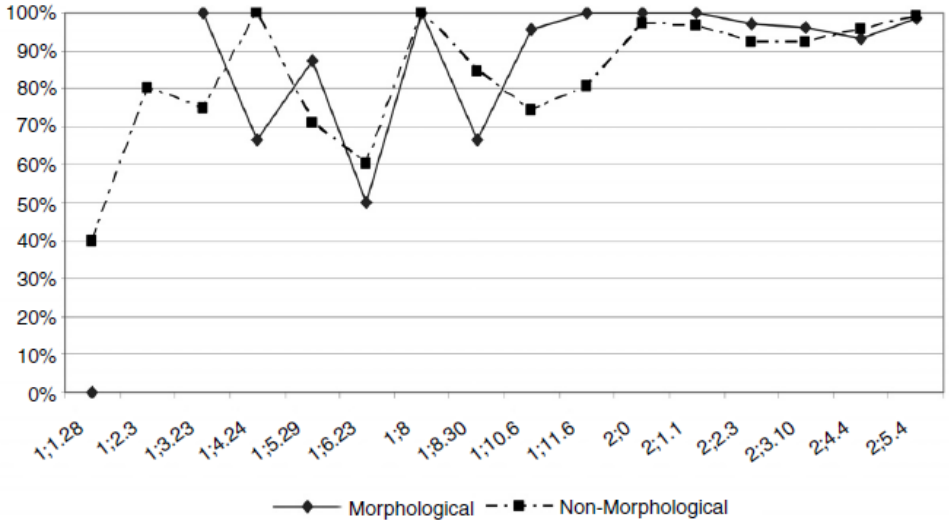


Figure 16: Production of morphological and non-morphological codas (Pep) (reprinted from Prieto & Bosch-Baliarda 2006, page 265, Figure 9)



Neither of these figures supports the researchers' hypothesis or Freitas et al.'s results regarding the interaction of morphology and phonology. Even though there are a few periods when morphological codas are more frequent, e.g. at age 1;11 for Gisela, and between 1;11 and 2;4 for

Pep, no systematic differences between the acquisition of morphological and non-morphological codas can be found in any of the four participants' data.

In fact, the four children produced a higher percentage of non-morphological codas, which was the opposite of what Freitas, Miguel & Hub Faria (2001) had found. Prieto & Bosch-Baliarda thus argue that the delay in the acquisition of morphological codas was due to their location in unstressed syllables. Even though the data in Figure 15 and Figure 16 shows a slightly higher percentage of morphological codas at some stages of the children's development, Prieto & Bosch-Baliarda claim that this study did not provide enough evidence to support the hypothesis that codas with morphosyntactic content are produced at an earlier age in the acquisition of Catalan. As seen in Table 13, Figure 13 and Figure 14, this study rather highlights the strong impact of prosody in the acquisition of codas.

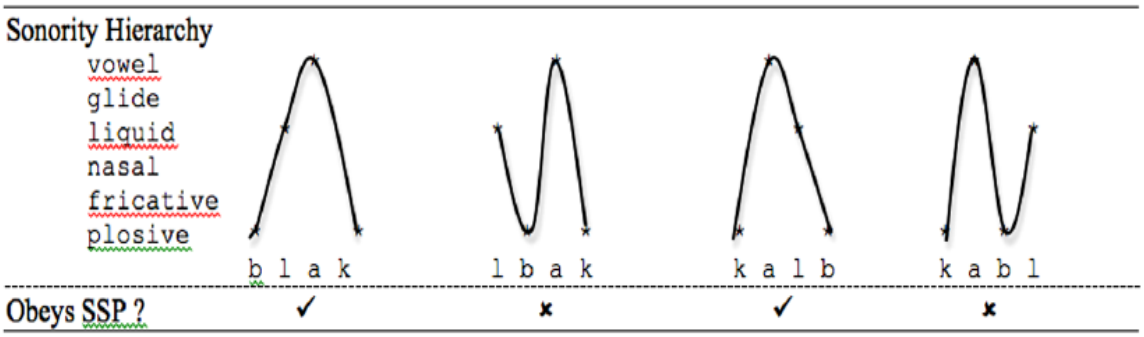
7 The Role of Phonology in Children's Acquisition of the Plural (Ettlinger & Zapf 2011)

7.1 Research Summary

Ettlinger & Zapf (2011) conducted a study to find whether children's morphological competence is related to their phonological development, specifically, whether learners' knowledge of language-specific phonological constraints, coda complexity (two adjacent consonants in word-final position, e.g. *books*) and sonority (rising sonority, e.g. *boats*, vs. falling sonority, e.g. *planes*) have an impact on the production and comprehension of the English plural morpheme /s/, which is one of the first grammatical morphemes acquired by English-speaking children. However, this morpheme poses some difficulties, as it is realized in three different ways: [s] after voiceless consonants, [z] after voiced segments, and [əz] after strident coronals. Also, /s/ usually forms complex codas, given that English noun forms tend to end in consonants. Therefore, some children still make production errors affecting this morpheme at age seven.

In this study, the researchers analyzed the data in light of the Sonority Sequencing Principle (SSP) (Clements 1990), which establishes that sonority must rise from the syllable onset to the nucleus, and it must decrease from the nucleus to the coda, as shown in the figure below.

Figure 17: Examples of Sonority Sequencing Principle (SSP) (reprinted from Ettlinger & Zapf 2011, page 296, Figure 1)



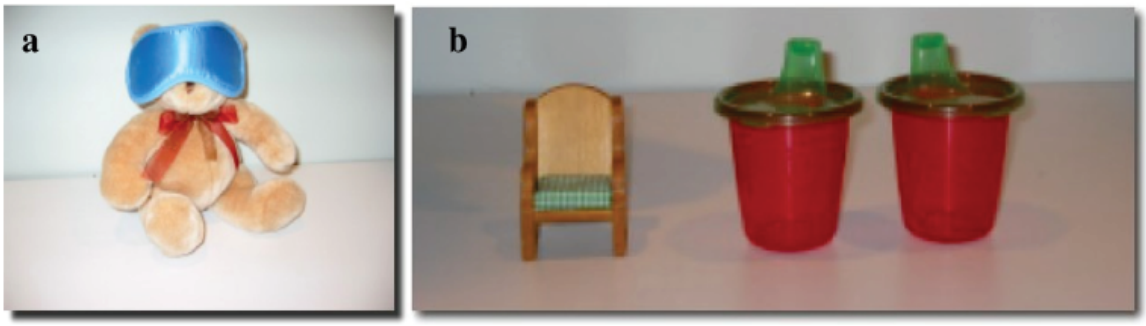
In Figure 17, the onset and coda of the words '*blak*' and '*kalb*' obey the SSP, as sonority rises from the complex onset of '*blak*', reaching its peak in the nucleus, and decreases in the complex coda of '*kalb*', given that the liquid consonant has a higher sonority than the plosive /b/. Ettlinger & Zapf expect for children to have less difficulties at producing words like the previous two, compared to English words like '*dots*' and '*ducks*', which contain the consonant cluster *plosive+fricative* that does not adhere to the SSP, as sonority slightly rises in the complex codas /-ts/ and /-ks/. According to the researchers, previous studies have shown that learners reduce complex codas into single codas by omitting the segment which provokes a more drastic sonority decrease from the nucleus, e.g. *'fast'* was reduced to *'fas'*, rather than *'fat'* (Ohala 1999). It has also been observed that pluralized words which violate the SSP, like '*dots*', are acquired later. Thus, Ettlinger & Zapf hypothesize that the acquisition of the English plural morpheme /-s/

depends on the complexity of the noun's final coda, and simple codas are expected to be acquired before complex codas.

7.2 Experiments

For this research, four experiments were conducted with 40 children with a mean age of 2;3 years. Experiment 1 analyzed coda complexity and the production of plurals. The participants played with two sets of toys (one individual toy, and one pair of toys) for 30 seconds to get familiarized, before starting the test. The experimenter pointed to any of the group of items that had been placed on the table, saying "Can you tell teddy bear to get _____?". The participants had to ask the blindfolded teddy bear to get an individual toy or a pair of toys.[7] Figure 18 shows the teddy bear in frame (a), and the toys used by the children in frame (b).

Figure 18: Blindfolded Teddy bear and sets of toys (reprinted from Ettlinger & Zapf 2011, page 298, Figure 2)



The results of this elicitation task suggest that coda complexity has a high impact on children's production of the plural, since the children produced 68% of the plurals from simple codas and 51% from complex codas.

7 The teddy bear was blindfolded so the participants would be as clear as possible when asking for the toys, and so they would not assume that the teddy bear knew which objects it had to get.

Experiment 2 evaluated the sonority of codas and the production of plurals by looking into the differences in the acquisition of plural nouns ending with sonorant codas, and plural nouns ending with obstruent codas. The task was identical to Experiment 1. The same items from Figure 18 were used. Children produced 59% of the plurals with sonorant codas (liquids and nasals), and 44% with obstruent codas (plosives). This suggests that falling sonority facilitates the acquisition of the English plural morpheme /s/. Experiments 3 and 4 studied the effect of coda complexity and sonority in the comprehension of plurals. Ettlinger & Zapf hypothesized that, if the same constraints found in production have an effect on comprehension, then the children's morphological system is affected, not just their production abilities. As seen in Figure 19, the researchers created three puzzles with 12 pieces each: six individual objects and six sets of two objects. One puzzle was used for training, and two puzzles were used for the test. The experimenter removed the pieces from the puzzle and laid them on the table. The participants were asked to find a specific piece, while pointing to the item or set of items, and saying "Can you find the ___? Where is/are the ____?".

Figure 19: Puzzle for experiments 3 and 4 (reprinted from Ettlinger & Zapf 2011, page 302, Figure 3)

Concerning coda complexity, 78% of simple codas were understood, compared to 53% of complex codas. Regarding sonority, the questions which contained sonorous codas obtained 70% of correct responses and those with non-sonorous codas obtained 57%. This task shows that learners' comprehension of plural forms is affected by the phonological nature of the coda, since children had less difficulties to produce and understand plural morphemes affixed to sonorous codas. The following table provides the results of the four experiments.

Table 14: Results of the experiments (adapted from Ettlinger & Zapf 2011)

	Coda complexity		**SSP-adherence**	
	Simple	**Complex**	**Adhere**	**Violate**
Production	68%	51%	59%	44%
Comprehension	78%	53%	70%	57%

Table 14 shows that coda complexity and the SSP are key in learners' production and comprehension of English codas containing morphological information. This implies a strong

interaction between the acquisition of phonology and morphology. These results are consistent with Ettlinger & Zapf's hypothesis, which suggested that the English plural morpheme /-s/ should be acquired earlier when located in simple codas rather than in complex codas, and that sonority can influence the development of the plural morpheme /-s/ involved in coda clusters.

8 Summary

As we saw through this summary of the literature, prosodic factors, in particular stress, appear as the main driver for the development of codas in Spanish (and other languages), beyond the development of syllable structure itself, with morphological expression depending in part on prosody, also possibly influenced by the frequency of specific morphemes in usage.

However, these studies offer relatively little information concerning the relationship between coda development and the development of segmental production abilities. While some studies hint at a practical influence from segmental development (e.g. Prieto & Bosch-Baliarda 2006 for Catalan; Polo 2013 for the development of codas /n/, /ɾ/, /s/, /l/ in Spanish), no study offers a detailed (qualitative vs. quantitative) comparison between the development of sounds in codas (lexical or grammatical) and the development of these sounds across other syllable positions, with Polo (2013) coming closest in this regard.

Focusing now on the only four longitudinal studies described in previous sections, these works shed light on how stress, word ending, morphology, frequency, word position, syllable count and segmental complexity may influence the productions of first language learners.

Lleó (2003), Prieto & Bosch-Baliarda (2006) and Polo (2013) found that stress plays a significant role in the acquisition of codas in Spanish, while morphological endings generally appear after the child has reached a certain level of prosodic development. This explains why lexical codas are produced earlier than codas with morphological content, like plural nominals

and verbal inflections. Arias-Trejo et al. (2014) further suggest that word ending influences children's performance at producing plural morphemes in Spanish, given that the plural suffix /-s/ emerges earlier on nouns ending in a vowel than on nouns ending in a consonant. According to Polo (2013), frequency does not appear to be a determining factor for either the emergence of codas or that of plural endings. Word position showed inconsistent results in Polo's analysis, since the two participants did not acquire medial and final codas at the same pace. However, Lleó (2003) found that medial codas appeared slightly earlier than final codas in her corpus data on Spanish. Note that the small groups of learners documented in each study cannot assess how this variation plays out in the larger population of Spanish learners. Concerning segmental complexity, Prieto & Bosch-Baliarda's (2006) results suggest that this factor does not play a significant role in the acquisition of codas in Catalan, while syllable count played an important role in their study, given that monosyllable content words are unavoidably stressed, as opposed to polysyllables, which may contain codas within unstressed syllables.

Finally, focusing exclusively on the two longitudinal studies of Spanish development (which together document only four children), stress has proven to be the most determining factor in the acquisition of codas. However, more data is required in order to gain further understanding of the interaction between phonology and morphology in coda production in Spanish, and to uncover whether other factors such as word ending, frequency, word position, syllable count or segmental complexity are determining of children's acquisition of Spanish as a first language. The current study offers one additional step in this direction, through the systematic consideration of the most central factors uncovered by the previous studies summarized above, within a single longitudinal study on the acquisition of Spanish lexical and morphological codas.

Chapter 3: Methodology

1 Introduction

For the current study, I engage in an in-depth look at a longitudinal case study on the acquisition of European Spanish from the autonomous community of Asturias, Spain, for which I track both morphological and phonological information within a single analytic framework, in order to supplement Polo's (2013) earlier study on the topic. I pursue the following questions:

(10) Research questions
   a. What are the factors affecting the development of codas in Spanish?
   b. How do these factors interact longitudinally, throughout the main stages of acquisition of codas in this language?

The first, general question aims at supplementing the few longitudinal case studies already present within the literature on Spanish development (Lleó 2003; Polo 2013) by investigating systematically the range of factors that have been uncovered in the previous studies summarized above, based on a new phonological study of Spanish development. The second, more specific question aims at obtaining a picture of how the factors that will prove relevant to the current study interact with one another over time.

2 Methodological Approach

For this longitudinal study, I analyze production data from Irene, a monolingual child from Asturias, Spain, who learned a European dialect of Spanish in which codas are produced. The corpus was retrieved from the CHILDES database.[8] It was recorded as part of the study by Llinàs-Grau & Ojea López (2000), and includes a set of transcripts of Irene's spontaneous productions at home, while interacting with her parents, as well as a set of media files

8 https://phonbank.talkbank.org/access/Spanish/LlinasOjea.html

accompanying the transcripts. Each media file shows the child engaging in playful activities with her family. Irene's parents used diverse methods to encourage her to produce simple as well as more complex syntactic structures, such as coordinated and subordinated clauses, for example. The activities included looking at pictures from a book, making puzzles, retelling a story from a movie or show which she had recently watched, or narrating what she had done during the day at day care.

The child was recorded throughout 24 sessions, once a month, from age 0;11.01 to 2;06.12. However, I only worked on 19 sessions, which were the ones with both transcripts and media files available on CHILDES. Given that the sessions from age 2;22.29 did not include a media file, I was not able to analyze them.

Phon (Rose et al. 2006) is a software program developed to manage and analyze phonological data, allowing its users to compare target and actual productions both segmentally and prosodically. I used *Phon* to segment Irene's records and synchronize them with their corresponding video file, and I phonetically transcribed Irene's actual productions, in order to compare them with the target (model, expected) speech forms. I also used *Phon*'s function to align target and actual word forms on a segment-by-segment basis, for systematic comparisons at both the segmental and related syllable levels.

When evaluating the corpus, I focused on the child's production of medial and final codas, with also a consideration of phonological development in other syllable positions (primarily, syllable onsets), in order to analyze coda development in light of more general segmental development. Using *Phon*, I was able to obtain systematic descriptions concerning how many codas Irene produced overall, in which prosodic context her codas were located (e.g. stressed vs. unstressed syllables; position within the word), as well as the age at which she started to acquire lexical and morphological codas within each context.

Chapter 4: Data Description

1 Introduction

In this chapter, I describe the results obtained from Irene's production of medial, final lexical, and final inflectional[9] codas during her acquisition of Spanish as first language. As we will see, certain sound classes are favoured in coda position. For instance, the child has a preference for nasals, across the three positions, over any other consonant sound. Also, the earlier emergence of lexical over inflectional codas gives an insight regarding the interaction between phonology and morphology in Irene's acquisition of codas.

This chapter is divided into these three coda positions. First, I describe medial codas /s/, /z/, /m/, /n/, /ŋ/, /l/, and /ɾ /, and residual cases involving /k/, /θ/, /ð/, and /ɣ/. I then continue with final lexical codas /θ/, /ð/, /s/, /n/, /l/, and /ɾ /, as well as residual cases for /k/ and /x/. Finally, I describe the development of Irene's final inflectional codas /s/, /n/, and /ɾ/. The results for each coda segment are illustrated through charts which indicate the relative proportions of Irene's accurate productions, deletions and substitutions during each month of recording, from age 1;01.25 to 2;06.12. I also describe the potential role of stress in the developmental pattern of each phone.

2 Medial Codas

In this section, I describe Irene's development of codas in word-medial position. Irene began producing medial codas around age 1;06.16. Her development is not systematic for all the segments. In the following sections, we will observe that some coda consonants are clearly

9 These codas will be called "final lexical", as opposed to "final morphological", due to the fact that Irene's corpus does not contain tokens of derivational morphemes, but only inflectional ones.

preferred, while others lag behind, a number of which were not acquired during the months of examination.

I begin this description with the fricatives /s/ and /z/ in medial codas, followed by the labial, coronal and velar nasals /m/, /n/, /ŋ/. I then continue with the lateral /l/, the rhotic /ɾ/ and, finally, cover the residual cases of /k/, /θ/, /ð/, and /ɣ/. The description that follows provides a general picture of the child's strengths and difficulties across these different phone classes in word-medial coda position.

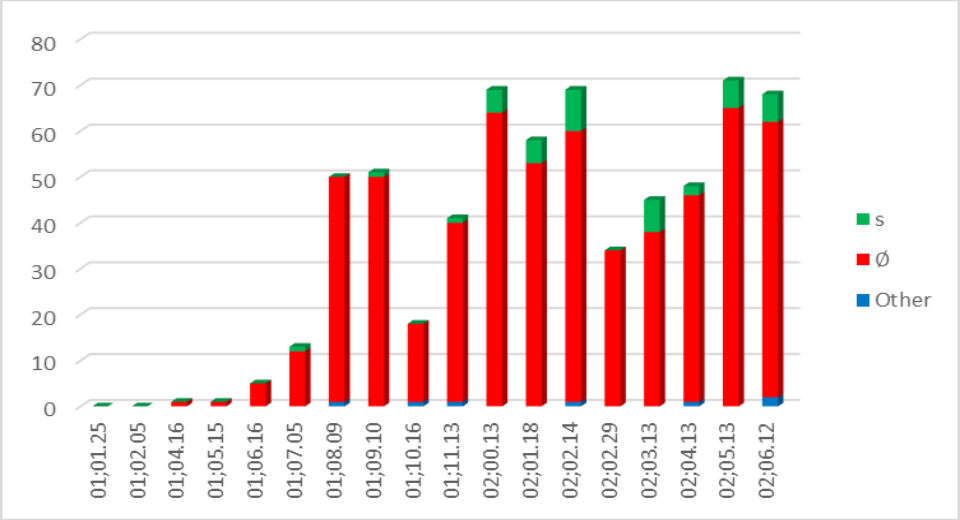
2.1 Fricatives

In this section, I describe Irene's production of the voiceless fricative /s/ and voiced fricative /z/ in medial codas. As we will see, the child had difficulties producing these segments throughout the recorded period.

2.1.1 Voiceless Alveolar /s/

As we can see in Figure 20, Irene did not acquire voiceless alveolar fricative /s/ in medial codas. Productions of /s/ were scarce and scattered across the second half of the observation period, while deletions were much more prominent from the beginning to the end of the study.

Figure 20: Irene's production of voiceless alveolar fricative /s/ in medial codas



The overall percentage of target-like productions of fricative /s/ is approximately 7%. Irene's best performance occurred at age 2;02.14, however with only 9 productions out of 69 attempts (13%). As we can also see in Figure 20, her development of /s/ in medial codas did not improve in the following sessions. The predominant pattern remains that of deletion, with an overall percentage of 92%.

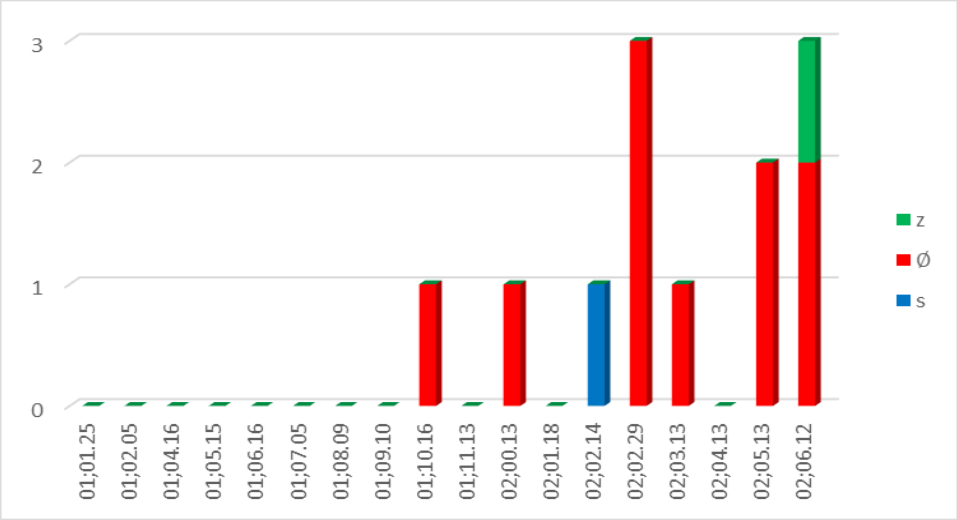
Consistent with this observation, Figure 20 also displays a noticeably low number of substitutions. We can only find seven substitutions out of the 642 attempts. Irene sporadically replaced /s/ by coronals /t/ and /n/ and, in a majority of cases, glottal /h/. This glottal substitution is something I noticed from time to time in her mother's speech; it may thus be attributed to an optional pattern of substitution in the ambient dialect.

Note, finally, that the data do not suggest any influence of prosody, as the deletion rate in stressed syllables (93%) was equivalent to that in unstressed syllables (91%). The dataset contains 261 stressed medial /s/ vs. 381 unstressed medial /s/.

2.1.2 Voiced Alveolar /z/

The voiced alveolar fricative /z/ is not as relevant as other segments described in this chapter, because it occurs in only a handful of attempts. For example, *chisme* /ˈʧizme/ 'gossip' or *desván* /dezˈβan/ 'attic'. However, it is important to describe its behaviour, if only for sake of exhaustivity. As we can see in Figure 21, just like with the voiceless fricative /s/ in Figure 20, the child did not acquire /z/ in medial codas during the course of the observation period.

Figure 21: Irene's production of voiced alveolar fricative /z/ in medial codas



Voiced fricative /z/ was only present in 12 occurrences in the dataset. The overall percentage of deletions throughout all of these cases was 83%. The first and only target-like production occurred in the last session, at age 2;06.12. There is also only one substitution (devoicing) observed, at age 2;02.14, when Irene produced [s] for /z/. This substitution might relate to the fact that Irene had already produced /s/ a few times in that position, since age 1;07.05. Finally, because there is only one target-like production of /z/ in this study, it is not possible to draw any

conclusion concerning the role of prosody in the child's acquisition of this segment in medial codas.

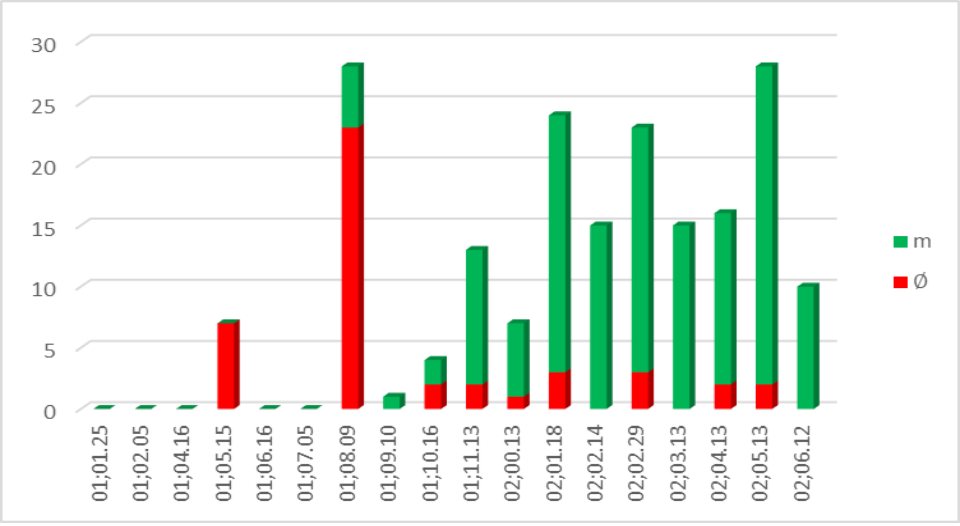
2.2 Nasals

This section offers a description of Irene's performance at acquiring nasal segments in word-medial position, specifically, the bilabial /m/, alveolar /n/, and velar /ŋ/. The results suggest that the child had an easier time acquiring nasals in medial codas than what we witnessed with the fricatives above.

2.2.1 Bilabial /m/

Irene acquired the bilabial nasal /m/ in medial codas during the course of the observation period. This consonant emerged in this position at age 1;08.09, and accurate productions of it became the majority pattern in the month immediately after, as of 1;09.10. Irene also did not substitute any other consonants for medial coda /m/.

Figure 22: Irene's production of bilabial nasal /m/ in medial codas

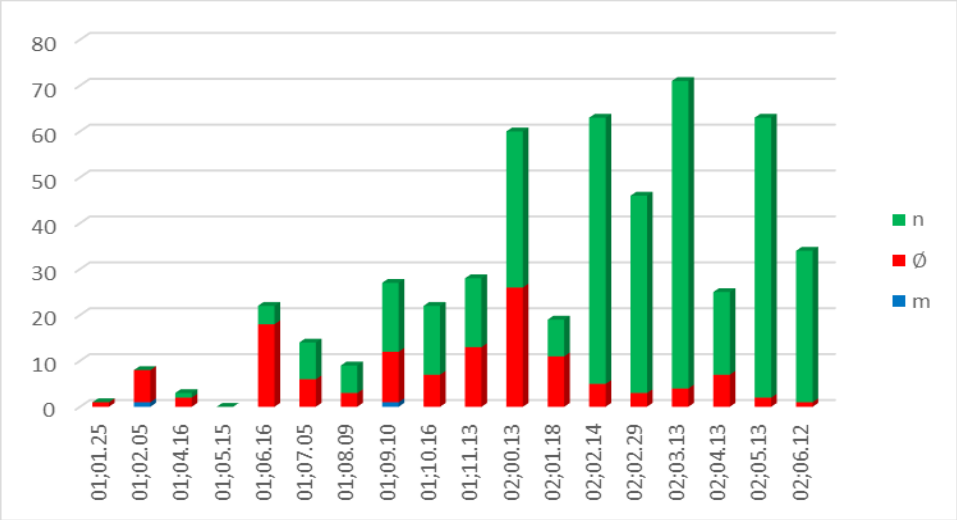


Concerning the potential influence of prosody, Irene produced 95% and deleted 5% of medial /m/ in stressed syllables, while she produced 87% and deleted 13% of bilabial /m/ in unstressed medial codas. The dataset contains 66 stressed /m/ vs. 90 unstressed /m/ in word-medial position. These tendencies do not offer robust-enough evidence to suggest that stress may have played a determining role in the development of /m/ in medial codas.

2.2.2 Alveolar /n/

Alveolar /n/, similar to /m/ described just above, developed relatively early in medial coda position. As we can see in Figure 23, Irene acquired /n/ in this position as of 1;07.05, with concomitant decrease in deletion rate.

Figure 23: Irene's production of alveolar nasal /n/ in medial codas



Between 1;01.25 and 1;06.16, Irene attempted 34 /n/ in medial codas. Of these, 82% underwent deletion (n=28). Between 1;07.05, when Irene began to display /n/ production as the majority

pattern, and 2;06.12, she attempted a total of 481 /n/ in medial codas, with a deletion rate of 21% (99 deletions).

However, at 2;01.18, we observe an isolated spike in deletion. These deletions occur in words like *cuantas* /ˈkwantas/ 'how many', *donde* /ˈdonde/ 'where', *escribiendo* /eskɾiˈbjendo/ 'writing' (each word underwent deletion in two tokens), and *pinté* /pinˈte/ ‘painted(1.sg.)’ (with deletions found in four tokens of this word), which appear to have posed difficulty for the child for no obvious reason. During the preceding session (at 2;00.13), 17 out of 26 deletions occurred in the word *donde* /ˈdonde/.

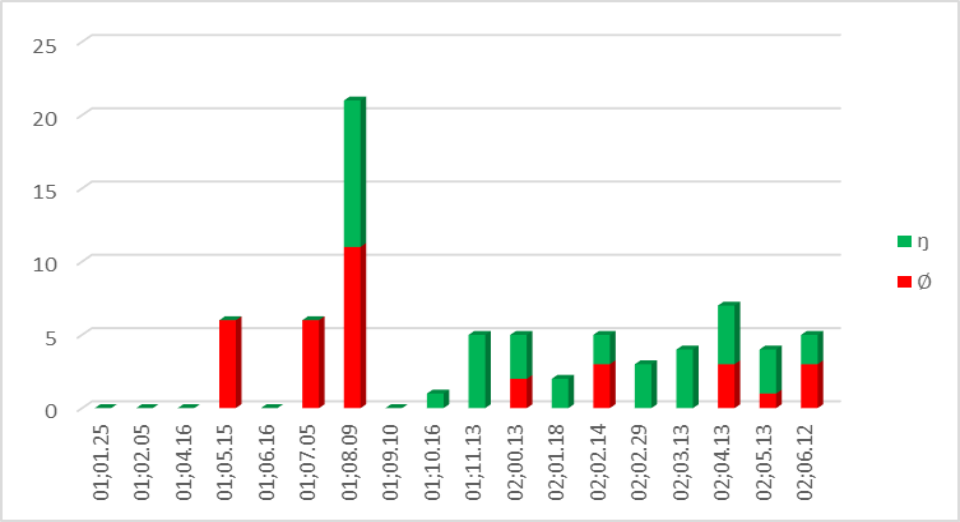
Also similar to /m/, we only find two substitutions affecting /n/ throughout the 24-session corpus. These substitutions occur at ages 1;02.05 and 1;09.10. In both cases, Irene assimilated the alveolar /n/ to the bilabial [m] in word medial position, with the consonant following it also produced as a labial. Specifically, she produced *panda* /ˈpanda/ as [ˈpamba] ‘panda’, and *encima* /enˈsima/ as [emˈbiβa] ‘on top’.

Finally, similar to what we observed for /m/ in medial codas, the child performed at relatively equivalent rates in both unstressed and stressed medial codas (the corpus contains 370 stressed /n/ vs. 111 unstressed /n/ in medial position). Specifically, the production percentage of unstressed /n/ in word-medial position was 82%, with a deletion rate of 17%, while stressed /n/ in medial codas resulted in 78% of productions and 22% of deletions.

2.2.3 Velar /ŋ/

There is a relatively low number of occurrences of velar nasal /ŋ/ in medial codas in the corpus. Irene’s performance at producing this consonant was also variable. As we can see in Figure 24, the child attempted velar nasal /ŋ/ in most sessions, but showed a noticeable percentage of deletions throughout the dataset.

Figure 24: Irene's production of velar nasal /ŋ/ in medial codas



Accurate productions of medial coda /ŋ/ began to emerge at the same age as that for bilabial /m/ (1;08.09). In the following sessions, productions kept occurring, but deletions remained prominent. This variable outcome may be due to the limited contexts requiring the presence of the homorganic nasal /ŋ/; more data would be needed to address this development more systematically. Given the data available, we can observe that Irene did not substitute coda /ŋ/ by any other sound. However, at the lexical level, we also note that Irene produced and deleted medial coda /ŋ/ within the same words and during the same sessions. For instance, words like *tengo* /ˈteŋgo/ 'have(1.sg.)' or *nunca* /ˈnuŋka/ 'never' were accurately produced from time to time, but they also displayed production errors occasionally, even during the last month of the observation period.

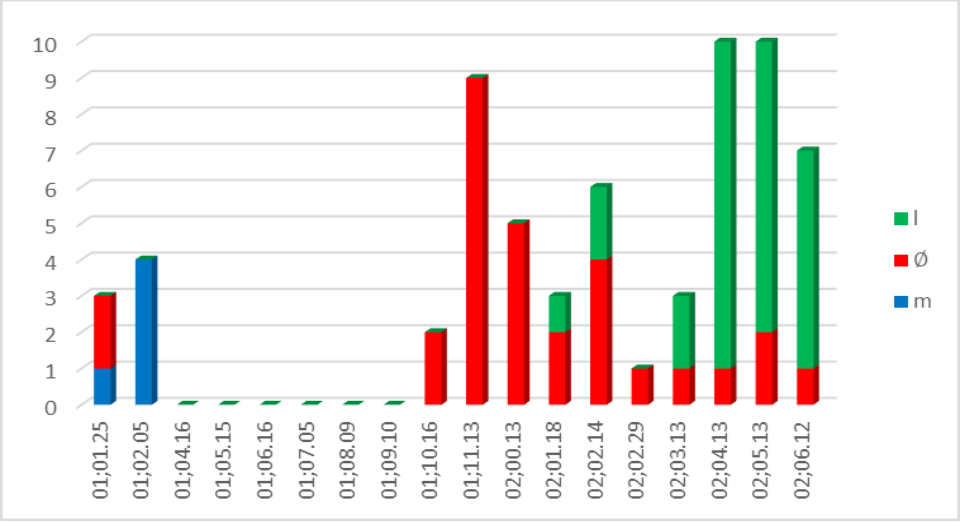
Concerning stress, the corpus contains 37 stressed medial /ŋ/ vs. 4 unstressed medial /ŋ/. Irene's productions of stressed medial codas (73%) outnumbered those of unstressed medial codas (50%). While this matches the slight tendency observed for /m/ in medial codas, the

number of occurrences is too low, especially concerning the unstressed context, to conclusively verify the validity of this trend.

2.3 Lateral /l/

Irene started to accurately produce lateral /l/ in medial codas at a late stage, compared to the nasals discussed above. Accurate productions were higher than deletions only in the last four months of the observation period.

Figure 25: Irene's production of lateral /l/ in medial codas



These productions began to emerge at age 2;01.18. In the first two sessions, at ages 1;01.25 and 1;02.05, we can see five substitutions of nasal [m] for medial /l/. They occurred in the proper noun *Alba* /ˈalβa/, which was produced as [ˈamba], the resulting nasal [m] sharing the same place of articulation as the following bilabial onset /b/. It is possible that this homorganicity helped consonant production, as opposed to deletion, at that early stage. However, there was a predominant pattern of deletion until age 2;02.29. During this period, we also observe an eight-

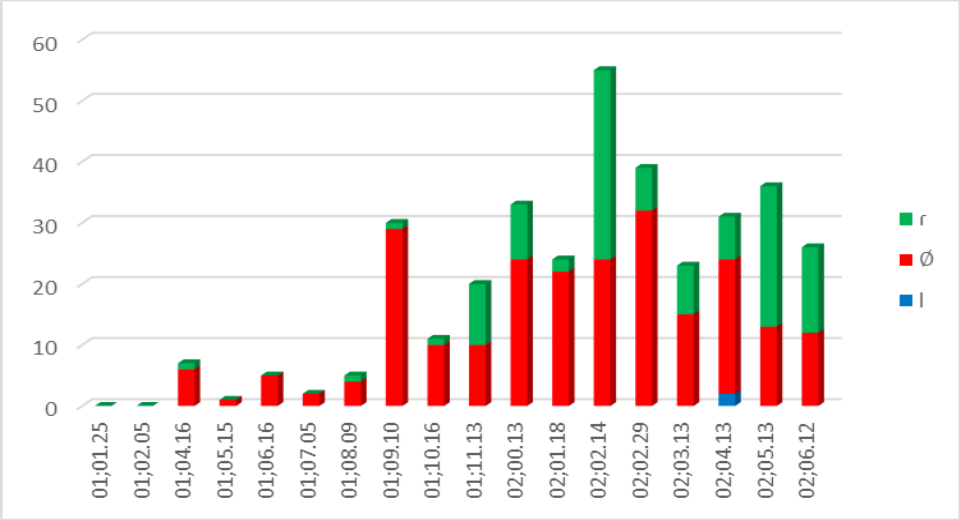
month time window where no attempts at this consonant are recorded (1;02.05-1;10.16). The child began to master /l/ in medial codas at age 2;03.13. As we have no reason to think that Irene explicitly avoided words containing /l/ in this position, we consider this gap to be an accident of the sampling method.

Finally, turning our attention back to prosody, Irene performed better at lateral /l/ in unstressed medial codas than in stressed ones (19 unstressed /l/ vs. 11 stressed /l/ are found in the dataset for medial codas). She displayed accurate productions of unstressed syllables in 95% of her attempts, with only a 5% deletion rate. In contrast to this, Irene displayed 64% of accurate productions vs. 36% of deletions in stressed syllables. However, similar to the figures reported above for the nasals, these percentages are based on numbers too small to be conclusive.

2.4 Rhotic /ɾ/

In contrast to /l/, Irene did not master rhotic coda /ɾ/ in word-medial position during the months of observation. The majority pattern for this medial coda consists of segmental deletion. As we can see in Figure 26, deletions outnumber productions in most of the recording sessions.

Figure 26: Irene's production of rhotic /ɾ/ in medial codas



The first target-like production of medial coda /ɾ/ occurred early, at age 1;04.16. Irene's performance, however, did not improve during the ensuing months. In fact, Figure 26 does not display any accurate production of coda /ɾ/ in word-medial syllables out of the few attempts recorded during the following three sessions. Irene's target-like productions reappeared sporadically in her speech development from age 1;08.09 to the last recording session. We can also observe that deletions are noticeably high between ages 1;08.09 and 2;04.13, except for age 2;02.14, where the child accurately produced 31 medial codas /ɾ/ out of 55 attempts. Most of these correct productions come from multiple occurrences of the same content word /ɛrmaˈnastɾas/ 'stepsisters'.

During the last two months of examination, we can see an improvement in Irene's adult-like productions of rhotic /ɾ/ in medial codas, especially at age 2;05.13. However, these last sessions do not provide enough data to conclude that the child acquired medial coda /ɾ/ during the course of the observation period.

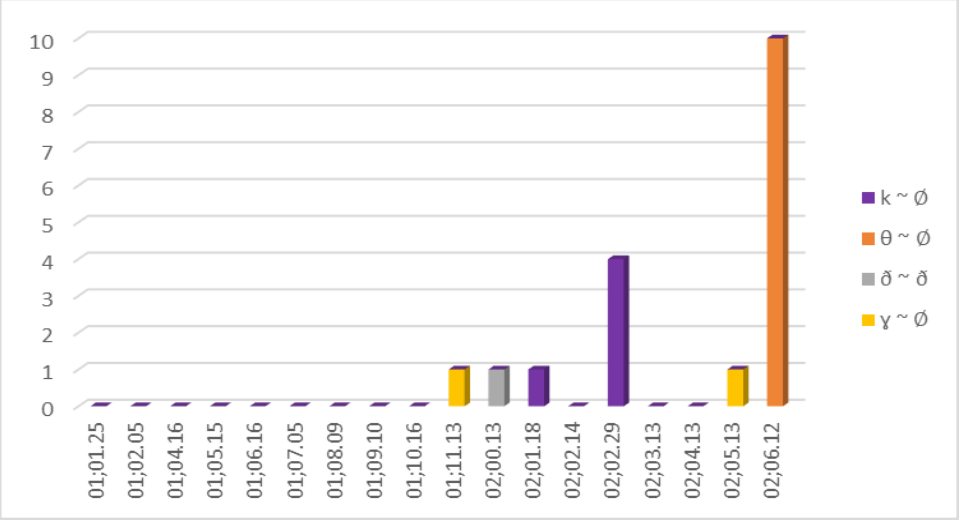
Besides the predominant pattern of deletions, there are only two substitutions out of 348 attempts at /ɾ/ in medial codas. Both cases occurred at 2;04.13, when the child produced lateral [l] for rhotic /ɾ/ in the word *carteros* /kaɾˈteɾos/ as [kalˈteɾos] 'postmen'.

Over the full observation period, Irene produced 43% and deleted 56% of unstressed medial coda /ɾ/. In contrast to this, /ɾ/ in stressed medial codas displays a production percentage of 25% and a deletion of 75%. These results suggest that the child was trending toward more productions of /ɾ/ in unstressed syllables than in stressed syllables (the corpus contains 187 stressed medial /ɾ/ vs. 161 unstressed medial /ɾ/). However, no formal conclusion can be drawn from these broad tendencies.

2.5 Residual Cases /k/, /θ/, /ð/, /ɣ/

Medial codas /k/, /θ/, /ð/ and /ɣ/ are not as relevant as the ones above, given that they display a low number of occurrences in the dataset. While I describe each of these coda segments in word-medial position for sake of exhaustivity in this section, I will ignore them in later discussions.

Figure 27: Irene's production of residual cases /k/, /θ/, /ð/, /ɣ/ in medial codas



Only one case of fricative /ð/ was observed, at 2;00.13, which was produced accurately. Irene did not accurately produce any stop /k/, or fricatives /θ/ and /ɣ/ in medial codas during the months of recording. Even though medial coda /k/ displays a higher number of attempts in Figure 27, compared to the other phones, we can still see 100% of deletions of this consonant. Note that this particular deletion is fully expected from a Spanish learner, given that even adult speakers tend not to produce medial coda /k/. For instance, a word like *protección* /pɾotekˈθjon/ is usually produced as [pɾoteˈθjon] 'protection' (Borràs-Comes & Prieto 2013), something that holds true of Irene's target dialect of Spanish as well. Voiceless dental fricative /θ/ was also 100% deleted. This medial coda only appeared in the last recording session, when Irene's phonological development was more advanced. However, the child did not accurately produce fricative /θ/, also in line with her generalized pattern of coronal fricative deletion reported in Figure 20. On the other hand, medial /ɣ/ only appeared in the word *significa* /siɣniˈfika/ 'mean(3.sg.)', which the child was not able to replicate in two attempts observed at 1;11.13 and 2;05.13, respectively.

2.6 Summary

In summary, Irene displayed a better performance at medial nasal codas than with any other type of word-medial coda consonants. Bilabial /m/, alveolar /n/ and velar /ŋ/ emerged earlier than other consonants and, except for scarcely-occurring /ŋ/, were correctly produced in almost every session after they emerged.

Lateral /l/ emerged at a late stage. In spite of this, it was acquired by 2;03.13, approximately three months before the end of the recording period.

Rhotic /ɾ/ emerged earlier than lateral /l/, but its accurate production was only the majority pattern in three sessions, including the last two. Given that Irene began to stabilize her production of this segment only during the latter part of the observation period, we can speculate that she was well on her way to mastery by then, which however did not take place before the end of the observation period.

Finally, the child had difficulties with the fricatives /s/ and /z/. We could notice that deletions outnumbered productions in each month of examination. By the end of the observation period, Irene had not acquired these fricative segments in medial codas. These trends are represented in the following timeline.

Table 15: Irene's medial coda acquisition

	01;01;25	**01;02;05**	**01;04;16**	**01;05;15**	**01;06;16**	**01;07;05**	**01;08;09**	**01;09;10**	**01;10;16**	**01;11;13**	**02;00;13**	**02;01;18**	**02;02;14**	**02;02;29**	**02;03;13**	**02;04;13**	**02;05;13**	**02;06;12**	**Not acquired**
[s]	--	--	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	X
[z]	--	--	--	--	--	--	--	--	D	--	D	--	S	D	D	--	D	D	X
[m]	--	--	--	D	--	--	D	D/ ✓	D/ ✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
[n]	D	D	D	--	D	✓	✓	✓	✓	✓	✓	D/ ✓	✓	✓	✓	✓	✓	✓	
[ŋ]	--	--	--	D	--	D	D	--	✓	✓	✓	✓	D	✓	✓	✓	✓	D	
[l]	D	S	--	--	--	--	--	--	D	D	D	D	D	D	✓	✓	✓	✓	
[ɾ]	--	--	D	D	S	D	D	D	D	D/ ✓	D	D	✓	D	D	D	✓	D/ ✓	X

Legend for chart interpretation:
✓: Acquired D: Deleted S: Substituted X: Not acquired
--: No attempts at target medial coda

3 Final Codas

In this section, I describe eight segments emerging in final lexical and inflectional codas. Similar to my description of medial codas above, I grouped them as fricative (/θ/, /ð/, /s/); alveolar nasal (/n/); lateral (/l/); rhotic (/ɾ/); and, finally, residual cases (/k/, /x/). As we will see, the age of acquisition and development pattern for some segments, like /n/ or /ɾ/, are consistent with the findings for medial codas described above. I begin with lexical codas in word-final position in the next section.

3.1 Final Lexical Codas

In this section, I describe Irene's development of lexical codas, which are word-final consonants that are part of lexical roots and, as such, involve no suffixation.

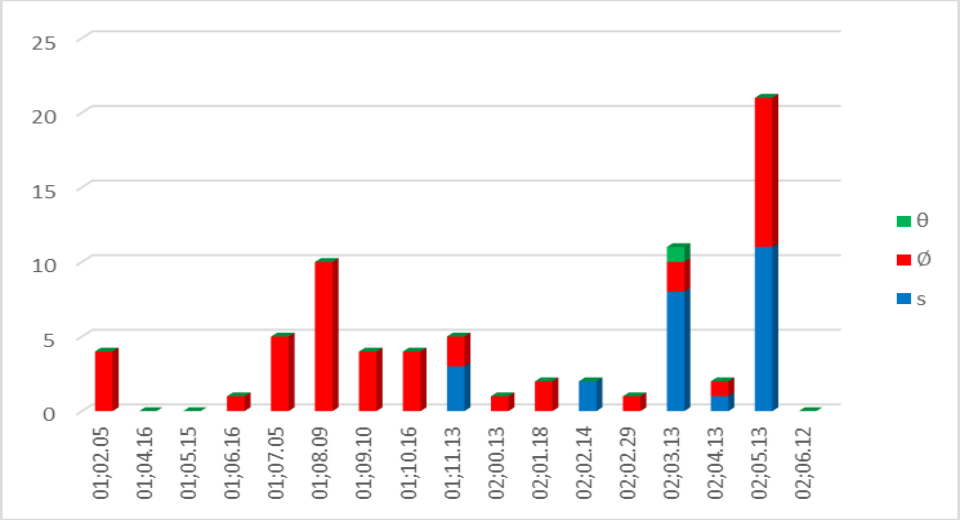
3.1.1 Fricatives

I begin by describing voiceless dental /θ/, then continue with voiced dental /ð/ and, finally, with voiceless alveolar /s/. Note that the number of occurrences for /θ/ and /ð/ is much lower than for the other segments; however, these two consonants are described in their own sections in order to provide a thorough account for the child's acquisition of lexical codas in word-final position.

3.1.1.1 Voiceless Dental /θ/

Similar to what we observed for word-medial coronal fricatives above, the child did not master fricative /θ/ in final lexical codas during the months of observation. The predominant pattern for this segment was that of deletion (47 deletions out of 73 attempts).

Figure 28: Irene's production of voiceless dental fricative /θ/ in final lexical codas



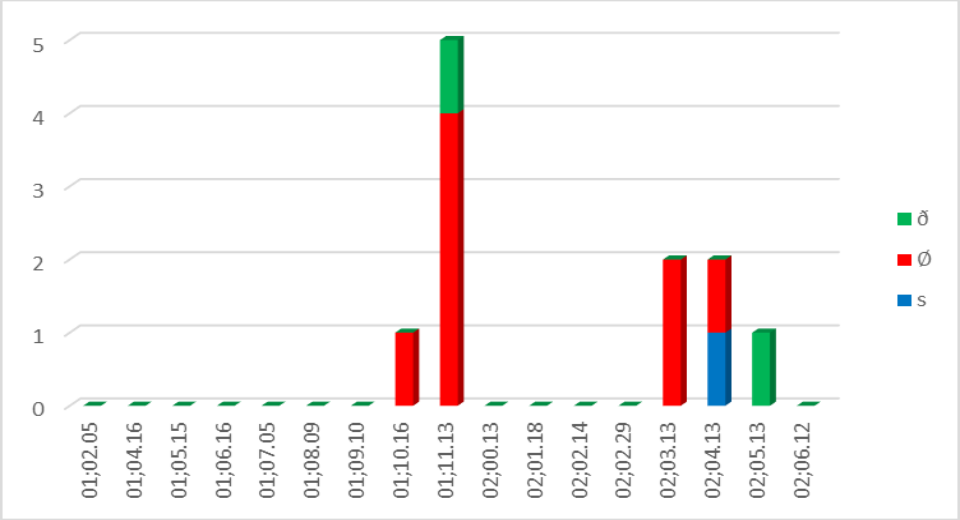
In Figure 28, we can see a high number of substitutions beginning in earnest at age 1;11.13. From this age, we observe attempts where the child produced fricative [s] instead of target [θ] in final lexical codas. Substitution spikes at ages 2;03.13 and 2;05.13, and predominantly occurred in the noun *vez* /ˈbeθ/ 'time'. In total, Irene deleted 62%, substituted 36%, and accurately produced 1% of her attempts at this consonant. Finally, we can observe only one accurate production of final coda /θ/ at 2;03.13.

Note that this description reports exclusively on final lexical /θ/ in stressed codas, as the corpus does not contain tokens of /θ/ in unstressed syllables.

3.1.1.2 Voiced Dental /ð/

There were only 11 attempts at voiced dental /ð/ in final lexical codas in the dataset. From this limited evidence, we can hypothesize that this consonant began to emerge at around 2;04.13 or slightly before, as suggested by the early production recorded at 1;11.13, representing one out of five attempts during that recording session.

Figure 29: Irene's production of voiced dental fricative /ð/ in final lexical codas

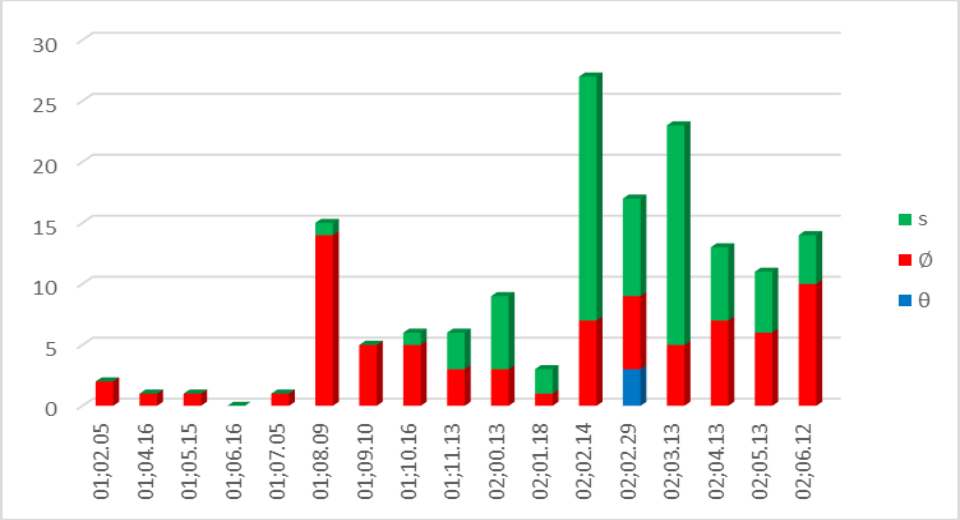


Irene's two accurate productions of /ð/ in final lexical codas occurred at ages 1;11.03 and 2;05.13, respectively. There was only one substitution of [s] for /ð/. These observations, which also include stressed syllables only, generally coincide with the child's performance with the voiceless dental fricative /θ/ described above.

3.1.1.3 Voiceless Alveolar /s/

Irene's performance in her productions of voiceless alveolar /s/ in final lexical codas was noticeably better than that in medial codas. She accomplished mastery of this segment by 2;00.13. Over the recorded period, the number of deletions (77) is almost equivalent to that of her accurate productions (74 out of 154 attempts).

Figure 30: Irene's production of voiceless alveolar fricative /s/ in final lexical codas



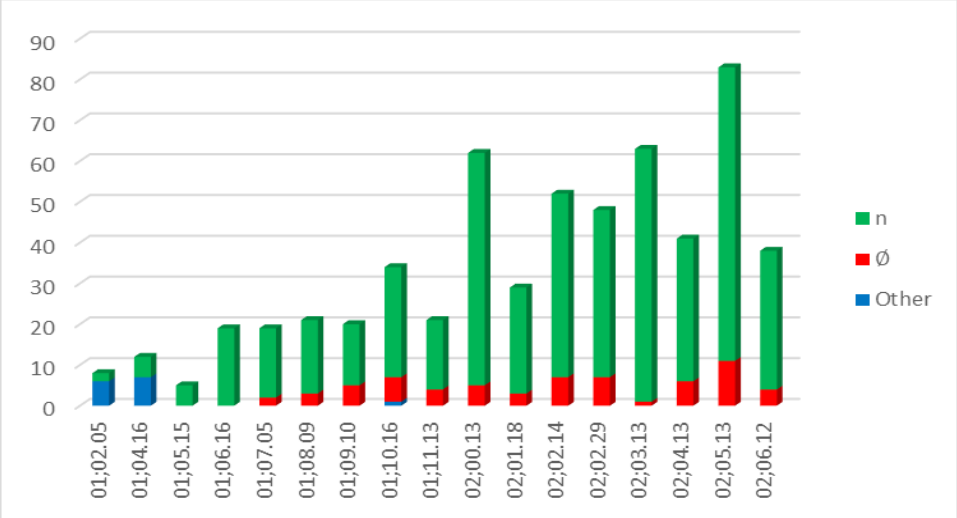
Fricative /s/ in final lexical codas began to emerge at an early stage, at 1;08.09, to then become the majority pattern in most sessions as of 1;11.13, a performance that however levels off, even with some decline during the last three sessions. The two main spikes in accurate production, at ages 2;02.14 and 2;03.13, relate to the high frequency of the words *después* /desˈpwes/ 'after' and *más* /mas/ 'more', this latter word also displaying the three cases of fronting substitutions of /s/ by dental fricative /θ/.

Regarding the role of prosody in the acquisition of fricative /s/ in final lexical codas, Irene accurately produced 47%, deleted 50% and substituted 2% of /s/ in stressed final lexical codas. Conversely, she produced 56% and deleted 44% in unstressed ones. Even though the number of occurrences of unstressed final lexical codas was lower than stressed codas (18 against 127), the variable results in both contexts suggest that stress was not influential in the child's development of fricative /s/. In sum, there is evidence of the child's acquisition of /s/ in final lexical codas over the course of the recording period, but there is no evidence of any prosodic influence from stress.

3.1.2 Alveolar Nasal /n/

In contrast to the fricatives described thus far, alveolar nasal /n/ in final lexical codas emerged in the first recording session, at 1;02.05. Irene did not have any difficulties at acquiring this segment, as the data display a clearly predominant pattern of accurate productions, with a low number of deletions (497 productions and 64 deletions out of 575 attempts). These findings are consistent with those for nasals in medial codas, which emerged at an early stage, although only at 1;07.05, so at least five months later than for word-final /n/ described here. The child showed a better performance at producing this coda than for any of the other analyzed segments.

Figure 31: Irene's production of alveolar nasal /n/ in final lexical codas



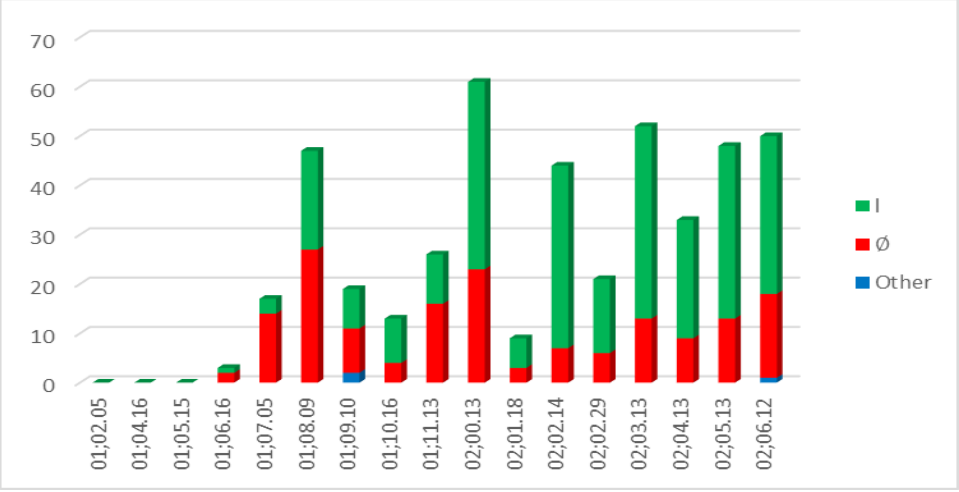
At ages 1;02.05 and 1;04.16, we can see 13 substitutions of alveolar /n/ by bilabial [m] in proper nouns *Pan* /pan/ and *Pedrín* /peˈðrin/, assimilated as [ˈpam] and [bemˈbim] or [ˈbim] respectively. This pattern is similar to what we observed in section 2.2.2, for the development of word-medial nasal /n/. We can thus claim that final lexical /n/ was acquired in earnest at 1;05.15.

Irene's corpus only contains three final lexical codas in unstressed syllables, specifically in the proper names *Virgen* and *Fuman.* The child accurately produced 100% of these codas. The other 572 attempts occurred in stressed syllables. It is thus impossible to observe potential prosodic effects for the development of these codas. However, we also cannot rule out that the early development of this consonant was influenced, at least part, by the fact that virtually all the attempts at producing it occurred in stressed syllables.

3.1.3 Lateral /l/

Irene also acquired lateral /l/ in final lexical codas during the course of the observation period.[10] This consonant emerged early in this position, at age 1;06.16 (there were no attempts in the four months preceding this observation). Mastery also occurred earlier than in medial codas, at around 2;00.13 (vs. 2;03.13), after four months during which Irene showed noticeable levels of accurate productions.

Figure 32: Irene's production of lateral /l/ in final lexical codas



10 Coda /l/ in Spanish is also present in derivational morphemes, e.g. *sensacional* /sensasjoˈnal/ 'sensational'. However, Irene's corpus only contains lexical /l/.

Between ages 1;06.16 and 1;09.10, deletions were more predominant than productions. This pattern changed at age 1;10.16, itself followed by a dip in performance at 1;11.13, after which accurate productions became the dominant norm.

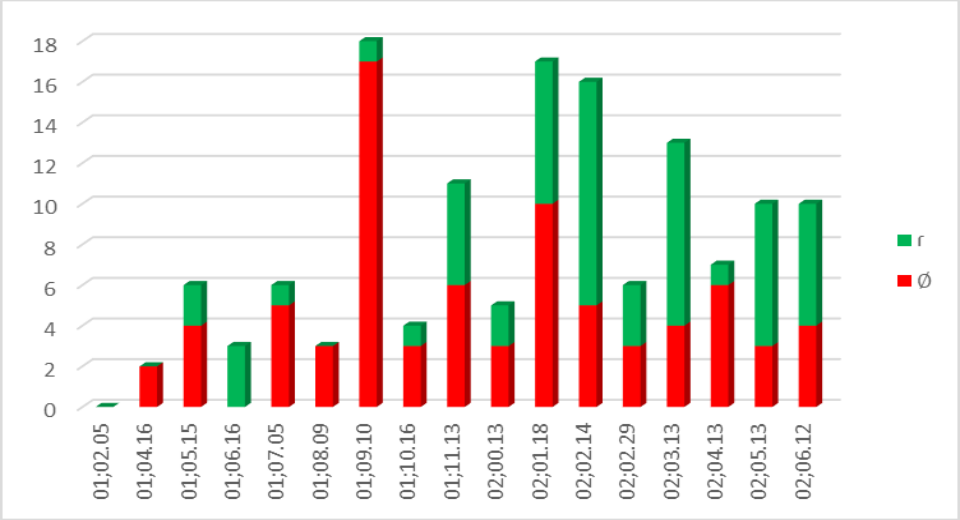
We can observe three substitutions overall. Two of them by nasal [n], at 1;09.10, with *Daniel* /daˈnjel/ produced as [ɾaˈɾen], and one substitution by rhotic [ɾ], at 2;06.12, in which *igual* /iˈɣwal/ was realized as [iˈɣwaɾ] 'same'.

Concerning stress, and similar to /n/, /l/ in final codas occurred predominantly in stressed syllables (435 out of 443 cases). Following the logic expressed above for /n/, it may be that stress played a facilitating role in the development of /l/ in final syllables, but we cannot independently verify this possibility.

3.1.4 Rhotic /ɾ/

Rhotic /ɾ/, in contrast to /n/ and /l/, but in line with the fricatives, displays a majority pattern of deletion in final codas, especially during the 11 months before it was acquired, at 2;02.14 (78 deletions and 59 productions out of 137 attempts). This consonant displays noticeable variability, especially from 1;11.13 onward, when accurate productions alternate as either the majority or the minority patterns between sessions, until the end of the observation period.

Figure 33: Irene's production of rhotic /ɾ/ in final lexical codas

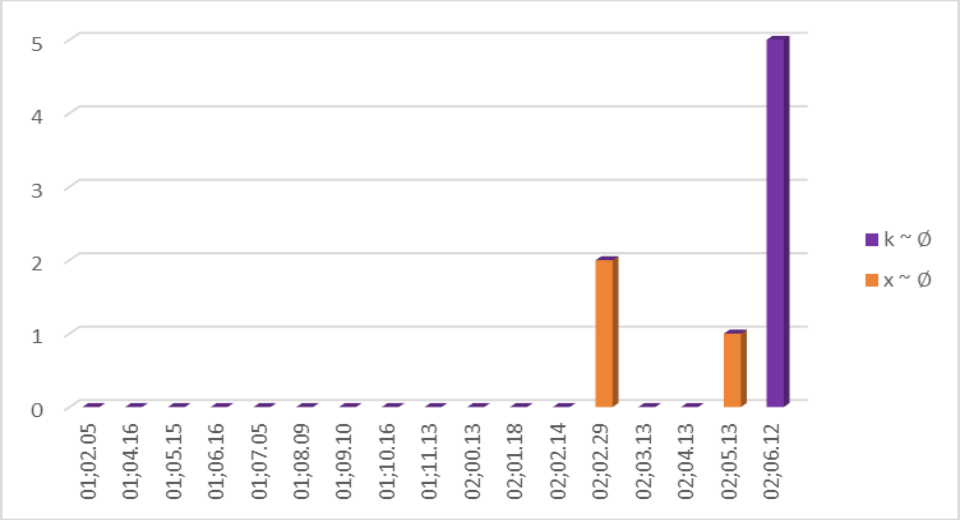


Finally, out of 124 /ɾ/ in stressed final lexical codas, Irene produced 40% and deleted 60%. On the contrary, out of 11 unstressed ones, she produced 82% and deleted 18%. These findings might suggest a preference for unstressed over stressed lexical codas. However, the relative lack of quantitative evidence concerning /ɾ/ in unstressed syllables does not allow us to safely draw conclusions about a clear role for prosody.

3.1.5 Residual Cases /k/, /x/

I decided to group final lexical codas /k/ and /x/ into a single residual category, given the low number of occurrences of these segments. It is important, however, to describe their development for sake of exhaustivity. As we can see in Figure 34, Irene did not acquire any of these target codas during the observation period.

Figure 34: Irene's production of /k/ and /x/ in final lexical codas



The child deleted velar fricative /x/ in its three occurrences in the word *reloj* /reˈlox/ 'watch', at 2;02.29 and 2;05.13. Note that fricative /x/ also tends to undergo deletion in syllable codas in the speech of all but the most prescriptive speakers of Spanish. Similarly, at age 2;06.12, velar stop /k/ undergoes deletion, with only five occurrences in the proper names *Asterix* and *Obelix*. Just like medial /k/, adult speakers of this Spanish dialect tend to delete this segment in final codas.

Finally, similar to the above attempts, it is not possible to draw a conclusion on the influence of prosody in the production of /k/ and /x/ in final lexical codas, as more data would be required.

Table 16 below depicts the timeline of Irene's development of all lexical codas described in this section. We can see that the child mastered nasal /n/ earlier than any other segment; rhotic /ɾ/, lateral /l/ and fricative /s/ emerged later, with fricatives showing the highest of difficulties more generally, as Irene did not acquire fricatives /θ/ or /ð/ during the observation period.

Table 16: Irene's final lexical coda acquisition

	01;01.25	01;02.05	01;04.16	01;05.15	01;06.16	01;07.05	01;08.09	01;09.10	01;10.16	01;11.13	02;00.13	02;01.18	02;02.14	02;02.29	02;03.13	02;04.13	02;05.13	02;06.12	Not acquired
[θ]	--	D	--	--	D	D	D	D	D	S	D	D	S	D	S	D/ S	D/ S	--	X
[ð]	--	--	--	--	--	--	--	--	D	D	--	--	--	--	D	D/ S	✓	--	X
[s]	--	D	D	D	--	D	D	D	D	D/ ✓	✓	✓	✓	✓	✓	D/ ✓	D/ ✓	D	
[n]	--	S	S	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
[l]	--	--	--	--	D	D	D	D	✓	D	✓	✓	✓	✓	✓	✓	✓	✓	
[ɾ]	--	--	D	D	✓	D	D	D	D	D	D	D	✓	D/ ✓	✓	D	✓	✓	

Legend for chart interpretation:
✓: Acquired D: Deleted S: Substituted X: Not acquired
--: No attempts at target final lexical coda

3.2 Final Inflectional Codas

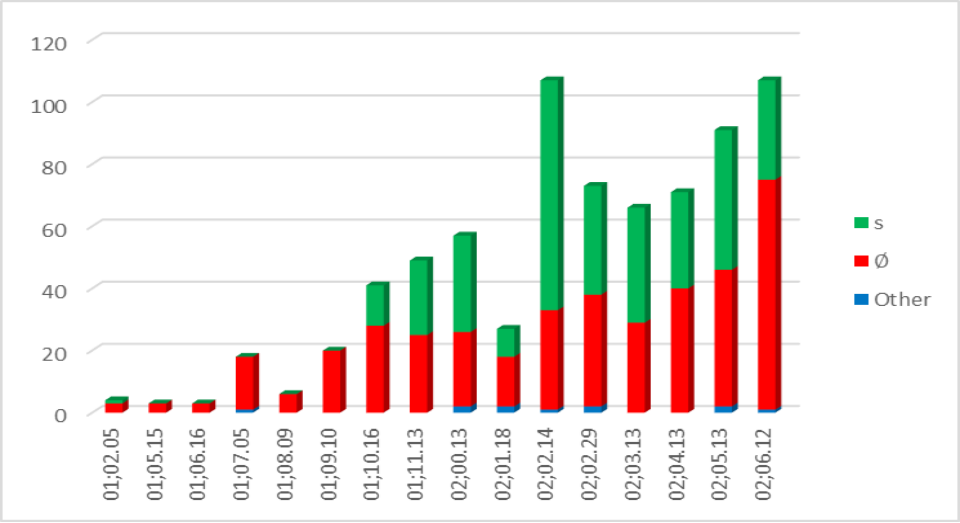
In this section, I describe the development of Irene's final inflectional codas /s/, /n/, /ɾ/, which are part of verbal inflections and plural number in Spanish. As we will see, based on comparisons with the final lexical and medial codas described above, Irene continues to prefer inflectional nasal /n/, while her performance at fricative /s/ and lateral /l/ alternates between deletions and accurate productions throughout the observation period.

3.2.1 Fricative /s/

Fricative /s/ occurs in plural forms of nouns, adjectives, determiners and pronouns, as well as in certain verbal forms like second person singular (*tú*), e.g. *habla*s̲ 'speak(2.sg.)', first person plural (*nosotros*), e.g. *hablamo*s̲ 'speak(1.pl.)', and second person plural (*vosotros*), e.g. *habláis*̲

'speak(2.pl.)' (Eddington 2004). As we can see in Figure 35, the dominant pattern of fricative /s/ in inflectional codas is that of deletion (400 deletions against 332 accurate productions). This result is consistent with the ones of /s/ in medial and final lexical codas described above.

Figure 35: Irene's production of fricative /s/ in final inflectional codas



The first accurate production of fricative /s/ is recorded at 1;02.05. However, the next accurate token did not occur until 1;10.16, when accurate productions started to be consistently present in each session, although in a variable way, until the end of the observation period. We can observe a spike in accurate productions at 2;02.14, which is not due to any specific word. In contrast to this, at 2;06.14, we can see a spike in deletions, which repeatedly occurred in the verb *es* /es/ 'be.3.sg.' (30 out of 74 deletions).

The results display seven substitutions by coda [θ] in five sessions (at 2;01.18, 2;02.14, 2;02.29, 2;05.13 and 2;06.12), all in words ending in /as/, like *das* /das/ 'give(2.sg.)', *las* /las/ 'the.fm.pl.' and *avellanas* /aβeˈʝanas/ 'hazelnuts'; and four substitutions by coda [h] in three

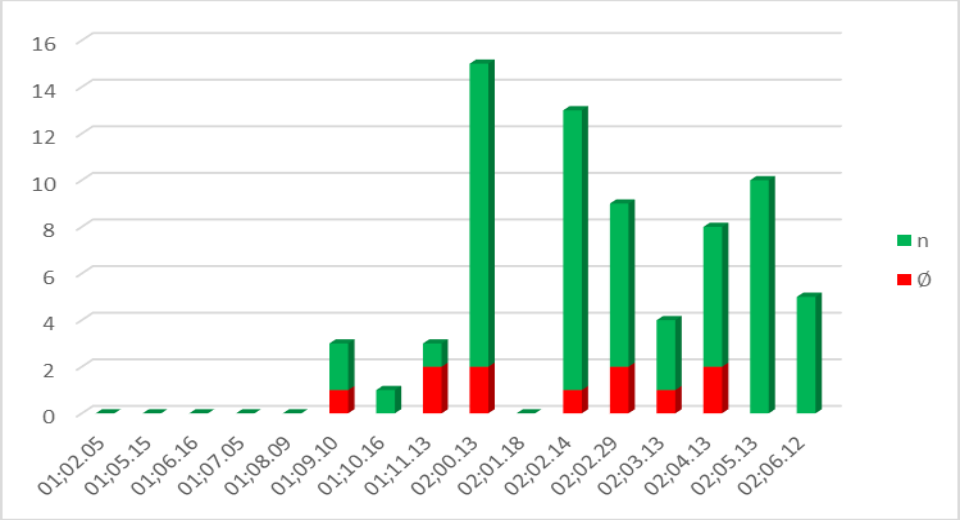
sessions (at 1;07.05, 2;00.13 and 2;05.13) in determiners *los* /los/ ‘the(mc.pl.)’, *las* /las/ ‘the(fm.pl.)’, and the noun *nenés* /neˈnes/ ‘babies’.

Concerning the role of stress in the acquisition of inflectional coda /s/, Irene produced 49%, deleted 50% and substituted 1% of /s/ in unstressed codas. On the other hand, the child produced 41%, deleted 57% and substituted 2% of /s/ in stressed codas. These trends do not suggest any clear influence of prosody in the child’s production of inflectional /s/.

3.2.2 Nasal /n/

Inflectional nasal coda /n/ occurs in verbal forms like third person plural indicative (*ellos/ellas*), e.g. *hacen* ‘do(3.pl.)’, second person singular (*tú*) and second person plural (*ustedes*) imperative, e.g. *ven* ‘come(2.sg.)’ and *lean* ‘read(2.pl.)’, as well as second (*ustedes*) and third (*ellos/ellas*) person plural subjunctive, e.g. *vean* ‘see(2.pl.)’ and *hablen* ‘talk(3.pl.)’. We can see, in Figure 36, a predominance of accurate productions (n=60) and a low number of deletions (n=11). This nasal coda first emerged late (at 1;09.10), compared to fricative /s/ described above. However, Irene acquired this segment by 2;00.13, in spite of the minor and variable pattern of deletion that persisted until 2;04.13. There were no substitutions of this segment during the months of observation.

Figure 36: Irene's production of nasal /n/ in final inflectional codas



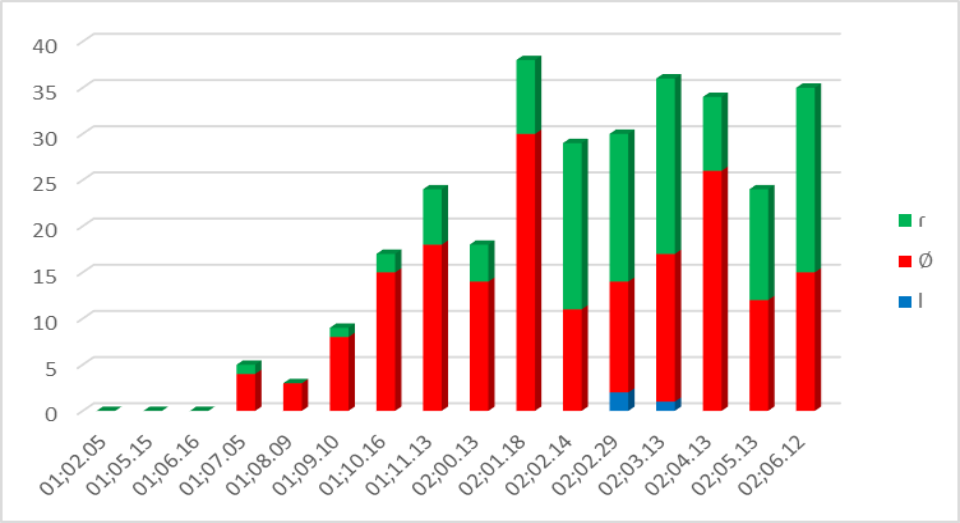
In fact, the child accurately produced 100% of inflectional coda /n/ both at 1;10.16 and during the last two recording sessions (2;05.13 and 2;06.12). In comparison to the other contexts surveyed in this thesis, the child's performance at nasal /n/ is generally good in final inflectional, final lexical and medial codas from the first sessions where it was attempted by the child. Regarding the impact of prosody on Irene's acquisition of inflectional coda /n/, she accurately produced 89% and deleted 11% of inflectional /n/ in stressed codas. She also accurately produced 82% and deleted 18% of /n/ in unstressed syllables. Irene's performance in stressed and unstressed inflectional coda /n/ thus yielded results that are similar to virtually all of the other contexts surveyed this far, where we can compare patterning in stressed vs. unstressed syllables

3.2.3 Rhotic /ɾ/

Inflectional rhotic /ɾ/ only occurs in infinitive verbs in Spanish, like *hablar* /aˈβlaɾ/ 'to talk', *hacer* /aˈseɾ/ 'to do' and *escribir* /eskɾiˈβiɾ/ 'to write'. Irene's development of this segment shows more variability than the other inflectional codas described above. The child did not

acquire inflectional /ɾ/ during the observation period, given the predominant pattern of deletions (n=184), and a lower number of accurate productions (n=115.)

Figure 37: Irene's production of rhotic /ɾ/ in final inflectional codas



Inflectional rhotic /ɾ/ first emerged at age 1;07.05. The following month, Irene deleted 100% of this segment. From 1;07.05 until 2;01.18, deletions outnumbered accurate productions. This same pattern was repeated at 2;04.13. During the last month of observation, accurate productions were higher than deletions, which suggests improvement in Irene's development of inflectional /ɾ/; however, from the still predominant pattern of deletion that persists through the last recordings, we cannot conclude that the child acquired this segment during the observation period.

In Figure 37, we can see three substitutions by lateral /l/ at ages 2;02.29 and 2;03.13, which come from the verbs *ver* /beɾ/ → [ˈbel] 'to see', *comprar* /komˈpraɾ/ → [komˈplal] 'to buy' and *hablar* /aˈβlaɾ/ → [aˈβlal] 'to talk'.

Concerning the effect of prosody, final inflectional coda /ɾ/ only occurs in stressed syllables, therefore, this dataset does not contain any attempts at this coda type in unstressed

syllables. Irene deleted 57%, accurately produced 41% and substituted 1% of stressed inflectional /ɾ/. In a way generally similar to what we observed with most other codas, these results suggest that stress did not facilitate the production of /ɾ/ in inflectional codas.

Table 17 provides a general picture of Irene's performance at final inflectional codas. We can see that the child did not have marked difficulties at acquiring nasal /n/. However, for fricative /s/ and rhotic /r/, there is variability between deletions and accurate productions from her first attempts at these inflectional codas until the last recording session.

Table 17: Irene's final inflectional coda acquisition

	01;01.25	**01;02.05**	**01;04.16**	**01;05.15**	**01;06.16**	**01;07.05**	**01;08.09**	**01;09.10**	**01;10.16**	**01;11.13**	**02;00.13**	**02;01.18**	**02;02.14**	**02;02.29**	**02;03.13**	**02;04.13**	**02;05.13**	**02;06.12**	**Not acquired**
[s]	--	D	--	D	D	D	D	D	D	D	✓	D	✓	D	✓	D	✓	D	X
[n]	--	--	--	--	--	--	--	✓	✓	D	✓	--	✓	✓	✓	✓	✓	✓	
[ɾ]	--	--	--	--	--	D	D	D	D	D	D	D	✓	✓	✓	D	D/ ✓	✓	X

Legend for chart interpretation:
✓: Acquired D: Deleted S: Substituted X: Not acquired
--: No attempts at target final inflectional coda

3.3 Summary

Irene's development of final lexical and final inflectional codas is generally consistent with the results yielded by medial codas. The child showed a better performance with final nasal coda /n/, both lexical and inflectional, while she had more difficulties with lateral /l/, fricative /s/, and rhotic /ɾ/.

Focusing on final lexical codas, Irene acquired the consonants /n/, /l/, /s/ and /ɾ/, but failed to acquire /θ/ and /ð/ during the observation period.

Concerning the final inflectional codas /n/, /s/ and /ɾ/, Irene only acquired nasal /n/, at 2;00.13, which had emerged at 1;09.10. Fricative /s/ emerged at 2;00,13, and rhotic /ɾ/ at 2;02.14, but neither of these two consonants was acquired during the observation period.

Comparing final lexical codas to inflectional ones, Irene showed a better performance with lexical nasal /n/, which was acquired at 1;05.15; while inflectional /n/ was acquired later, at 2;00.13. Similarly, lexical fricative /s/ emerged earlier than inflectional /s/ (1;11.13, and 2;00.13, respectively). In fact, only lexical /s/ was acquired, at 2;00.13. Lexical rhotic /ɾ/ was also better than its inflectional counterpart. Lexical /ɾ/ emerged at 1;06.16, and the child acquired it at 2;02.14; while inflectional /ɾ/ emerged later, at 2;02.14, and was not acquired during the observation period. Lexical /s/ and /ɾ/ emerged earlier than their inflectional counterparts, but mastery was not reached for either of these inflectional segments.

Regarding the interaction between phonology and morphology in Irene's coda acquisition, these results suggest that all of these phones either emerged or were mastered phonologically before they started expressing themselves as inflectional markers.

Chapter 5: Discussion

1 Introduction

In this chapter, I discuss the results of my thesis, presented in the preceding chapter, according to both the position of the codas within the word, and their morpho-phonological status, namely as medial, final lexical and final inflectional codas. I begin with a summary of Irene's development of these consonants. I then address my results in light of the previous studies I surveyed in Chapter 2 of this research, comparing other scholars' findings to the current ones.

As we will see, the current results support previous claims that phonology emerges before morphology, and also fall in line with the order of acquisition of segmental categories reported in earlier studies. However, these results fail to independently show that stress accelerates coda development, given that prosody does not appear to have an impact on medial codas, while its potential effect on final codas (especially the lexical ones) cannot be verified independently. In sum, my results offer a new perspective on coda development in Spanish, which highlights an already-established correlation between stress and coda position during the process of acquisition, yet cannot establish a causal relationship between these two elements.

2 Summary of Findings

In this section, I present a summary of the current findings. Beginning with medial codas, we can observe a majority pattern of accurate productions of nasal consonants (/m/, /n/ and /ŋ/). These segments were acquired earlier than any other phonological category in medial coda. Irene acquired alveolar nasal /n/ at 1;07.05, followed by labial /m/ at 1;09.10, and by velar /ŋ/ at 1;10.16. By comparison, rhotic /ɾ/ and lateral /l/ were never acquired during the course of the observation period. Minimally, we saw an increase in the proportion of accurate productions of

these consonants toward the end of the period, suggesting a possible shift toward Irene's mastery of /l/ and /ɾ/ not too long after the end of the period covered by the corpus.

Regarding final lexical codas, Irene acquired nasal /n/ at 1;05.15, two months before medial /n/. The child acquired lateral /l/ at 2;00.13, and rhotic /ɾ/ at 2;02.14. These three phones were thus mastered earlier in final lexical codas than in medial codas, but in the same general order. Similarly, fricative /s/ was acquired in final lexical codas at age 2;00.13, while it was not acquired in medial codas by the end of the period described by the corpus.

As compared to final lexical codas, inflectional codas clearly lagged behind in their development. For instance, nasal /n/ was acquired seven months after lexical codas and five months after medial ones, at 2;00.13. Aside from this, Irene's performance at inflectional /n/ was similar to the nasals in the other two coda positions, as she acquired this phonological category before any other one in each of the three positions studied. Irene attempted inflectional /s/ one month later than lexical /s/, at 2;00.13. However, the child did not acquire this inflectional coda. The same applies to rhotic /ɾ/, which emerged in final lexical codas at 2;02.14, the same month the child attained mastery of the lexical rhotic, but was not acquired in inflectional codas by the end of the period under investigation. As we can infer from these results, morphology played no role in the child's development of medial, lexical and inflectional codas, given that lexical codas were the ones that the child acquired first; conversely, we can claim that phonology was solidly in place before the child mastered the morphological content related to final inflectional codas.

Finally, no conclusive evidence was uncovered about the potential influence of stress on the developmental patterns. In medial codas, for instance, where there is no difference in morphological status (lexical vs. inflectional), we can observe only slight and contradictory tendencies in the data. Indeed, while medial /m/, /n/, and /ŋ/ were slightly favoured in unstressed syllables, medial /l/ and /ɾ/ were slightly favoured in stressed syllables.

Minimally, it is possible that the earlier development of lexical codas in final position was influenced by stress, given that the vast majority of lexical codas appear in stressed syllables in the data, which correlates with their early mastery: 572 stressed final lexical /n/ vs. 3 unstressed ones; 435 stressed final lexical /l/ vs. 8 unstressed ones; and 127 final lexical /s/ vs. 18 unstressed ones. However, because we cannot compare coda development in final stressed vs. unstressed syllables based on such disproportionate distributions, we cannot possibly determine whether stress, as opposed to the word-final status of the coda, is truly the driver of the early mastery pattern observed. Indeed, as reported in many studies of other languages, word-final codas do appear to enjoy a privileged status in phonological development, independent of their being in stressed or unstressed syllables (e.g. Fikkert 1994; Freitas 1997; Costa 2010; Smith 1973; Rose 2000, 2003). This conjecture is particularly important given that, as summarized above, the mastery of codas in word-medial position is arguably not determined by stress. This thus begs the question as to why stress should be taken as the driver of development in final syllables if it is not in medial ones.

More generally, the results fall in line with models of phonology and phonological development which attribute a different syllabification status to word-medial vs. word-final codas (e.g. Piggott 1999), as these models correctly predict that, all else being equal (in the present case, in the absence of morphological inflection), word-final consonants be acquired before word-medial ones (see also Goad & Brannen 2000, 2003 for phonetic evidence pointing in the same direction as Piggott 1999; see also Rose 2000, 2003 for additional discussion).

These observations thus call for additional case studies on the acquisition of Spanish phonology following the methods applied in the current thesis, or similar methods also focused on the systemic comparison of coda development across the three positions described above (medial, final lexical, and final inflectional). Should the findings of this eventual study be

generalizable to other participants, the data would then pose a challenge to previous analyses which conclude that stress influences the development of codas, both in Spanish and in other languages. Similarly, if stress proves to be determining for the acquisition of final codas, additional investigations would also need to address the apparent paradox that the current results suggest, whereby prosody would influence final codas but not medial ones. More generally, results from this extended, cross-linguistic study would contribute to current debates about syllabification and prosodic development at the right edge of words.

3 Addressing Previous Studies in Light of Current Studies

This research was primarily based on Polo's (2013) longitudinal study of two Spanish-speaking children, in an attempt to supplement her original investigation, as well as on other scholars' works on the development of coda consonants in Spanish, which I summarized in Chapter 2. I now return to these studies in light of the results above.

First, at the level of segmental development, Polo's (2013) analysis revealed that both participants acquired the nasal coda /n/ and the lateral coda /l/ earlier, followed by the fricative /s/, and lastly, by the rhotic /ɾ/. The results that I obtained from Irene's speech follow this exact pattern.

Second, at the level of prosody, Polo (2013) claims that stress plays a major role in children's development of codas /s/, /n/, /l/ and /ɾ/, as these segments were accurately produced earlier in stressed syllables than in unstressed syllables in her corpus data. Polo's findings are also in line with that of Lleó (2001) for Spanish and Prieto & Bosch-Baliarda (2006) for Catalan, who also found codas in stressed syllables to be acquired before codas in unstressed ones. However, as already mentioned, the current findings fail to support this apparent generalization. In the absence of independent evidence for the role of stress in shaping

development, word finality appears to be the main driver of early acquisition. Note, however, that the differences between past and current results may have arisen, at least in part, from methodological differences in data classification. Polo (2013), for instance, analyzed codas based on word position, stress, and morphological content in separate sections, while my thesis proposed two main groups: medial codas and final codas, in order to offer a better understanding of how different factors may interact in the acquisition of coda segments in Spanish. In addition, returning to Polo's (2013) results, note as well that stress was a determining factor in her study of codas /s/, /n/, /l/ and /ɾ/ both in word-medial and -final position. The same cannot be said of Lleó's (2003) findings, which show that medial codas, rather than final ones, are facilitated by stress, as the emergence of medial codas occurs earlier. This variability in previous results may also point to differences in learning patterns between children of which Irene would then be just another example. As suggested above, this can only be determined based on further research.

4 Self-criticism

This study offers an additional contribution to research on the role of phonology and morphology in the acquisition of Spanish codas. However, it is based on only one longitudinal case study, which makes it difficult, for instance, to generalize the current results to the larger population of Spanish learners. This fact is particularly important in light of the divergent conclusions discussed above; it is indeed possible that, as suggested, beyond potential issues inherent to methodological differences, it is Irene's individual development of codas in medial position that gave rise to these divergent conclusions.

In sum, other factors, like word finality, segmental development, or the potential role of stress across different positions within the word need to be further investigated based on additional children, and also from a cross-linguistic perspective.

5 Conclusion

The results of my thesis generally fall in line with previous studies of segmental development in syllable codas in Spanish, which claim that nasal codas are favoured over any other phonological category. My research also supports the conclusion that morphology does not accelerate the acquisition of codas. However, the current results, which provide a systematic separation of stress effects in word-medial vs. word-final positions, pose new questions concerning the correlation highlighted in previous studies between the early acquisition of lexical codas, and their being prosodified in stressed syllables. The results of this thesis thus call for further research concerning which factors ultimately govern the developmental sequences across different phonological positions.

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