THE ACQUISITION OF STRESS IN QUÉBEC FRENCH: A CASE STUDY

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by

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Abstract

In this thesis, I investigate the development of stress in EL's speech. EL is a first language learner of Québec French. I examine this young child's productions of the three typologically most prominent correlates of stress (fundamental frequency, intensity, and duration) from the age of 1;01.7 to 2;04.17. Building on this acoustic investigation, I propose three formal stages in the development of her stress system.

My proposal is based on systematic comparisons between final and penultimate syllables in declarative utterances, expressed in terms of calculated ratios which offer a measure of relative prominence for each of the three cues under investigation. I illustrate that the child uses duration as her main cue to mark stress. This mirrors the target stress system. However, at early ages, the child also appears to use fundamental frequency to mark stress, in a way that departs from the target system. Observations such as this are one of the considerations that compel me to develop stages of stress acquisition in the formal proposal. I also consider the variation in the data, which takes the form of relatively high positive and negative ratios. I examine these values and account for them through identification of various influences on the child's speech. Finally, I extend my acoustic study to incorporate one further influence, that of phonological compensatory lengthening, which also affects duration ratios.

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Table of Contents

List of Tables

Chapter 1

INTRODUCTION

1.0 Introduction

Speech production, despite its overwhelming complexity, is generally taken for granted by most individuals. In fact, most people are not overtly aware of the phonological processes that take place in a seemingly automatic way during speech production. For example, syllable reduction is a process that occurs in English. This phonological process depends on the position of the stressed syllable. Stress is the emphasis of a syllable or a segment within a word or phrase. In English, all non-initial and non-final vowels are typically reduced with the exception of vowels carrying primary or secondary stress. For example, in (1), these reductions turn full vowels, such as [æ], to [ ], and the phoneme [t] becomes either of two allophones [t] or [ ], in an unstressed or weak syllable.

(1) *System* *Systematic* *Systematicity*

[s st m] [s st mæ k] [s st m t s i]

In addition to governing phenomena such as vowel reduction or aspiration of voiceless plosives, stress is extremely important for the rhythm of speech, which itself influences speech perception. Stress also plays a part in semantics and allows us to distinguish categories of speech. For example, in English, a language with lexical stress, a shift in stress position in multisyllabic words may affect the grammatical category of the word, as illustrated in (2).

(2) *Project* (noun) *Project* (verb)

[p kt] [p kt]

Stress can be described through both its metrical properties and its correlates at the acoustic level (Hayes 1995). The metrical properties are phonologically abstract and pertain to the types of rhythmic patterns that the language allows for. These rhythmic patterns are typically unveiled through paradigmatic comparisons across sets of words. As opposed to this, acoustic correlates are concrete and phonetically measurable. Of these two types of properties, the study that I focus on below primarily deals with the analysis of phonetic correlates and their emergence in a first language learner of Québec French.

Stress is indicated by one or more phonetic correlate(s). Potential correlates include fundamental frequency (pitch), intensity (amplitude), and duration (Hayes 1995). Each language has its own specific correlates. Adult English speakers, for example, use higher fundamental frequency, intensity, and, to a lesser extent, longer duration in stressed syllables (e.g. Fry 1955, 1958; Lieberman 1960; Klatt 1976). In contrast to this, French speakers mainly use one correlate: they produce stressed syllables with longer duration (O'Shaughnessy 1981; Vaissière 1991).

Most linguistic investigations of phonetic correlates are based on adult speakers' speech, as opposed to children's speech. This leaves the area of acquisition largely open for investigation. Acoustic investigations of the acquisition of stress are indeed far from abundant. This problem is further compounded by the fact that the existing studies are mainly restricted to the acquisition of English (e.g. Archibald & Carson 2000; Kehoe

1998; Allen & Hawkins 1980; Kehoe, Stoel-Gammon & Buder 1995; Pollock, Brammer & Hageman 1993). However, because of the fact that, as mentioned above, languages display specific properties of stress, previous information from these English studies cannot readily apply to data from other languages. There is, thus, a need to uncover the acquisition patterns of stress in other languages.

In this thesis, I offer a contribution to this area by examining data from a young female child, code-named EL, learning Québec French as her first language. I focus on her stress production patterns, which I investigate longitudinally, across various developmental stages. As mentioned above, adult French speakers produce longer syllable duration to mark stress, as opposed to the cue primarily affecting amplitude and fundamental frequency in English. One empirical question in this context relates to whether first language French learners across different developmental stages, display different phonetic correlates or different degrees of control of these correlates.

This thesis is organized as follows. Subsequent to this introduction, I provide a survey of background information in section 2 where I discuss phonetic correlates marking stress, stress acquisition studies, and tendencies of Québec French. I describe the methodology of the current study in chapter 2, focusing primarily on the participants (EL primarily, with some notes about her parents' linguistic profile), data recording and analysis protocols, and interpretation of the results. The ensuing chapter offers a discussion of my results, as well as a proposal detailing three developmental stages in the phonology of this learner. I also provide a slight extension to this study in Chapter 4, where I explore an apparent process of compensatory lengthening which affects final vowels in words whose target (adult) counterparts contain a consonant that is missing

from the child's production. I briefly conclude in chapter 5, summarizing the most central aspects of the thesis, and suggesting potential areas for further research.

1.1 Background Literature

This section offers a review of background literature which motivates the current study. Following this brief introduction, I begin with a discussion that focuses on the phonetic correlates of stressed syllables, in order to define the objects studied in section 1.1.1. Background literature on the acquisition of stress and its correlates follows in 1.1.2. Section 1.1.3 addresses stress production in adult (Québec) French, the target language under investigation. The final section (1.1.4) is a summary of the literature.

1.1.1 The perception and production of acoustic cues in young learners

As mentioned above, stressed syllables are acoustically characterized by increased intensity, fundamental frequency, and/or longer duration (Hayes 1995). Despite recent focus on these correlates in the field of acquisition, little is known about the acoustic cues that children use to mark stress in their early word productions. Relatively few studies have been conducted in this area, with most focusing on English learners. In this section, I discuss English studies by Allen & Hawkins (1980) (§ 1.1.1.1); Kehoe, Stoel-Gammon & Buder (1995) (§ 1.1.1.2); and Pollock, Brammer & Hageman (1993) (§ 1.1.1.3). In section 1.1.1.4, I will summarize the main issues raised by these three studies.

1.1.1.1 Allen & Hawkins (1980)

Allen & Hawkins (1980) conducted a phonological and phonetic study to determine the degree of prosodic control by English children producing stressed and unstressed syllables. In the phonological study, tape-recorded conversations with five children (age 2;2 to 3;9) were analyzed. Their productions of light syllables were compared to that of adult English speakers. Light syllable here refers to unstressed, open syllables, which were selected to ensure unbiased results from following tautosyllabic (coda) consonants. Results revealed that most children preserved strong (stressed) syllables and reduced light syllables. Light syllables were produced appropriately by some learners 65% of the time while others achieved only 35% target productions. Age and light syllable production were weakly correlated. Furthermore, an acoustic analysis was conducted on productions by three children (age 2;8 to 3;4) during verbal interactions with their mothers. It was found that the position of a syllable in a phrase had an effect on its duration: phrase-final syllables tended to have longer duration. Results from strong syllable preservation and light syllable reduction, which resembles the adult target system, indicate that most three-year-olds are able to produce distinctions between stressed and unstressed syllables.

1.1.1.2 Kehoe, Stoel-Gammon & Buder (1995)

Kehoe et al. (1995) examined similarities between phonetic correlates of stress produced by 22 children (1;6 to 2;6) and 6 adults. Both children and adults were tape-recorded in soundproofed rooms. The children's productions were spontaneous, while the adult's productions were elicited from 12 sentences where the target word was sentence-final.

Target words were phonetically-matched pairs of trochaic disyllables and monosyllables (e.g. MONkey vs. KEY). The monosyllable was matched with the unstressed syllable of the disyllabic word according to emotional level, phrase position and segmental effects (e.g. KEY vs. key). The results indicate that the correct use of amplitude as a phonetic correlate in English increases with age. Yet, the main point made by the authors is that children who are 1;6 years of age use the same phonetic cues as adult speakers. However, productions at this young age are not 100% consistent. As a result, the age at which children consistently use proper correlates of their language to indicate stress remains unclear. This study therefore points toward a gradual mastery of the acoustic correlates of stress. As we will see in chapter 3, my case study will reveal a similar pattern, with an additional correlate: duration.

1.1.1.3 Pollock, Brammer Hageman (1993)

The results by Kehoe et al. (1995) are contradicted by those of an earlier study by Pollock et al. (1993), who also examined the phonetic correlates of stress in English learners. They investigated, through acoustic measurements, children's stress productions in novel two-syllable words. Their study focuses primarily on the phonetic correlates used to mark stress by children who are two, three, and four years of age. The phonetic correlates measured were fundamental frequency, intensity, and duration. The children were asked to repeat nonsense words that were associated with objects. The authors used nonsense words to ensure lexically-unbiased results. These words were disyllabic and controlled for segmental content and stress position. The words were elicited in a random order through an imitation procedure using the objects to which the words were associated.

Presented with these target words, the subjects were repeatedly presented with the objects until three token productions were noted for each object. A group of 18 subjects, separated into three sub-groups with six children in each, produced the target utterances. Five English-speaking graduate students judged the children's stress productions. They listened to each child's productions and determined which syllable was stressed.

Results indicate that as the child's age increases, the listeners' perception on accuracy of productions did as well. From these results, Pollock et al. (1993) argue that three- and four-year-olds are able to produce the appropriate correlates to mark stress, thereby positing a difference between the two-year-olds, on the one hand, and the three- and four-year-olds, on the other hand. The two-year-olds showed variability with stress placement, but within multisyllabic words they were able to produce a distinction between stressed and unstressed syllables. In contrast, those over three years of age were consistent in marking the stressed syllable in a word by their use of fundamental frequency and/or intensity on stressed syllables. Those over three years of age also used duration as a cue to stress placement.

1.1.1.4 Interim discussion

The data from Kehoe et al. (1995) and Pollock et al. (1993) indicate that correct use of phonetic correlates to mark stress increases with age. Allen & Hawkins (1980) note that most three-year-olds correctly distinguish stressed from unstressed syllables in their productions. The stress patterns of English-speaking adults are similar to children age three years and older. Kehoe et al. (1995) and Pollock et al. (1993) found that not only do children over the age of three produce distinctions between stressed and unstressed

syllables, but children under the age of three also make some stress distinctions in their productions. These findings of Kehoe et al. (1995) and Pollock et al. (1993), however, are not identical. Kehoe et al. (1995) found that children at 1;6 use the same phonetic cues as adults, yet Pollock et al. (1993) found that two-year-olds do not use the same phonetic correlates. Surprisingly, for two-year-olds, it is unstressed syllables that are characterized by increased duration (Pollock et al. 1993), an observation that suggests that appropriate control of the right phonetic correlates is not yet acquired at this early age, whether this control is grammatically-determined or simply at the lower level of articulatory productions. Recall that the stress patterns of both English children and adults are based on a trochaic (strong-weak) system in which the stressed syllable typically has higher intensity, fundamental frequency, and, to a lesser extent, longer duration (e.g. Fry 1955, 1958; Lieberman 1960; Klatt 1976). As Allen & Hawkins (1980) suggest in their earlier work, the longer duration produced by the two-year-olds may be due to phrase-final syllables, as a rule, having longer duration (see Hayes 1995: 33 for the same phenomenon as universal in adult languages).

1.1.2. Background information on the acquisition of stress

This section focuses on children's acquisition of stress as a phonological system, beyond its phonetics, in order to highlight grammatical stages and related phonological patterns observed across learners. In section 1.1.2.1, I propose a comparison of Kehoe's (1998) acquisition patterns of stress, based on her observation of English learners, to Fikkert's (1994) proposed acquisition patterns based on data from Dutch learners. In section

1.1.2.2, I address Archibald & Carson (2000), who compare acquisition data of repair strategies, truncation, and foot type from English and French.

1.1.2.1 Kehoe (1998)

Kehoe (1998) compared her English data to Fikkert's (1994) previous findings of Dutch. Kehoe, in turn, created a model based on Fikkert's own proposal. Fikkert proposes four stages of stress acquisition, as follows.

(3) Fikkert's (1994) stages of acquisition

a. Stage 1: Trochaic feet are built from the right edge of the target in disyllabic productions and stress errors are absent.

b. Stage 2: Multisyllables are produced with trochaic stress, which may, in turn, yield an incorrect stress position (e.g. WS and SŚ are produced with a trochaic stress pattern).[1]

c. Stage 3: Equal level of stress production on each syllable.

d. Stage 4: Correct (adult-like) stress pattern is produced.

Kehoe draws on these stages to discuss results from her English corpus. She compares the two languages because they are both trochaic and, as such, she predicts, should yield similar patterns of acquisition. 18 English-speaking children (22- to 34-month-olds) were separated into three groups with six children in each (22 months, 28 months, and 34 months). The stimuli consisted of 20 three-syllable words (both novel and

[1] W= light unstressed syllable; S= heavy unstressed syllable; Ś= heavy stressed syllable.

real) with four different target metrical patterns (e.g. ŚWS, SWW, SWŚ and WSW). The experiment was based on a semi-elicitation task during two 45-minute recording sessions, which took place one week apart. Recordings were examined both perceptually and acoustically with focus on the analyses of fundamental frequency and the sound's waveform.

Focusing on ŚWS, SWW, SWŚ, and WSW word shapes, Kehoe organized her data into stages. Based on her results, which are for the most part in line with Fikkert's findings, Kehoe proposes a slightly different, three-stage acquisition path.

(4) Kehoe's (1998) stages of acquisition

Stage 1: Trochaic Constraint Stage

Stage 2: Experimental Stage

Stage 3: Consistent Stress Pattern Stage (Mastery Stage)

The youngest children in the data set (22-month-olds) display the Trochaic Constraint Stage, which is consistent with Fikkert's stages 1 and 2. These children produce many truncations that result in one- and two-syllable word productions that generally conform to a trochaic foot. The Experimental Stage, congruent to Fikkert's third stage, is attained by the 28-month-olds who attempt multi-syllable word forms with multiple stresses. When attempting these word forms, the children produce level and incorrect stress. Lastly, analogous to Fikkert's Stage 4, adult-like productions by the 34-month-olds occur at Kehoe's Mastery Stage.

Both Kehoe and Fikkert discuss the consistency of children's productions within the main parameters in Metrical Stress theory (e.g. foot-headedness, quantity-sensitivity, directionality of stress parsing, extrametricality and main stress). With regard to footing and direction of stress parsing, the errors produced by both English and Dutch children are consistent with right-to-left parsing of trochaic feet. They are also consistent with quantity-sensitivity. Findings related to extrametricality and main stress (end rule right) in English children are in line with the evidence from Dutch. 34-month-olds produced word-initial stress instead of word-final stress and occasionally shifted stress to the final syllable. This clearly suggests that extrametricality is not yet acquired even at this stage. In addition, the default parameters proposed by Fikkert (foot-headedness [Left], directionality [R-L], no parsing, and quantity-insensitivity) could not be verified in this study. This lack of verification comes from the fact that Kehoe's study is cross-sectional, as opposed to Fikkert's longitudinal investigation. However, from Kehoe's analyses, all default parameters appear to be set as proposed by Fikkert. As mentioned above, Fikkert states that the quantity-sensitivity setting changes at Stage 3. This could not be confirmed because the youngest children's productions appear to abide by quantity-sensitivivity, an observation which contradicts Fikkert's proposal for a quality-insensitive default setting. However, again here, the relative absence of early data in Kehoe's study does not enable one to draw firm conclusions on this topic. In other words, the fact that no data have been found in this study cannot be interpreted as conclusive proof undermining Fikkert's proposal.

1.1.2.2 Archibald & Carson (2000)

Archibald & Carson (2000) examine the acquisition of stress by English- and French-speaking children to determine and compare the acquisition of different types of foot patterns (iambic and trochaic). Addressing issues similar to those in Fikkert (1994) and Kehoe (1998), the authors compare acquisition data from the two languages while focusing on word form production and truncation patterns, with an emphasis on foot type.

During their acquisition of English, children produce bimoraic feet, which the authors analyze as a prosodic template. Children adjust their productions to make their words fit this template through either the addition or deletion of syllables. For example, to fill the bimoraic structure, the children will delete an unstressed syllable preceding a stressed syllable rather than delete an unstressed syllable following a stressed syllable, because their template is trochaic (strong-weak).

(5) Tomato > MAto (WSW)

— Deletion of antepenultimate unstressed syllable 'to'

— Production of trochaic (SW) pattern 'MAto'

(6) Tomato > *toMA (WSW)

— Deletion of final unstressed syllable 'to'

— Production of iambic (WS) pattern 'toMA'

The attestation of (5) and absence of attestation of (6) together suggest the effect of a trochaic bias or some kind of default setting (cf. Rose & Champdoizeau 2007 for a

discussion on the trochaic 'bias' construct, which they claim to be language-specific). Children may also attempt to fill this template through the release of the final consonant, which provides a nucleus that allows the final consonant to reside in onset position (e.g. Goad & Brannen 2003). This process is illustrated in example (7) below:

(7) *fête* /fɛt/ > /fɛt^{h}/

CVC > CVC^{h}

-Aspiration is the phonetic exponent of the nucleus present in the representation

In Québec French, primary stress falls primarily on the ultimate syllable. When this does not occur, it is located on the penultimate syllable. According to Walker (1984) and Paradis and Deshaies (1990), the shifting of stress to the penultimate syllable may be due to factors such as vowel quality or rhymal structure, which influence the location of stress. This suggests that foot type in Québec French is not strictly iambic.

Archibald & Carson analyzed the earliest utterances produced by three French-speaking children (1;3 to 1;10) and two English-speaking children (1;7 to 1;9). All productions considered in this study were spontaneous. These productions were first digitized and phonetically transcribed. Archibald & Carson then analyzed the duration of syllable rhymes according to syllable type (stressed or unstressed) and position within the word. Foot type was also investigated by analyzing productions of 185 target groups (e.g. iambic, trochaic, unknown, and monosyllabic).

In French, Archibald and Carson found that the final syllable (stressed or unstressed) is longer than any syllable in non-final position. This observation however

contradicts the observations by Armstrong (1999). Armstrong states that non-final syllable lengthening is optional in Québec French. Aside from other observations, French children also display stress retraction, which may indicate one of two things. Either the children have acquired adult-like stress retraction or they shift stress because they are resorting to a default trochaic template and later that template will adjust to an iambic pattern. Discussing this observation, the authors speculate that the trochaic-like productions may emerge from an influence of either child-directed speech or some type of parsing strategy (cf. Rose & Champdoizeau 2007).

The types of feet produced by all children were analyzed. The highest proportion of correct target utterances produced contained iambic targets, with iambic stress produced 37% of the time (70/185). Although this indicates that not even half of the iambic productions were correctly produced, the complete data set may suggest that French learners abide by an iambic template. Indeed, non-iambic target forms were correctly produced at a much lower proportion (e.g. target trochaic forms were correctly produced at a rate of only 13%).

The authors' analysis of production patterns suggests that French and English children truncate syllables at the same frequency, however not for the same reason. English-speaking children truncate words to form trochaic feet. From this, one would expect French-speaking children to truncate syllables to form iambs, but this is not the case. French-speaking children truncate syllables to produce monosyllables and, in turn, they preserve stressed and/or final syllables. Therefore, when stress retracts to the penultimate position, two syllables are retained, but when stress is in the ultimate position, only the final syllable is preserved.

As we can see from this study, we cannot draw a firm conclusion concerning the types of factors that may influence the development of stress in (Québec) French, at least at the phonological level. In my case study in Chapter 3, I aim to document this topic, mostly from an acoustic perspective, and I do not address the issue of syllable truncation further. I leave this topic for further research. In the next section, I turn to the properties of stress in the child's target language: Québec French.

1.1.3. Stress in Québec French

In this section, I present a survey of studies focusing on stress in adult Québec French (QF) and acquisition. I begin with a study by O'Shaughnessy (1981), in section 1.1.3.1, which documents the main phonetic correlate of stress measured from the speech of a single Canadian French (CF) speaker.[2] This study focuses mainly on the influence of differing phonetic contexts on the duration of vowels and consonants in stressed syllables in French. The possibility of stress occurring in either penultimate or final position is examined in section 1.1.3.2. Section 1.1.3.3 follows with a brief description of the influence of fundamental frequency in QF as described by Poiré (2000). Section 1.1.3.4 focuses on Paradis, Petitclerc & Genesee's (1997) study of word productions by young speakers. In section 1.1.3.5, I discuss Paradis & Deshaies (1990), which approaches the examination of stress and its positioning from an angle which is, for the most part, atypical. Here, they discuss subdivisions of stress into three categories (tonic, emotive and emphatic). The importance of this study, which at first may appear tangential to the current study, lies in its documentation of potential stress shifts in QF.

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[2] The general properties of CF discussed here are representative of most dialects of QF (Y. Rose, p.c., Dec. 2007).

1.1.3.1 O'Shaughnessy (1981)

O'Shaughnessy tape-recorded an adult CF male speaker who read 285 French target words, all produced in the carrier sentence: "Le mot X est simple", where X (target) is a stressed word followed by a brief pause. These recordings were analyzed on a spectrogram, with an emphasis on three potential effects on duration: (1) the effect of consonant clusters on consonant duration; (2) the effect of consonant properties (voicing and manner of articulation) and position on vowel duration, as well as the effect of vowel properties such as nasalization and height on vowel duration; and (3) the effect of word length (calculated in number of syllables) and position on both vowel and consonant duration.

O'Shaughnessy indicates that durations vary according to phonetic context in both vowels and consonants, as summarized in (8).

(8) Duration of vowels and consonants (O'Shaughnessy 1981)

a. Vowel duration is influenced by nasality and by the following consonant. There is an influence only in closed syllables, not in open syllables. In closed syllables, nasalized vowels are longer than corresponding oral vowels.

b. Consonants increase or decrease in length in clusters depending on ease and proximity of articulations between the consonants.

c. Long consonant durations indicating a lack of voicing, shortened in clusters when there was a common voicing feature.

d. Speakers mainly try to produce equal duration syllables, however, syllables directly preceding a pause are very long.

As we can see from this summary, while stress (or, more generally, rhythm) is heavily influenced by segmental factors in Québec French, pre-pausal salience, phonetically encoded as increased duration, emerges as a systematic rhythmic marker. This is significant in that the (Québec) French system does not have lexical stress, in contrast to languages such as English or Dutch discussed above. Stress therefore serves a syntactic delimitation function in this language, as discussed further below.

1.1.3.2 Differences between Standard and Québec French

O'Shaughnessy (1981) thus reveals certain tendencies in QF. However, linguists have discussed one significant discrepancy between QF and European French, specifically

concerning the position of the stressed syllable[3]. As posited by most linguists, French stress placement occurs in the ultimate syllable of each phrase, whichever the number of syllables involved in this phrase (Fouché 1934; Garde 1968). However, other scholars state that in QF stress position is variable (Paradis & Deshaies 1990; Walker 1984).

Recall that syllable (vowel) duration is the main cue for stress in French. Therefore, if syllables of longer duration occur in non-final position then stress may be perceived in that particular location. For example, in the phrase <*en tout cas*> [:tuk] 'in any case', the first syllable, which surfaces in the form of a long vowel, is perceived as stressed. This non-final lengthening, also referred to as stress shift, is relatively frequent in QF. The data reviewed in an earlier article by Walker (1980), however, does not offer a clear reason for non-final stress placement. In spite of this indeterminacy, Walker (1980) does suggest that non-final stress often occurs due to discourse emphasis as is discussed further in section 3.3.1.4.

SF and QF also differ in the shape of their intonational patterns. Intonation takes place over phrases where tones (perceived pitch on each syllable) indicate differing pitch patterns. Walker (1980) identifies two types of intonation: grammatical and lexical. Grammatical intonation reveals sentence type (declarative, interrogative, etc.) and lexical intonation relates to emotion. Intonation patterns illustrate differences between SF and QF by range of intra-sentential frequency variation. This range is greater for SF speakers rather than QF speakers; however, there appears to be no clear judgment on intonational

[3] For all current intents and purposes, European French (EF) is taken as equivalent to Standard French (SF), even though there are clear differences between various dialects of French on the European continent and beyond. Henceforth, SF will be used instead of EF, for consistency.

patterning in QF, presumably because of the relative variability of all of the correlates involved in this system (Walker 1984; see also Poiré 2000 on this topic).

In essence, QF has a number of characteristics differing from SF. The main difference, for the purpose of my study in chapter 3, is that of stress position. While stress in QF can be optionally realized in non-final position, it is consistently realized in final position in SF. In both dialects, however, stress is indicated by increased vowel duration. As we will see in upcoming sections, duration is also the correlate that emerges the most strongly in the developmental data covered by the current investigation. This is not to say that duration is systematically used by the child from the earliest recordings, however; the profiling of duration across the period covered will indeed offer clues on aspects of phonological development.

1.1.3.3 Poiré (2000)

Poiré's (2000) more recent study offers additional insight into the above discussion of stress placement. He reports that a distinction between the different correlates of stress exists in Québec French. Knowing that stress is marked by duration in Québec French, Poiré also examines the influence of fundamental frequency on syntactic functions. He observes that increased duration indicates phrasal stress while fundamental frequency indicates intonation, and that these two cues may interact on syllables which are both the locus of stress and intonation. I later describe in chapter 3 how this relates to the young child's productions in my study in section 3.2.2. A summary of his observations about fundamental frequency is provided in (9):

(9) Raising of fundamental frequency in Québec French (Poiré 2000)

a) Word-initially: marks emphasis

b) In phrase-final but non-utterance-final position: indicates that the sentence or utterance is not over

c) In phrase-final, sentence-final position: indicates interrogative mode

In light of these additional observations, we can see that the first language learner of Québec French is not facing a language with rhythmic, duration-based syllable modulations only, but a relatively more complicated system that also incorporates variations in fundamental frequency, some of which may also correspond to stress, especially those in (9b) and (9c). In spite of this, we will see in chapter 3 that the learner documented in the current case study appears to quickly focus on the correct correlates, even though the mastery of these correlates affects the majority of the developmental period covered.

1.1.3.4 Paradis, Petitclerc & Genesse (1997)

The studies discussed in sections 1.1.3.1 to 1.1.3.3 are examinations of QF-speaking adults, without addressing child language acquisition. Paradis et al. (1997), however, offer one of the only studies of the acquisition of stress in QF. They investigate whether universal or language-specific perception or production patterns can be responsible for syllable truncations attested in two-year-old children. If universal properties are involved, the authors predict on grounds of typological markedness (e.g. Hayes 1995) the prominence of trochaic patterns whereby heavy and final syllables should be preserved.

However, if language-specific properties are responsible for syllable truncation, then the authors predict preservation of the final two syllables only. Paradis et al. (1997) analyzed the truncation of novel words that are four syllables in length and contain one closed CVC syllable. This closed syllable was positioned in random places in each word (e.g. word-initial, word-final, etc.). Stress was located on the final syllable of each utterance. The stimuli were produced after the experimenter taught 18 QF-speaking children aged 28 to 36 months novel names of books and toys. These novel names were repeated by the children. The results reveal that the stressed syllables were preserved most frequently (92%), as opposed to the non-stressed syllables (51%). This finding has no relevance to syllable weight as the test of preservation of heavy (CVC) and light syllables excluded the factor of stress. On this topic, however, the authors found little difference in the amount of preservation of heavy unstressed syllables (45%) to light unstressed syllables (53%), with no trend supporting any effect of syllable weight. In addition, effects related to the position of stressed syllables were tested to determine if stress position was significant in the preservation of a syllable. This positional factor was found to be very important. The final syllable was preserved more than any other position (e.g. fourth position (92%) to third position (71%)). Moving away from the final syllable toward the first syllable the percentage of syllable preservation decreased incrementally. However, there was no significant difference in preservation with the second (45%) and first syllables (37%), both of which were deleted much more often than the last two syllables. These findings thus indicate that the input from the (iambic) target language is analyzed as such by the children, who parse feet into binary iambs (WS), the last two syllables being the ones that enjoy the highest preservation rates in their productions. The results

also reveal that some word-initial onset consonants were preserved alongside vowels contained in the second syllable of the stimuli. This indicates that the first and second syllables were also perceived even though they were frequently truncated. Paradis et al. (1997) thus support the claims that truncation patterns are production-based (as opposed to perception-based) and follow a language-specific, as opposed to universal, trend.

1.1.3.5 Paradis & Deshaies (1990)

Coming back to the properties of the adult system, Paradis & Deshaies (1990) offer a different angle on the topic. They propose a categorization of stress types that differs from that which is typically established in the literature. Three types of stress are usually posited; tonic stress, which helps speakers to produce and recognize meaning; emotive stress, which expresses feelings; and emphatic stress, which consists of the prosodic highlighting of lexical/grammatical items within a given phrase or utterance. Paradis & Deshaies (1990) argue against such a basic categorization. They in fact present a more complicated picture through which they argue that the latter two types of stress, emotive and emphatic, breach the rules of tonic stress. This violation means that emotive and emphatic stress both follow different stress rules and, in turn, yield stress locations that differ from those characterizing tonic stress. We have seen from other studies of QF that this dialect of French displays stress patterns that are different from those observed in SF. For example, Vinay (1995) found that pretonic syllables are longer than tonic syllables in words such as *maison* 'house' or *poteau* 'pole'.

Paradis & Deshaies (1990) conducted two perceptual tests based on a middle-class 32-year-old's productions during an interview. This speaker's data originate from a

previous corpus used by Paradis (1985) from the Chicoutimi-Jonquière area. The first test was given to a "Well-Informed Group (WIG)" of 16 almost randomly selected university students who were knowledgeable in phonetics. The second test was completed by the "Non-Informed Group (NIG)", which consisted of 40 university students who had no previous knowledge in phonetics. Both groups were provided with the same list consisting of 20 sentences produced by the speaker under investigation and a reply sheet. Each student was asked to listen to the sentences and then underline the stressed syllables and circle the most prominent syllable.

The results from this study reveal that the final syllable is generally considered to be the most prominent with regard to stress. However, not all students agreed on the position of stress placement. When the penultimate syllable was compared to the final syllable, the final syllable was perceived as having either an equal or greater degree of stress than the penult. In the absence of any acoustic analysis of the experimental items used by Paradis & Deshaies, these results are difficult to interpret. It is however plausible that structural factors may have affected the perception of stress by the participants. For example, some conditions may not have been considered when assigning stress. Eurhythmic rules may be applied and/or incorrect assignment of beats on metrical structures on wrong or on incomplete segments may have occurred which can also influence stress perception. Whatever the upshot, however, Paradis & Deshaies (1990) provide additional evidence for the claim that the QF stress system displays some degree of variation, a conclusion that supports observations made, for example, by Walker (1984).

1.1.4. Conclusion

The background literature discussed above provides motivation for the study I describe in chapter 4. In addition to offering a contribution to our understanding of language (stress) development in Québec French, this study is also relevant in the context that, as mentioned above, most of the studies currently available in the scientific literature are based on the acquisition of English or other trochaic languages such as Dutch. The current study will thus provide a basis for a cross-linguistic comparison of the developmental facts. In chapter 3, I introduce the methods that I use to gather data and analyze the productions of the child under scrutiny.

Chapter 2

METHODOLOGY

2.0 Introduction

As we can see from the background literature discussed in chapter 1, an examination of the acquisition of stress in Québec French can easily be motivated on the grounds that it will provide first strides in terms of both empirical documentation and cross-linguistic comparisons of the types of prosodic properties of stress that this language displays with other languages. In this chapter, I discuss the methodological aspects of my study.

2.1. Participants

Three native Québec French speakers participated in this study—a mother, father, and the focus of my study, their young female child code-named EL. I observe productions from this child from age 1;01.07 to 2;04.17 as this is a longitudinal case study. The parents are French-English bilingual speakers and speak French in the home with their monolingual French-speaking child. It must be noted, however, that they do occasionally produce English loanwords around the child, the prosodic shape of which influences EL's own productions of these words. For example, when the child produces words such as "jello" which display regular English trochaic stress patterns, she does so with an English-like, as opposed to French, stress pattern. I further discuss this influence on stress in the next chapter, in section 3.3.2.3.

2.2. Detailed methodology

This section offers a description of the methods used to attain the results that are discussed in the subsequent chapter. Data compilation is based on audio-video recordings annotated and measured using specialized computer software programs. The data analysis and measurement consider the three main correlates of stress identified cross-linguistically (Hayes 1995) —fundamental frequency, intensity, and duration. In the following section, I provide a more detailed description of how I combined these different data, technologies and methods in my current study.

2.2.1 Technology

Technology has been a very important aspect of my study. I was able to analyze the child's utterances for more than a one-year time span as well as measure and analyze the child's productions efficiently and accurately. This was possible through the use of audio-video recordings, the content of which I annotated and measured using the software programs *Phon* (http://phon.ling.mun.ca/phontrac/; Rose, Hedlund, Byrne, Wareham & MacWhinney 2007) and *Praat* (http://www.fon.hum.uva.nl/praat/; Boersma & Weenink 2005).

I studied the data from a longitudinal case study, which was digitally audio-video recorded by her parents. All productions were either spontaneous or were elicited through pictures or objects presented by her parents. Recordings occurred on a semi-regular, fortnightly basis.

Using *Phon*, a research assistant first identified and orthographically transcribed the utterances produced by the child. I then exported the utterances with phrase-final

disyllables occurring within declarative sentences, as individual sound files for analysis into *Praat*. This specific context was measured for three reasons: 1) stress in French occurs primarily in phrase-final position; 2) to have a constant variable; and 3) to easily and efficiently compare stress between syllables.

Within *Praat*, I acoustically measured the three main correlates of stress (fundamental frequency, intensity, and duration) in each phrase-final disyllabic utterance in a declarative sentence that the child produced. Both vowels in each word were measured and the values were entered into a spreadsheet for analysis.

2.2.2 Interpretation of ratios

I analyzed the data based on an approach that facilitates a comparison across each of the three main correlates of stress. Because stress correlates are not absolute but rather relative values of syllable prominence, I could not limit my study to the consideration of raw numbers obtained from the acoustic measurements. Instead, I established comparisons between final and penultimate syllables based on a ratio calculated between each of these syllables, for each correlate. This ratio was obtained simply by the division of the value of the final syllable by that of the corresponding penult, for each correlate. The calculation of ratios for each session then led to the identification of two important values, namely average ratios for each session (used to observe overall trends in the data), and standard deviations, as a way to assess variability within and across sessions (see further in section 2.2.3).

Since syllable prominence, is a relative notion, it is impossible to know exactly what prominence threshold is required to actually obtain stress marking. As a starting

point, and based on a preliminary assessment of the data, I opted for an arbitrary ratio of 1.5 to mark stress. I also considered, this time in a more objective way, any ratio around 1.00 to indicate absence of syllable prominence (lack of stress marking) for any given correlate. As we will see, this starting point for analysis was largely adequate, as the data from each correlate are in and of themselves quite suggestive of the ways in which the child expresses —or does not express— syllable prominence in her productions.

As we will see overall, my data suggest that duration is the main correlate used by the child to mark stress, with most ratio values lying above 1.5. In some cases, however, I found that duration ratios that fall below 1.5 (e.g. in sessions 8 and 12), still suggest a role for this cue in syllable prominence as they are accompanied by ratios for the two other correlates that hover around the neutral value 1. Furthermore, values of fundamental frequency and intensity are rarely indicative of any prominence contrast, which also suggests that duration is the main cue used by the child to mark stress. I discuss counter-examples to this generalization as is appropriate in chapter 3.

2.2.3 Assessment of variation

In order to assess the rate of variation within any given session, I calculated standard deviations from the mean ratio values. This calculation enables an objective assessment of the variation within each session for each phonetic correlate. A comparison of the standard deviations across sessions offers, in turn, an assessment of the variation over time.

In addition, I derived a means which, although it is arbitrary, enables an identification of what are clearly extreme values in the data. I first calculated the overall

average ratio across sessions, which is 1.94, followed by a calculation of the overall standard deviation, which is 1.14. Based on these figures, I calculated a normal range for duration using the average ratio plus or minus the standard deviation (1.94 ± 1.14 = 0.80 to 3.08). Based on this range, I classify ratio values below 0.80 and above 3.08 as extreme values. I discuss these extreme values in section 3.2. As we will see, the examples that display these values reveal some of the factors that influence the child's productions. A consideration of these factors enables, in turn, a more objective assessment of the grammatical development of the child's stress system.

2.3. Assessment of compensatory lengthening

As we will see in section 3.3.1.2 as well as in chapter 4, I take into consideration an additional factor, that of phonological compensatory lengthening, to account for some of the child's extreme ratio values and to identify the context in which this process occurs. The child produces high, extreme ratio values above 3.08 when she lengthens the final syllable in contexts where she displays deletion of final target consonants from the adult (target) form. I compare word-final vowels to word-final deleted consonants to determine whether there is in fact a process of deletion occurring across sessions, and in turn, if a possible compensatory process exists. Based on this comparison, I examine ratio values in the context of sonorants and obstruents to reveal the environment in which compensatory lengthening occurs.

As we will see in the following chapters, consideration of each variable included in the methodology section is pertinent to the analysis of the data. Each penultimate and final syllable of each disyllabic word is acoustically analyzed within declarative

sentences in utterance-final position to eliminate as many variables as possible that may influence the data. The participants themselves contribute a second language factor that influences the stress patterns of the child. In addition, critical analyses of ratios above and below 1.5 is necessary to decide which correlate marks stress during certain instances. In the chapters that follow (3 and 4), I use this methodology to examine the child's productions and to observe trends in the data to form conclusions on the acquisition of stress in Québec French.

Chapter 3

THE DEVELOPMENT OF STRESS IN QUÉBEC FRENCH

3.0 Introduction

In this chapter, I discuss the patterning of intensity, fundamental frequency, and duration observed in the data, based on the methodology described in the previous chapter. We will see that throughout development, EL generally expresses stress through vowel duration. This result is in line with the stress cues produced by adult speakers of the target language (O'Shaughnessy 1981; Vaissière 1991). In addition to revealing the main correlate, the results reported below highlight other important details concerning the development of stress. Looking at acoustic development, I observe noticeable changes in the patterning of two acoustic correlates, duration and fundamental frequency, over time. In fact, I observe an evolution of the interplay between cues as the subject's age increases. In order to provide a sensible account of the observed patterns, I also consider this interplay in light of what appears to be extreme values in the data, which I summarize in two ways, one including, the other excluding, these data. From this empirical investigation, I propose three stages of stress acquisition of Québec French.

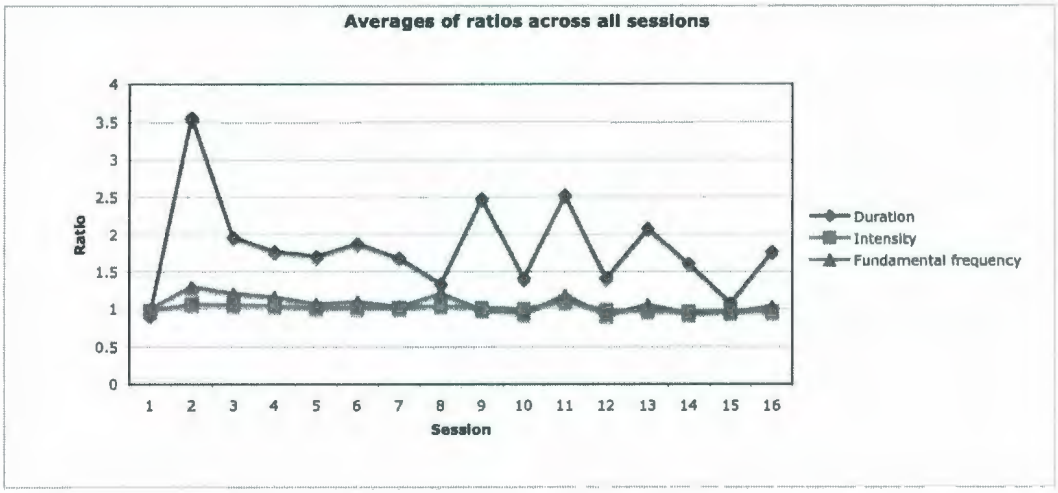
3.1. Overview of phrase-final prosodic patterns

A general examination of the data reveals, more or less, a specific patterning of each correlate across sessions. As we will see in section 3.1.1, intensity displays patterning that is largely autonomous in that it does not seem to interact much with duration or fundamental frequency. Ratio values for this intensity fall close to and below the neutral

value 1, an observation that suggests that neither the final nor the penultimate syllable is particularly prominent in light of this acoustic parameter. In section 3.1.2, I describe the possible use of fundamental frequency by the child to mark stress. In contrast to intensity, fundamental frequency displays ratios that lie above 1, close to 1.3, during EL's early ages. However, following this period these ratios fall around neutral 1, suggesting the child does not use fundamental frequency to mark stress. As we will see in section 3.1.3, duration offers the most distinguished pattern of syllable prominence, as it almost consistently displays high ratio values throughout the corpus. The high ratio values suggest that EL uses this cue as a prominent indicator of stress.

While revealing the stress marker used by the child is important to my study, I also consider the potential influence that each correlate may have on the other ones, in order to derive a more complete picture of the child's system development through time. A discussion of this interplay, which is represented in a rather general way in (10) below, will follow in section 3.1.4.

(10) Averages of ratios across all sessions



As example (10) illustrates, duration clearly stands out with relatively high ratios for most of the recording sessions. While this observation offers a good general summary of the basic story, I endeavor to describe EL's developmental path in more detail in the following subsections.

3.1.1 Intensity

In general, the average intensity ratios are centered around 1.00 throughout the sessions, with little variation in the data. A breakdown of the ratios across sessions is provided in (11) giving us a more detailed description. Between ages 1;01.7 to 1;10.2 (sessions 1 and 11), the average ratios lie slightly above 1.00. However, the subsequent ages 1;11.22 to 2;04.17 (sessions 12 to 16), show a steady decrease in ratio values, all of which fall below 1.00. This is a shift in the relative prominence of the cue. Overall, there is little variation in intensity, as suggested by the fact that standard deviations range from 0.05 to 0.12, i.e. are confined within 12 percent of the mean values. The intensity data range from average ratios of 0.96 to 1.10 without outliers.

(11) Intensity average and standard deviation ratios over time

Session	Age	Average ratio	Standard deviation
1	1;01.7	0.987037249	0.059352798
2	1;01.22	1.069270857	0.073660441
3	1;02.3	1.061344145	0.121264592
4	1;02.12	1.049916397	0.059311109
5	1;04.3	1.019111401	0.061203012
6	1;05.1	1.02460504	0.067610793
7	1;06.16	1.02127224	0.054662162
8	1;07.7	1.05140394	0.109987449
9	1;08.4	1.015663823	0.077941976
10	1;09.22	1.005516713	0.102394093
11	1;10.2	1.104036792	0.173951283
12	1;11.22	0.992530377	0.067384719
13	2;00.14	0.978747851	0.090565331
14	2;01.20	0.966070391	0.08005917
15	2;03.8	0.980876635	0.070842874
16	2;04.17	0.962199536	0.105972903

The data in (11) indicate that due to the generally neutral patterning of intensity and the low variation observed across sessions, intensity cannot be considered a relevant marker of stress in the child's system. In contrast, the remaining correlates, addressed in turn in

the following subsections, will bring about patterns that are much more distinctive, and interesting.

3.1.2 Fundamental frequency

The overall average ratios for fundamental frequency also pattern around the neutral value of 1, with a standard deviation ranging from 0.06 to 0.50, thus with all of the data within 50 percent of the mean. Slight increases and decreases range from 0.94 to 1.31. From age 1;01.7 to 1;07.7 (session 1 to 8), the average ratio of fundamental frequency is 1.13. During this time, fundamental frequency fluctuates from 1.0 to 1.3, where the higher values (around 1.3) may in fact be suggestive of stress marking. At age 1;08.4 (session 9), we can see a noticeable decrease in average ratios of fundamental frequency. In fact, all values above and below the neutral value 1 tend to edge towards this value.

(12) Fundamental frequency average and standard deviation ratios over time

Session	Age	Average ratio	Standard deviation
1	1;01.7	1.006309334	0.059298629
2	1;01.22	1.30870659	0.189484794
3	1;02.3	1.210048314	0.148754868
4	1;02.12	1.165453207	0.139921977
5	1;04.3	1.069431138	0.126657426
6	1;05.1	1.104443074	0.264228837
7	1;06.16	1.036315371	0.15771097
8	1;07.7	1.210446055	0.356304553
9	1;08.4	1.002260925	0.132990427
10	1;09.22	0.941065886	0.184418717
11	1;10.2	1.189970532	0.508868962
12	1;11.22	0.924899329	0.247410666
13	2;00.14	1.061227413	0.40574213
14	2;01.20	0.949239596	0.368380669
15	2;03.8	0.962224717	0.18590629
16	2;04.17	1.031467466	0.421116569

If one were to assume that the child uses fundamental frequency to mark stress, the data would reveal a gradual decrease of the primacy of this phonetic correlate through time, with a virtual end in the usage of this cue by age 1;10 (session 11). In section 3.2, I

propose that EL actually begins to master this cue as a marker of intonation, as opposed to phrasal stress, at around that age.

3.1.3 Duration

As illustrated in the graph in (10), duration ratios are generally in the vicinity of 1.5 or above, which indicates that the final syllable is at least 50% longer than the penultimate. As I discuss further below, I hold this observation central to my interpretation of this cue as the main correlate of stress, in spite of what appears to be an extreme peak in the ratios during the second session and a few drops in ratio values, for example in the second-to-last session.

As we can see in (13), the average ratio noted for age 1;01.7 (session 1) indicates no clear use of duration as a cue to mark stress. The situation is clearly different at age 1;01.22 (session 2), where the average ratio of duration is at its highest peak, at 3.56, a number that comes from no less extremely variable individual values, with a standard deviation of 4.33. From this age until 1;06.16 (session 7), the average ratio of duration ranges from values 1.68 to 1.96. These values consistently mark stress during this period as they lie above 1.5. However, between subsequent ages 1;07.7 and 1;11.22 (sessions 8 and 12), average ratios are less consistent and vary from well above 1.5 (2.52) to below 1.5 (1.34). Standard deviations are also variable, ranging from 0.45 to 1.66. From age 2;00.14 to 2;04.17 (session 13 to 16), the data are more typical of adult stress values centering around 1.5, values that are also accompanied by much more acceptable standard deviations. I observe one value at age 2;03.8 (session 15) where this ratio noticeably diminishes to 1.07, however, the data from this session show a fair degree of

variability, with a standard deviation of 0.42. In addition, this drop is immediately followed by a peak of 1.76 with a high variance (standard deviation of 1.39) in the final recording session at age 2;04.17 (session 16).

(13) Duration average and standard deviation ratios over time

Session	Age	Average ratio	Standard deviation
1	1;01.7	0.933797969	0.320832827
2	1;01.22	3.556651042	4.332722687
3	1;02.3	1.961477233	0.964383126
4	1;02.12	1.774777397	0.590933736
5	1;04.3	1.706929295	0.675654756
6	1;05.1	1.874984432	0.628946795
7	1;06.16	1.681845214	0.944171624
8	1;07.7	1.340425643	0.926511714
9	1;08.4	2.480039406	1.657058207
10	1;09.22	1.415709894	0.611423501
11	1;10.2	2.528200853	1.258267559
12	1;11.22	1.414441986	0.451175871
13	2;00.14	2.076593542	0.803606031
14	2;01.20	1.604922413	1.190923942
15	2;03.8	1.079604776	0.419251853
16	2;04.17	1.759783373	1.387684803

Average ratios and standard deviations in table (13) display three generally consistent as well as three relatively inconsistent time periods. In section 3.2, I interpret the data based on these observations, which I take as a starting point to propose three developmental stages of stress acquisition of Québec French.

3.1.4 Interplay between phonetic cues

The overall average ratio for each correlate provides information about their patterning within and across sessions. These averages can also be indicative of potential interplays between correlates. Such interplays are in fact noticeable between intensity and fundamental frequency in a way that suggests two different developmental periods, which are displayed in table (14) below. During the first period extending between ages 1;01.7 and 1;07.7 (session 1 and 8), no patterning between these correlates is in fact observed. Intensity ratios diminish, but fundamental frequency ratios remain high. For example, at age 1;01.22 (session 2) the average intensity ratio is 1.07 and fundamental frequency is 1.31; during the next session, age 1;02.3 (session 3), the average intensity ratio is 1.06 and fundamental frequency is 1.21; these values are in fact very similar to those observed at age 1;07.7 (session 8) with an average intensity ratio of 1.05 and fundamental frequency again at 1.21.

Starting at 1;08.4 (session 9), however, we can observe a different patterning of these correlates. Between ages 1;08.4 and 2;04.17 (session 9 and 16), intensity and fundamental frequency actually appear to pattern much closer together; when one of these two correlates increases or decreases, the other generally does as well. For example, at age 1;09.22 (session 10) the average ratio of intensity is 1.00 and fundamental

frequency is 0.94; following this, at age 1;11.22 (session 12) the average ratio of intensity is 0.99 and fundamental frequency is 0.92; and at age, 2;03.8 (session 15), the average ratio of intensity 0.98 and fundamental frequency is 0.96.

(14) Average ratios of intensity and fundamental frequency over time

Period 1	Session	Age	Intensity	F0
	1	1;01.7	0.987037249	1.006309334
	2	1;01.22	1.069270857	1.30870659
	3	1;02.3	1.061344145	1.210048314
	4	1;02.12	1.049916397	1.165453207
	5	1;04.3	1.019111401	1.069431138
	6	1;05.1	1.02460504	1.104443074
	7	1;06.16	1.02127224	1.036315371
	8	1;07.7	1.05140394	1.210446055
Period 2	9	1;08.4	1.015663823	1.002260925
	10	1;09.22	1.005516713	0.941065886
	11	1;10.2	1.104036792	1.189970532
	12	1;11.22	0.992530377	0.924899329
	13	2;00.14	0.978747851	1.061227413
	14	2;01.20	0.966070391	0.949239596
	15	2;03.8	0.980876635	0.962224717
	16	2;04.17	0.962199536	1.031467466

In section 3.2, I hypothesize that these two developmental periods correspond to the three stages of development of stress patterns that I propose. The distinctive patterning of fundamental frequency is considered as part of stages 1 and 2, during which EL unsystematically uses these potential correlates (stage 1) and subsequently begins to incorporate them in what appears to be more general linguistic understanding of the phrasal stress system (stage 2). At stage 3, we observe relatively close patterning of these correlates, the stability of which suggests adult-like attainment of the overall target system of syllable prominence.

3.2. Analysis: EL's development of stress

As the observations summarized above suggest, duration appears to be the only cue to syllable prominence that offers clearly distinct patterns. This is in line with the observations by O'Shaughnessy (1981) and Vaissière (1991) that duration is the main cue to stress in the child's target language. In this section, I focus more specifically on the patterning of this cue. While I take duration to be the main acoustic marker of stress in the child's emerging system, I also identify three qualitative stages in the development of her stress system, each of which shows distinctive behaviours with regard to the production of syllable prominence, both qualitatively and quantitatively. Between the ages of 1;01.7 and 1;05.1 (sessions 1 to 6), I posit that the child is lacking the required control to accurately produce stress, which provides relatively unsystematic usages of each of the three potential phonetic cues. The next stage occurs between the ages of 1;06.16 and 1;10.2 (sessions 7 to 11), where I observe the emergence of much more systematic patterns in syllable prominence, which are also constrained syntactically, in

line with the characterization of the adult system discussed previously in section 2.3.3. Finally, between the ages of 1;11.22 and 2;04.17 (sessions 12 to 16), we observe a generally adult-like attainment of the Québec French stress system.

(15) Proposal: three stages in the development of EL's stress patterns

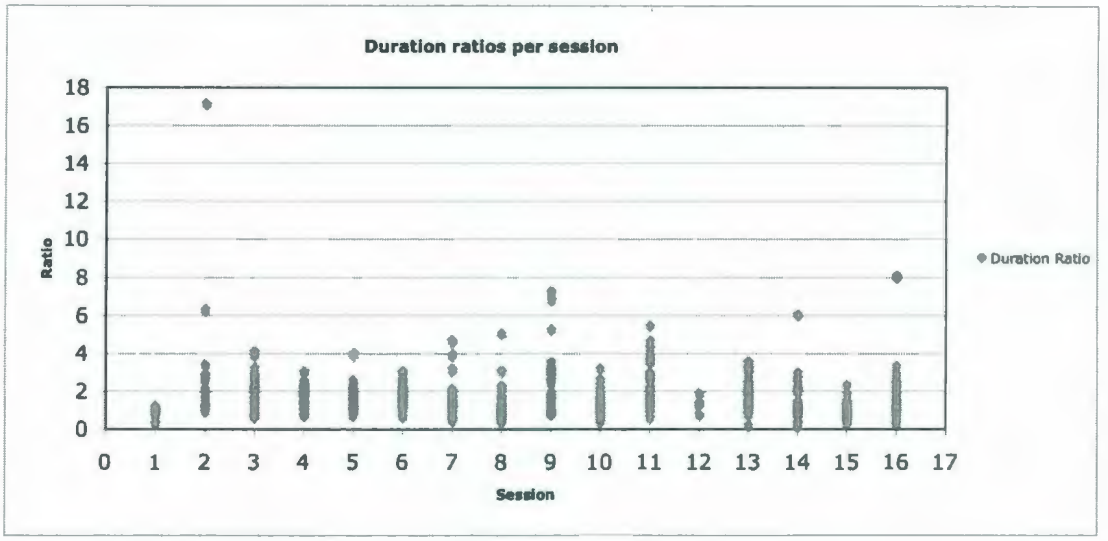
Stage 1: Unsystematic use of the potential correlates (1;01.7-1;05.1)

Stage 2: Emergence of the syntactic domain (1;06.16-1;10.2)

Stage 3: Adult-like attainment (1;11.22-2;04.17)

Duration appears to be the most reliable correlate of stress, even though it does display some extreme values at various points during the developmental period observed. I provide a more specific look at these values in the graph in (16), which breaks down all of the ratio values for duration across all sessions.

(16) Duration ratios per session



While duration does exhibit some extreme values, the bulk of the data is clustered at the bottom of the chart, thereby exhibiting some degree of systematicity. In the subsections that follow, I take a more in depth look at specific values. The additional detail offers finer insight into the development of the child's stress system. Especially through a discussion of duration in light of the other two cues to syllable prominence considered in this study.

3.2.1 Stage 1

Between the ages of 1;01.7 and 1;05.1 (sessions 1 and 6), duration and fundamental frequency ratios are generally high, with very few examples departing from this generalization. As noted above, these correlates are used with a relative lack of control. Also, intensity values are basically centered around 1 and, as such, do not display any clear pattern of syllable prominence, with some values (ratios slightly below 1.00) even

edging against the trends observed for the other two cues. As a result, I propose that EL does not use intensity as a cue to syllable prominence, and that she lacks control in her handling of the other two cues. For example, between ages 1;01.7 and 1;01.22 (sessions 1 and 2), duration falls below 1.5 (0.94) and dramatically increases to an extreme peak (3.55), even despite individual values that also fall below 0.80. Similarly, fundamental frequency ratios are high during this period (ranging from age 1.01 to 1.31) in comparison to observations from later sessions. This raises the possibility that EL actually used fundamental frequency as a cue to syllable prominence in early sessions, potentially in conjunction with duration. However, no firm conclusion can be reached given the generally unsystematic productions observed across individual examples. The only safe conclusion is that the child had a notion of the final syllable as being the most prominent in the target system but was incapable of reproducing this prominence in a systematic way.

3.2.2 Stage 2

During the following period, from 1;06.16 to 1;10.2 (sessions 7 to 11), the child begins to systematize her use of duration as a cue to syllable prominence. However, what seems to be an increased focus on duration also includes more frequent productions of outlier values. Interestingly, this high frequency of outlier values of duration ratios also patterns with similar variability in fundamental frequency ratios across these sessions. For example, from age 1;06 to 1;07.7 (session 7 to 8), fundamental frequency ratios increase from 1.03 to 1.21, then, between ages 1;08.4 and 1;10.2 (sessions 9 and 11), decrease to values around or even below 1. In turn, the child produces more outlier values, thus

increasing her duration ratios, to surpass those of fundamental frequency. This variability of fundamental frequency ratios compared to the relative patterning of duration indicates that the child is gradually implementing this latter cue to mark syllable prominence, even though she produces it in rather variable ways. Despite this, the main point is that this marks a change in her realization of syllable prominence. I interpret this fact as a change in the child's expression of syntactic functions which actually brings her closer to the target system as described by Poiré (2000), discussed in 1.1.3.3 and repeated here for convenience. As Poiré reports, increased duration indicates phrastic stress while fundamental frequency indicates intonation, which itself can fulfill one of three different syntactic/discursive functions.

(17) Raising of fundamental frequency in Québec French (Poiré 2000)

a) Word-initially to mark emphasis

b) In phrase-final but non-utterance-final position: indicates that the sentence or utterance is not over

c) In phrase-final, sentence-final position to indicate interrogative mood

While the data present in this thesis could offer the basis for an investigation of intonational patterns in EL's developing system, a full coverage of this topic would require additional empirical considerations, the scope of which lays outside the limits of the current study. I will thus limit myself to formulating the hypothesis that as the child develops better control of her stress productions, she is in a position to attain a more systematic control of her target language's other prosodic characteristics such as

intonation, the development of which also depends on the acquisition of syntactic and discursive aspects of the system.

3.2.3 Stage 3 of EL's development of stress

Between the ages of 1;11.22 and 2;04.17 (sessions 12 and 16), the number of outliers greatly diminishes in comparison to the previous set of sessions. Duration ratios display generally lower values; so do the fundamental frequency ratios. However, duration ratios all remain above 1.5, with one exception: an average duration ratio of 1.08 at age 2;03.8 (session 15) where the fundamental frequency ratio at this age is 0.96, suggesting that because only duration is above neutral 1, duration is the exclusive marker of stress. This is in line with the phonetic marking of stress observed in the target language, whereas fundamental frequency ratios fall well below 1.5 to the extent where the penultimate syllable at times displays more intonational prominence than the ultimate. Again, here, this is suggestive of the development of aspects of the child's intonational system, since neutral to descending intonations are expected utterance-finally in the target language. Aside from this issue, which has been left for further research, the central observation is that duration is produced as an independent marker of stress in ways that correspond to normal average ratios for adult Québec French speakers. We can conclude from this that the child has attained the target adult grammar, at least for this component of the target prosodic system.

As I have discussed, duration is the main cue to stress production for this child. However, this is a correlate that displays many variances across sessions. These variances

are addressed in section 3.3, and as we will see, the extreme values of duration are the cause of many influential factors.

3.3 Factors influencing the assessment of stress productions

I have proposed the three stages in (15) to account for the development of stress in EL's phonology. Aside from the generalized trend towards relatively high duration ratios observed across most of the sessions, we have also seen that duration can at times display enormously high standard deviations within some of the sessions. In the up coming subsections, I provide a more qualitative discussion of some of the extreme values observed, in order to gain a more accurate characterization of the developmental stages proposed.

Recall that as per the calculation proposed in section 2.2.3, ratio values are considered extreme when they lie above 3.08 and fall below 0.80. While these values are inherently arbitrary, they still provide us with clear cutting points to discuss data that are by all means exceptional. These examples provide us with some clear cases of how prosodic aspects of speech production in child language can be influenced. Such cases therefore have the advantage of offering us hints about potentially more subtle effects, the systematic study of which would need to rely on different, more controlled data recording and coding methods. Minimally, the discussion below highlights the need for careful methods of assessing the phonetics of child language productions, which are likely to be influenced by a myriad of factors in natural speech contexts.

3.3.1 Extremely high values

As I discuss in more detail in the subsequent sections, high duration ratio values are the result of influences by the child, extending from phonetic context to emotional factors. In order to provide a systematic discussion of these various influences, I discuss the extreme values in separate categories, which I attribute to vowel reduction, the child's mood, compensatory lengthening, and context.

3.3.1.1 Influences of vowel reduction

Overtly short penultimate syllables occur throughout proposed stages 1 and 2 because of the process of vowel reduction. This process affects duration ratios when a substitution of the nucleus of the penultimate syllable with vowel reduction occurs, creating shorter syllable duration. This results in augmented ratios above the normal range. I discuss specific examples below.

At age 1;02.3 (session 3), this process first occurs where the child displays vowel reduction in 2/24 utterances with a ratio over the arbitrary 3.08 threshold. These productions result from the replacement of the first vowel in penultimate position in 'papa' [papa] with what can be described as a short period of frication (transcribed as aspiration) between the two consonants ([p^hpa]). A consequence of this is the reduction of the relative duration of the first syllable and, by implication, an increase of the ratio between that and the final syllable. This process also occurs at age 1;05.1 (session 6), where 2/25 utterances are above the 3.08 ratio. The same utterances 'papa/papi' at age 1;02.3 (session 3) are produced with first syllable vowel reduction. The same phenomenon is observed at ages 1;06.16, 1;08.4, and 1;09.22 (sessions 7, 9, and 10).

Example (18) illustrates that most of the examples come from the word *papa* 'daddy', an observation that points to a possible lexical effect affecting this no-doubt high-frequency item which often, too, shows first vowel reduction in the ambient language (Y. Rose, p.c., June 2009).

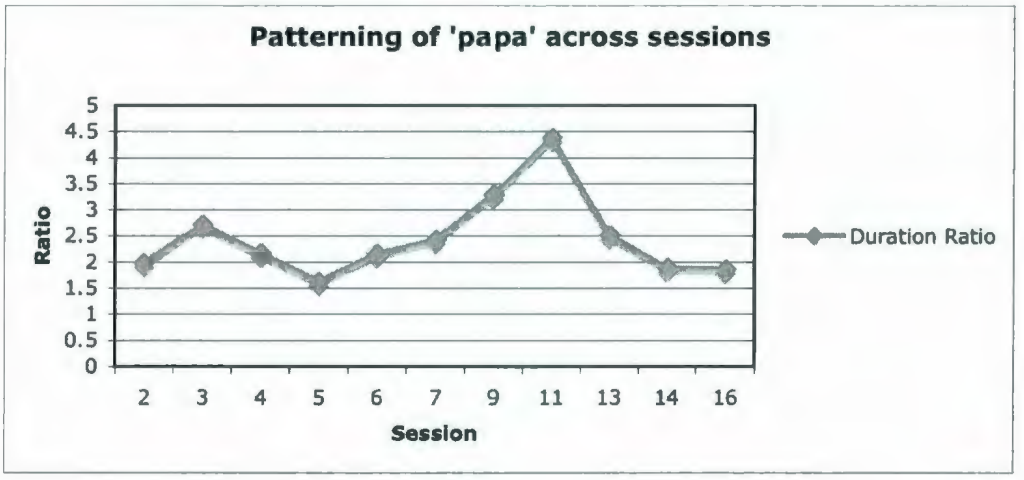
(18) Examples of productions influenced by aspiration

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) papa	1;02.3	53	220	4.15
b) papa	1;02.3	105	347	3.30
c) papa	1;05.1	92	290	3.15
d) papi	1;05.1	75	232	3.09
e) papa	1;06.16	53	212	4.00
f) papa	1;08.4	59	431	7.30
g) petits	1;08.4	105	377	3.59
h) poppets	1;09.22	71	232	3.27

While penultimate vowel reduction yields extreme values in the data, it also follows a particular trend. I observe this trend in 'papa' through average duration ratios across sessions. The ratios for this utterance all lie above 1.5, which indicate that duration is used in all cases to mark stress. Penultimate vowel reduction therefore occurs during each production of 'papa'. Ratios of 'papa' display similar patterning to the graph in (10) of all duration ratios across sessions in that the data increase and decrease until age 1;04.3 (session 5), I observe an increase in values from ages 1;05.1 to 1;10.2 (sessions 6 to 11),

and a decrease from ages 1;11.2 to 2;04.17 (sessions 13 to 16). This suggests that as the child ages she gains more control of her productions following the proposed stages 1 through 3.

(19) Patterning of 'papa' across sessions



In section 3.3.1.2, we see that the lengthening of the final syllable to compensate for deletion of a final consonant also affects the data over time. This compensatory process is explained and further detail of the context of the process is provided in the subsequent chapter.

3.3.1.2 Influences of compensatory lengthening

In addition to the vowel reduction process noted above, I observed a potential phonological conditioning which, throughout all three stages posited, has an impact on the duration ratios observed. This process, which I describe as compensatory lengthening, occurs in the context of final consonant deletion.

Compensatory lengthening, which is discussed in the context of other child language learners and, also, in adult phonological systems (e.g. Rose 2000: 232-235 and references cited therein) can be described as the realization of extra vocalic length in the place of what would otherwise be the target final consonant. Compensatory lengthening can thus result in extremely high final syllable values. Rose bases these findings from the compensatory strategies of a Québec French child in her production of [ ] in word-final position. He reports that when deletion of word-final [ ] occurs the preceding vowel lengthens. He also attests that this vowel lengthening is context specific. Contrary to lengthening of the final vowel when word-final consonant deletion occurs, this process does not occur when the final consonant deletes within unstressed, penultimate syllables.

From preliminary observations of EL's data, I for now make the general observation that this process only occurs in the context of sonorants. To examine this trend, in the next chapter, I compare the duration of syllables in the context of sonorants and obstruents, where target final consonants are deleted.

3.3.1.3 Influences of the child's mood

I have also observed potential mood-related effects that cause extreme values in the data. Throughout the study, EL's moods fluctuate from agitation to excitement. This is an important influence on the child's duration ratios because of the change in ratio length with each expression of emotion. I observe variable effects of this influence on the data. For example, if EL is agitated or excited during the majority of a session, the data will reflect that mood, by increasing ratio values. Similar effects will be reflected in the data even if just for a moment the child's emotions change. This is especially true because of

the speed at which EL's (or any child's) emotions can shift. I discuss specific examples of this below.

It is not surprising that EL's mood (in and of itself) can influence aspects of the speech production data. Since mood is not a linguistic factor, it is likely to influence speech properties independent from any grammatical degree of development. These expectations are all supported by the data. The parents encourage EL to produce each utterance twice. She does so without irritation during the first 4 utterances producing duration ratios within the normal range. With increased irritation with these repetitions, EL produces the following words with extreme ratios, some as high as 17.2. An observation of the extremely high ratios within the session suggests that the vast majority are found between the eighth and the thirteenth utterances. These observations suggest that vowel lengthening in the final syllable may be a result of tiring or increased agitation with completing repetitive tasks.

The child's mood also affects her productions at age 1;02.3 (session 3), and can be observed through her body movements and demeanor. At this age, EL conveyed excitement and interest during the production of the word *garçon* 'boy', through her facial expressions and body language. This same phenomenon exists in the following session nine days later when she produces the words *jeudi* 'Thursday' and *Gigi* (the name of a toy giraffe). While producing these utterances, the child appears to be very excited. The duration ratios for these utterances subsequently fall between 3.08 and 3.10.

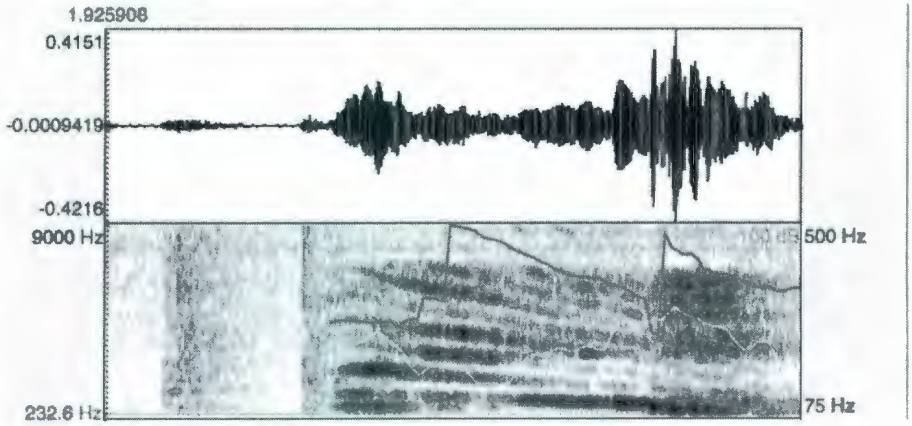
At age 1;06.16 (session 7), three of the 29 utterances have extremely long final syllables, which all result from the child's mood. Two of the target words in this case originate from a single target form, *minou* 'cat'. Both of the utterances that EL produces

with an abnormally high ratio appear immediately following four productions of the same word. This points toward a sign of agitation by the child for producing this word so many times in succession. The rarity of extreme duration ratio values is brought to an end with one extreme ratio (5.10) at age 1;07.7 (session 8). This ratio is the result of the production of *bébé* 'baby', which is also produced with the highest ratio of fundamental frequency in that session. The ratio of fundamental frequency and the examination of the videotape both suggest that the child was particularly excited at this moment.

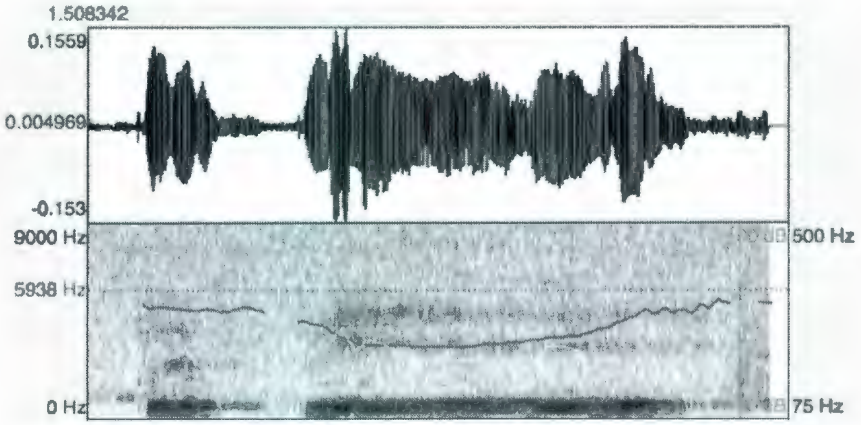
Mood also affects the child's productions at age 1;08.4 (session 9). The first two extreme values produced during this age appear in two occurrences of again the word *bébé*, which display ratios of 5.33 and 3.35, respectively. Upon careful listening of EL, I observe that she produces an emphasized declarative tone when she spontaneously produces *bébé*. However, she displays less emotion during her second production of this utterance following a correction and an addition of the preceding article from her father —consequently the length of the final syllable in the second utterance is decreased. In spite of this, the ratio produced by the child is still above 3.08, which may suggest that another factor may be involved in final syllable lengthening. However, I hypothesize that the second production of *bébé* is accounted even though it is above 3.08 because the increment that the ratio dropped was clearly noticeable (1.98), and the initial ratio of this word was a lot higher than normal. A comparison of fundamental frequency (the uppermost line) of *bébé* is made in (20) between productions during age 1;07.7 and 1;08.4 to illustrate the difference of the child's mood from an excited to a declarative tone.

(20) A comparison of fundamental frequency in the production of *bébé*

a) *bébé* (20 (i)) produced at 1;07.7



b) *bébé* (20 (j)) produced at 1;08.4



At age 1;10.2 (session 11), many of EL's utterances lie above 3.08. I attribute this high amount of extreme values to the child's relatively silly mood during this session. The child is extremely alert and she stresses the final syllable as a display of excitement. In some utterances, for example, *un cadeau* 'a present', the child produces the first syllable [ka] as [a]. Her playful, assertive mood, clearly suggests that she is overly emphasizing many of her productions, from which the higher ratios occur. At 2;00.14

years of age (session 13), I examine the outliers in the videotape and observe that EL was confident and playful during the session. This suggests that the lengthening of the final syllable that would otherwise not be as long may be a result of the mood or emotions of EL during that session.

(21) Examples of productions influenced by the child's mood

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) banane	1;01.22	53	912	17.2
b) ballon	1;01.22	102	649	6.36
c) ballon	1;01.22	119	410	3.45
d) garçon	1;02.3	117	459	3.92
e) jeudi	1;02.12	66	205	3.11
f) Gigi	1;08.4	89	275	3.09
g) minou	1;06.16	90	289	3.21
h) minou	1;06.16	54	255	4.72
i) bébé	1;07.7	131	669	5.10
j) bébé	1;08.4	144	768	5.33
k) bébé	1;08.4	161	540	3.35
l) cadeau	1;10.2	185	681	3.68
m) raisins	1;10.2	99	356	3.59
n) moto	1;10.2	173	658	3.80
o) mouton	1;10.2	156	568	3.64

p) cochon	1;10.2	93	368	3.95
q) montant	1;10.2	86	476	5.53
r) canard	1;10.2	126	595	4.72
s) doucement	2;00.14	276	942	3.41
t) maman	2;00.14	151	499	3.30
u) boutons	2;00.14	187	623	3.33
v) fini	2;00.14	185	602	3.25
w) papa	2;00.14	171	617	3.60
x) café	2;04.17	184	624	3.39
y) moto	2;04.17	75	608	8.10

3.3.1.4 Influences of larger discursive context

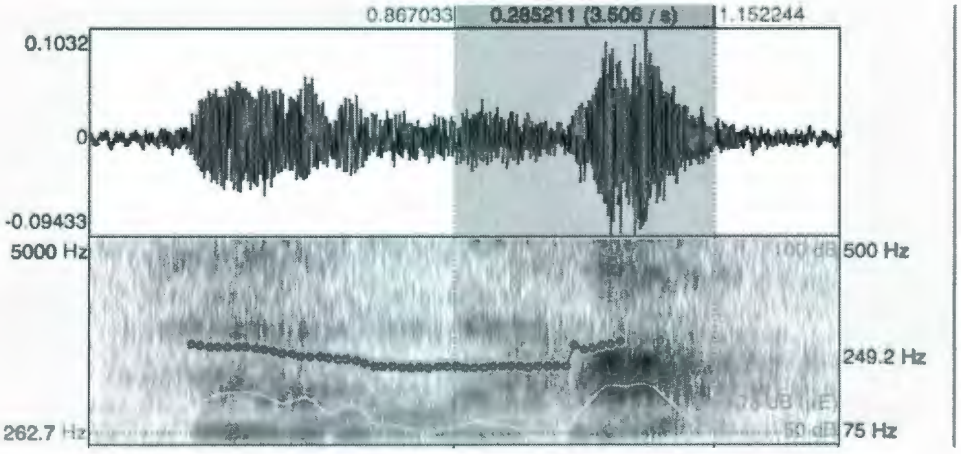
In section 2.2.1, I noted that I examined only declarative sentences produced by the child, in order to limit the amount of variation in the data. However, in spite of this relatively restrictive approach to the data, I was unable to control for the types of sentences produced by the father, which, in turn, can have an influence on the child's productions.

I observe the influence of this larger discursive context during stages 2 and 3 of the child's development. The father produces both declarative and interrogative sentences to stimulate the child and encourage her productions, which results in an increase in the length of the final syllable. The child first listens to her father's questions or statements, while observing particular contexts, and adjusts her outputs to match a specific intonation and context concerning the topic of choice. For example, the change in sentence type

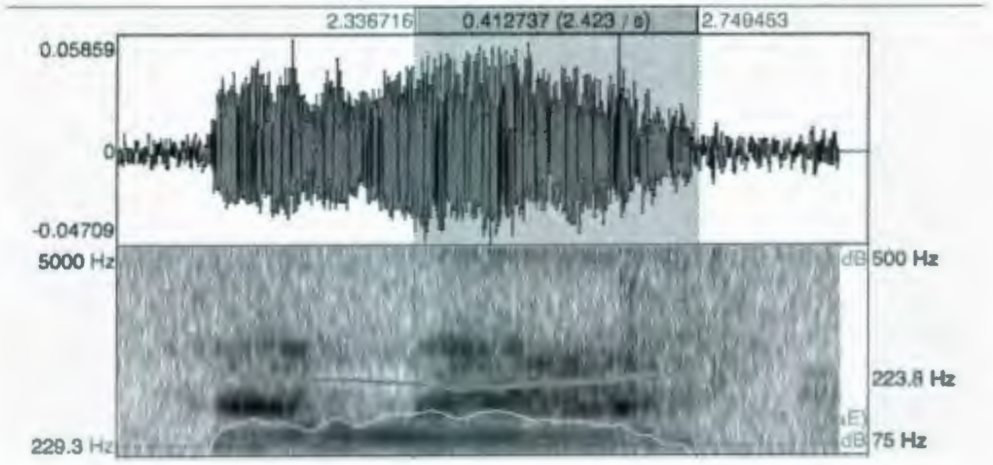
(intonation change) influences the two productions of the word *cheval* 'horse': the first production falls below 3.08 (1.48) while the second lies above 3.08 (3.22). The first time the child is asked, 'what is that?' and the child responds *cheval* [hela]. Note that this production may still be considered high given compensatory lengthening. The second time the father asks the child what the horse is doing and the child responds that the horse is sleeping, *dodo cheval* [dodo hela]. In this context, the child slows her speech, mimicking a prosodic pattern that she associates with the context of falling asleep, from which results this higher ratio. The difference of duration of the vowel of the final syllable in this particular example is made explicit in (22).

(22) A comparison of final syllable duration values for *cheval*

a) Production 2 of *cheval*



b) Production 2 of *cheval*



This prosodic pattern even seems to extend itself to the following utterance, an occurrence of *café* 'café', which displays a ratio close to the second production of *cheval*, presumably because the child is still in the same 'falling asleep' mood. In addition, the first syllable of *café* is clearly reduced, with a short, schwa-like quality, a fact that also contributes to the higher ratio observed.

(23) Examples of productions influenced by discursive context

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) cheval	1;08.4	128	413	3.22
b) café	1;08.4	127	396	3.11

3.3.1.5 Interim summary

As we saw in section 3.3.1, a number of factors may manifest themselves and result in modulation in duration ratios. These factors, be they grammatical (e.g. compensatory lengthening) or non-linguistic (e.g. EL's mood), result in values that may warp our interpretation of the data if they are not adequately addressed. Similarly, other factors may depreciate the ratios observed. I discuss some of these factors in section 3.3.2.

3.3.2 Extremely low values

Similar to the extreme values observed above, examination of extreme values below the arbitrary threshold of normal values set in section 2.2.3 (0.80) indicate specific influences on EL's speech. These influences are mostly noted during stage 3 (except mood, which also occurs during stage 2), and arise from the child's mood, the discursive context, some pronunciations of non-native words as well as grammatical development.

3.3.2.1 Influences of mood

Influences of the child's mood on productions below 0.80 occur similar to those above 3.08. However, unlike the previous discussion on EL's mood, this influence, noted during stages 2 and 3 (ages 1;09.22 to 2;04.3), result in shorter final syllables.

Several of the child's utterances showing duration ratios below 0.80 are phonetically simple, disyllabic CVCV productions. In addition, such productions of word forms were successfully articulated during previous sessions, which rules out phonological complexity as an influence. However, in all cases, EL expresses a lot of

emotion, and an overall silly mood during production of these forms. I provide a list of such cases below.

(24) Examples of productions influenced by the child's mood

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) moto	1;09.22	209	137	0.66
b) auto	1;09.22	165	131	0.79
c) cochon	1;09.22	143	111	0.78
d) raisin	1;10.2	225	153	0.68
f) fromage	2;00.14	278	221	0.79
g) maman	2;01.20	197	96	0.49
h) ampoule	2;03.8	225	165	0.73
i) dodo	2;03.8	190	147	0.77
j) gâteau	2;03.8	199	150	0.75
k) bonjour	2;04.17	417	222	0.53

In contrast to what we saw in section 3.3.1.3, we can see that excitement, as opposed to more neutral moods, can leave a systematic trace on the prosody of child speech productions. Given the inverted duration ratios observed here, we can see that the type of enthusiastic emphasis that EL was producing yielded word-initial syllable prominence. This is particularly interesting in the context that, as reported by Poiré (2000), emphasis is marked on initial, as opposed to final, syllable. We can thus conclude that emphasis in the 'excitement' speech context can also have a converse effect in EL's speech on the

otherwise expected phrase-final vowel lengthening that characterize stressed syllables in Québec French.

3.3.2.2 Influence of context

In the discussion of discursive context in section 3.3.1.4, I stated that this influence can affect syllable duration irrespective of age or grammatical development. I further observe that context can decrease penultimate as well as final syllable duration and that many types of contextual influences exist. Syntactic complexity of productions for this child as well as the context of the response to her father testing her knowledge both affect the length of the penultimate syllable.

For example, at age 2;03.8 (session 15), EL attempts to produce a longer more difficult sentence and, in turn, her production diminishes toward the end of the sentence. This results in a shorter final syllable as compared to the length of the penultimate syllable (e.g. *gentil* 'nice'). In addition, two of the child's productions are affected by the father's question. For example, when EL was asked a question by the father, 'is this a car?' where the 'car' is known to her as being an incorrect answer, she answered with 'non, un lion' with emphasis and lengthening on the penultimate syllable.

(25) Examples of productions influenced by context

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) gentil	2;03.8	247	140	0.57
b) bateaux	2;03.8	240	185	0.77
c) lion	2;03.8	401	167	0.41

3.3.2.3 Influences of word borrowing

As described by Fry (1955, 1958), Lieberman (1960) and Klatt (1976), for example, English is a trochaic (strong-weak) language with high intensity and fundamental frequency marking stress. French, however is an iambic (weak-strong) language with duration as the sole stress marker. As mentioned in section 2.1, EL's parents are English-French bilinguals and often produce English loanwords with their original, English stress patterns. The child is then likely to be exposed to the trochaic forms. Interestingly, when EL attempts to produce English words, she produces them with their original stress patterns as well, in ways that mimic perfectly that of her parents' pronunciations. This is apparent when the child produces English words such as 'jello' and 'peanut' using the English trochaic stress system.

At the age of 1;09.22 (session 10), the child produces 'jello' with an increased penultimate syllable length. Likewise, at age 2;01.20 (session 14) 'peanut' is assigned a lengthened penultimate syllable. Interestingly, immediately after her production of 'peanut', the child extends the trochaic pattern and produces a French word, *bouton*

'button' with the same strong-weak footing. I interpret this as a direct effect of the stress patterns of the preceding English word.

(26) Examples of productions influenced by word borrowing

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) jello	1;09.22	159	73	0.46
b) peanut	2;01.20	168	70	0.42
c) bouton*	2;01.20	152	30	0.19

* Produced in the context of an English word.

3.3.2.4 Accounting for the remaining extreme values (below 0.80)

The table in (26) accounts for what seems to be relatively systematic influences on EL's productions of syllable prominence. However, a number of extreme values, most of which are observed during the earlier part of the development period under investigation, between ages 1;01.7 and 1;08.4 (sessions 1 and 9), remain unaccounted for. For example, in the context of the examples, listed in (27) below, I observe no increase in either fundamental frequency or intensity when duration of penultimate syllables increased. This suggests that EL's extremely low ratio values cannot be attributed to context or mood. This acoustic assessment is confirmed by a review of the videotaped sessions, which indicate no prominent manifestation of the types of factors that influence the child's productions at a later stage.

(27) Examples of productions lacking control

Utterance	Age	Penultimate Duration	Final Duration	Ratio
a) minou	1;01.7	179	68	0.38
b) manger	1;01.7	499	392	0.79
c) tracteur	1;02.3	171	122	0.71
d) minou	1;02.3	241	188	0.78
e) minou	1;04.3	294	231	0.79
f) magna	1;05.1	273	197	0.72
g) bébé	1;06.16	305	168	0.55
h) minou	1;06.16	195	129	0.66
i) cadeau	1;06.16	243	148	0.61

Because of this lack of empirical evidence, and because of the fact that these examples all come from the stage where the child had not yet systematically mastered duration, I conclude that these values cannot be accounted for in any systematic way and, as such, presumably reflect a lack of prosodic control on the child's part at this stage.

3.3.2.5 Interim summary

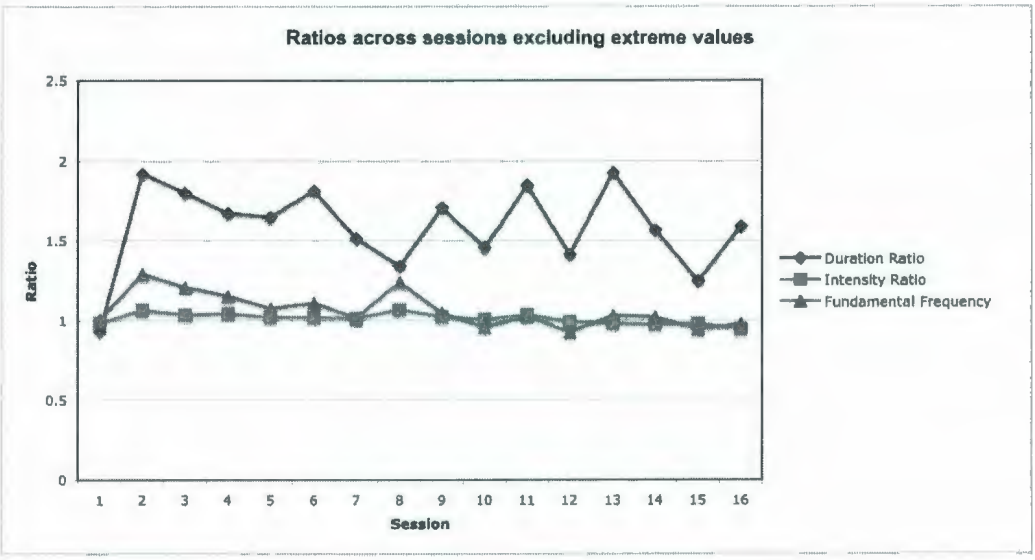
Processes that modulate duration when extreme ratios occur below 0.80 mainly occur during stage 3, with the exception of mood, which also appears during stage 2. We saw that lower ratio values tend to be associated with silly, upbeat moods, as opposed to the whiny moods that characterized the production of extremely high ratio values. Other factors were noted, most prominently the faithfully reproduced prosodic properties of

target foreign word forms, and, at an earlier stage, unsystematic productive abilities, which I left to explain what otherwise would appear to be ungrammatical stress patterns.

3.4 Durational patterns without extreme values

An analysis of extreme values is essential to account for the patterning of data as was illustrated in graph (10) in section 3.1. However, because they are mostly caused by independent factors, these values may warp our assessment of the child's overall system throughout development. In order to achieve this fairer assessment, I propose an alternative picture of the acquisition of syllable prominence which takes out these extreme values, in (28).

(28) Ratios across sessions excluding extreme values



As we can see in this updated graph, the picture generally remains the same but

highlights a few different details, mostly about the child's use of fundamental frequency, that may require further investigation, in an investigation that would focus more specifically on the intonational system, as mentioned above. However, the big milestones remain the same with regard to the stabilization of the overall system. Similar to the previous analysis including outliers, intensity centers around neutral 1.0, suggesting that this correlate is neutral with regard to stress. The child also exhibits higher duration ratios than ratios of fundamental frequency; however, this set of data display fundamental frequency as being comparable to duration between the ages of 1;01.7 and 1;07.7 (sessions 1 and 8). During this period, EL appears to be confused about the assignment of grammatical function as she produces high fundamental frequency and duration ratios close to and above 1.5. This suggests that she may be using both duration and fundamental frequency interchangeably to indicate stress. Incorporating the data that excludes extreme values with the data that includes extreme values alludes to a revised acquisition pattern.

(29) Stages of stress development in Québec French: revised version

Stage 1: Unsystematic use of the potential correlates (1;01.7-1;07.7)

Stage 2: Emergence of the syntactic domain (1;08.4-1;10.2)

Stage 3: Adult-like attainment (1;11.22-2;04.17)

During stage 1, EL produces extreme values and high ratios of fundamental frequency and duration and as such I expand this stage to include up to age 1;07.7 (session 8). Stage 2 occurs between the ages of 1;08.4 and 1;10.2 (session 9 and 11) and

is marked by the decrease of fundamental frequency ratio values and extreme values above 3.08. I observe that fundamental frequency values diminish close to 1, extreme values decrease, and duration remains as the lone marker of stress during stage 3. As previously stated, in this stage, EL decreases the amount of extreme values in her productions. When these values are eliminated, I observe a decrease in the average duration ratio from 2.57 to 1.54 and fundamental frequency remains below 1. During this period, the data suggest that EL attained the adult grammar and that she edges towards the adult system as described by Poiré (2000), who depicts fundamental frequency as the main marker of intonation and duration as the main marker of phrasal stress.

3.5 Summary and discussion

As we saw in chapter 3, duration is the main cue that EL uses to mark phrase-final stress. Looking beyond average ratios, standard deviations reveal that duration is also variable with, in some instances, very high variability. An examination of the data, illustrates that these values occur due to a number of influential factors. Effects of the child's mood, compensatory lengthening, context, borrowed non-native words, and age provide headways into the interpretation of the extreme values observed. Building on these observations, I proposed three hypothetical stages of stress development, which also offer grounds for additional studies of the child's larger prosodic system.

The development of stress in Québec French generally lacks previous documentation as we saw in chapter 2. This is, to my knowledge, the first proposal of acquisition stages for this aspect of language development in Québec French. Since the

current study is limited to a single participant, none of the conclusions drawn above can be taken as conclusive outside of the current study.

After an examination of the data from the development of acoustic correlates of stress in English in chapter 2, it is noteworthy that the child's ages of acquisition found in the current study do not correspond to Kehoe et al. (1995) or with Pollock et al. (1993). Kehoe et al. found that children at the age of 1;6 use the same phonetic cues as adults to indicate stress, while Pollock et al. (1993) found that two-year-olds do not use the same phonetic correlates as adults. First, these studies themselves are contradicting each other, especially in that they both focus on the same language. Second, the data from my study reveal that at the age of 1;6 the child is producing correlates in an unsystematic way, thereby not using adult-like correlates to mark stress. The data also reveal that at age 2;0 the child is gaining adult-like attainment of stress, which departs from Pollock et al. It is thus evident that no firm conclusion can be drawn from either of the studies, as they all present different ages of acquisition of the target stress system. This warrants further research, in order to pinpoint the source(s) of such variability and further contribute to our understanding of prosodic development in first language learners.

In chapter 4, I further examine the process of compensatory lengthening in order to determine the context in which it occurs. From this, I will provide an account of this process in the context of sonorant versus obstruent consonants.

Chapter 4

AN INVESTIGATION OF COMPENSATORY LENGTHENING

4.0 Introduction

As we saw in chapter 3, the child gradually develops her target stress system through the mastery of domain-final vowel lengthening. We also saw that the increased vowel duration observed in this context can be subject to various types of influences, be they linguistic (e.g. degree of grammatical development) or non-linguistic (e.g. child's mood). Each of the factors observed, namely EL's mood, context, linguistic borrowing, grammatical development, and compensatory lengthening can potentially explain exceptional patterns observed in the data.

In this chapter, I extend my study in order to examine one of the linguistic influences noted, that of compensatory lengthening. In chapter 3, I briefly stated that a preliminary observation of the data suggests that compensatory lengthening is restricted to the context where word-final sonorants undergo deletion. In addition, I stated that this compensatory process is not exclusive to this child's speech. Rose (2000: 232-235 and references cited therein) also found evidence of compensatory lengthening within his corpus of a young first language learner of Québec French as was described in section 3.3.1.2. In the follow up study presented below, I examine the duration ratio of the vowel preceding deleted word-final consonants to analyze the potential contextualization of compensatory lengthening in EL's phonological system.

4.1 Analysis of compensatory lengthening

In this section, I address the trends in the data by highlighting three cases where extreme values are produced as a result of compensatory lengthening.

As was discussed in section 3.1.3, results from the first session (age 1;01.7) suggest that there is no clear use of duration as a cue. At age 1;01.22 (session 2), the average ratio of duration is at its highest peak at 3.56 and is extremely variable with a standard deviation of 4.33. In this session, the child produces twelve of the thirteen utterances with an overall average ratio of 2.42 for duration.

At age 1;08.4 (session 9), two utterances of *chandelle* 'candle' were lengthened. The child produced this word as [hade] where the 'l' is replaced by an off-glide ([ ]) and lengthened the final syllable because the required word-final consonant was absent (see, e.g. Fikkert 1994 and Freitas 1997 for the development of post-vocalic, tautosyllabic liquids in the speech of children learning Dutch and European Portuguese, respectively).

At age 2;01.20 (session 14), EL produces only one outlier, which occurs when she is counting. Speaking slowly, she clearly focuses on producing the word correctly. It is because of this that when she produces a more difficult disyllabic word, 'quatorze' she takes her time to ensure correct production. In addition, the child may have produced this final [rz] cluster syllable with longer duration to compensate for its difficult level of production. Her actual production of this [rz] cluster is produced as [a z], deleting the rhotic portion of the cluster, and subsequently lengthening the preceding vowel.

Such anecdotal evidence points to potential grammatical conditioning, which I explore more systematically in the next section.

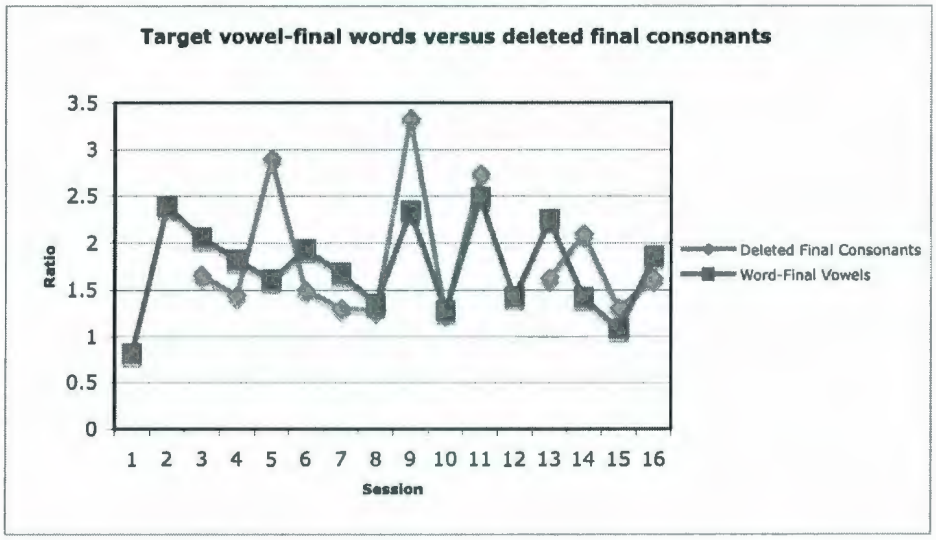
4.2 Classifying compensatory lengthening

Expanding on the analysis from chapter 3, I examine average duration ratios across sessions in order to analyze in detail the segmental conditioning of compensatory lengthening. To begin, I first compare the duration ratios across all sessions in the contexts of produced word-final vowels, on the one hand, and deleted word-final consonants, on the other.

4.2.1 Target word-final vowels versus deleted word-final consonants

In (30), I compare the ratio values in the contexts of target word-final vowels versus deleted word-final consonants. This comparison offers a basis to claim that a significant number of word-final consonants are deleted across sessions. This process of word-final consonant deletion appears to occur consistently across all ages except at the earliest age 1;01.7 (session 1) and age 1;11.22 (session 12).

(30) Duration ratios: target vowel-final words versus deleted final consonants

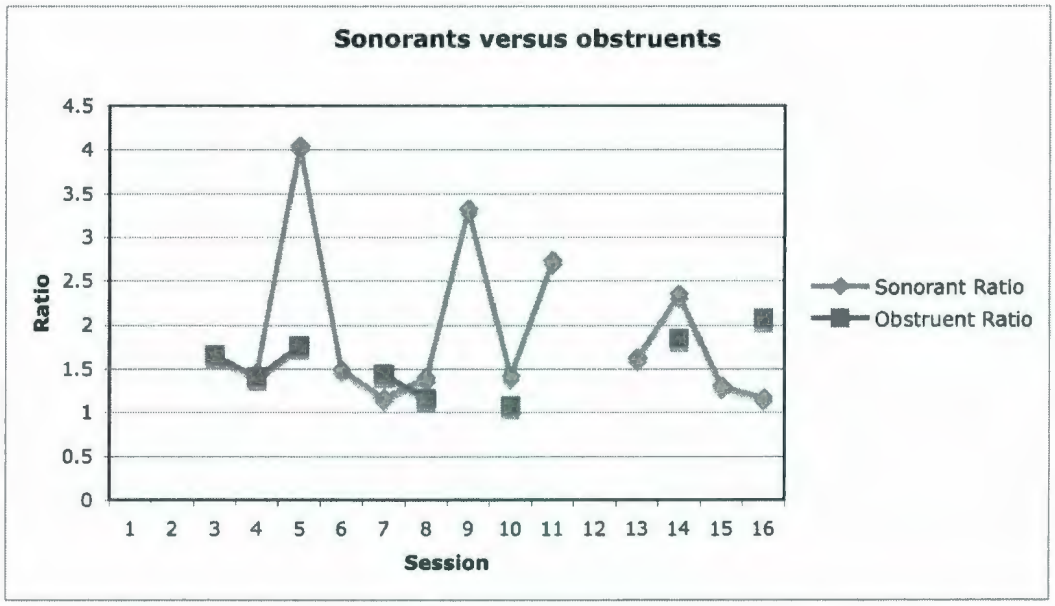


Across sessions, the child, at times, exhibits extreme values in the context of word-final consonant deletion in comparison with word-final vowels, the latter of which all occur within the arbitrary normal range discussed in chapter 3 (duration ratios of 0.80 to 3.08). As displayed in (30) and due to final consonant deletion resulting in an open final syllable, I propose, following Rose (2000), that this final syllable must lengthen to compensate for the loss of the consonant duration. Ratios below 0.80 are excluded in the category of compensatory lengthening because these values are minimal (one occurrence). Likewise, I observe a greater number of utterances with ratios below 0.80, in fact there are a total of 28, from which word-final consonant deletion is entirely absent. The data also suggest that compensatory lengthening occurs at age 1;01.22 and 1;08.4 (sessions 2 and 9).

4.2.2 Sonorants versus obstruents

In the graph in (31), I display the average ratios observed in the contexts where word-final consonants are deleted from the child's target forms, this time dividing the data into two sets of consonant types: sonorants and obstruents.

(31) Deleted word-final sonorants versus obstruents across sessions



As we can see, the data reveal, first, that final consonant deletion can affect both sonorants and obstruents. The gaps in the graph correspond to sessions where the child did not attempt the target forms.

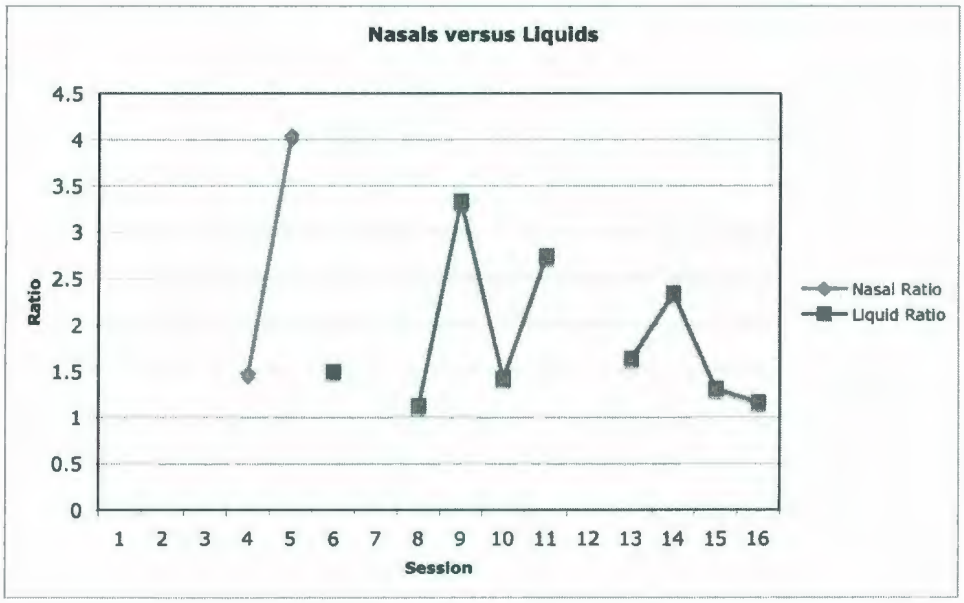
Recall from the previous chapter that compensatory lengthening was taken as one of the conditioning processes that yield the appearance of extreme values (duration ratios above 3.08) in the child's productions. As we can see in (31), these extreme ratios tend to occur more in the context of deleted sonorants. In addition, we can also see that the

average ratios in the context of sonorant deletion, whether they fall in the extreme category or not, tend to be higher than those found in the context of deleted obstruents. This clear trend suggests that the presence of word-final sonorants in target forms has a lengthening effect on the preceding vowel.

4.2.3 Nasals versus liquids

Extreme duration ratios of sonorants warrant further exploration of subcategories of this class. The sonorants found in this context are either nasals, liquids, or glides. However, across all sessions only two forms with final glides are found in my corpus, at ages 1;06.16 and 1;07.7 (sessions 7 and 8) and both lie within the normal range, suggesting they do not undergo compensatory lengthening. Therefore, only nasal and liquid ratios are reported in the graph in (32).

(32) Deleted word-final nasals and liquids across sessions



The graph in (32) illustrates that there is no clear trend to enable a distinction between these two classes of sonorants; while nasals are centered around early ages, they yield larger ratios (e.g. sessions 4 and 5), the opposite holds true in liquids (e.g. sessions 6 to 16, excluding sessions 7 and 12) which center around the latter sessions with lower ratios. Examples of compensatory lengthening of nasals and liquids are provided in the table in (33).

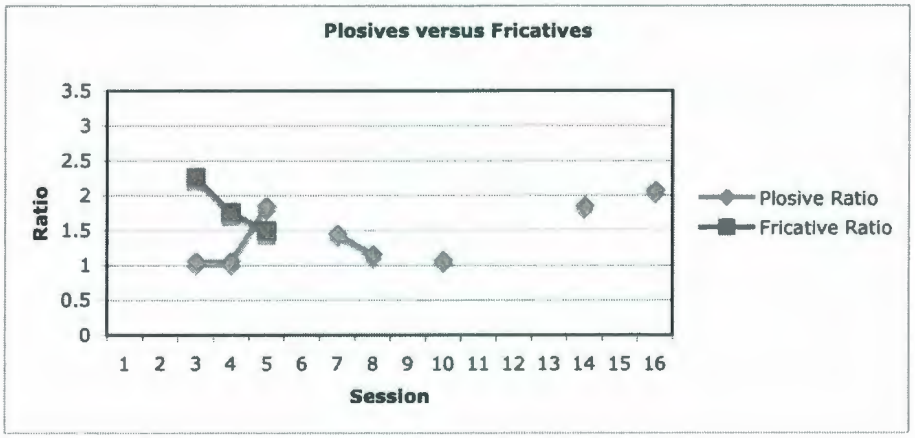
(33) Compensatory lengthening of nasals and liquids

Age	Session	Target	Production	Penultimate	Final	Ratio
1;04.3	5	*banane*	[mnæ]	68	275	4.04
1;08.4	9	*chandelle*	[hade]	162	521	3.2
1;08.4	9	*chandelle*	[hade]	81	558	6.89

4.2.4 Stops versus fricatives

In table (31), we saw that compensatory lengthening does not appear to manifest itself in the context of obstruents. However, because I am examining average ratios, a detailed tabulation is warranted for all of the data. I examine plosives and fricatives, as they are the only obstruents that occur in word-final position in the child's productions.

(34) Plosives and fricatives across sessions



As we see in the graph in (34), the deletion of plosives occurs sporadically across sessions, with fricative deletion occurring during EL's early ages. The data in graph (34) illustrates that no ratios above 3.08 are found in these data, suggesting that compensatory lengthening does not occur in either of these contexts. We can also conclude from this that voicing within obstruents is irrelevant to the story, as the main distinction that appears to manifest itself in EL's data concerns the difference between sonorants and

obstruents, only the former of which is actually associated with larger ratio values that fall in the exceptionally high category.

4.3 Summary and discussion

The classification discussed in section 4.2 provides support to the hypothesis formulated in chapter 3 that the process of compensatory lengthening affects the duration of EL's final syllables. I observe from a closer examination of compensatory lengthening in the context of deleted final sonorants and obstruents that this process is much more noticeable in the context of deleted word-final sonorants. This class of segments thus patterns as a whole, in a way that differs from Rose's (2000) observations, which are themselves restricted to the class of rhotics. While the source of this discrepancy cannot be established firmly within the confines of this thesis, I suggest that such differences are not surprising across children, as variation does exist across learners of any give language (e.g. Fikkert 1994).

Despite the difference noted, however, we also observe the trend that compensatory lengthening is related in both cases (Rose's and the current study) to sonorant consonants (rhotics in Rose's work versus the whole class of liquids in the current study). Such a generalization is itself worthy of interest, and could offer a basis for further investigations, among more French learners and across languages, should the tendencies observed in French be reflective of more general factors affecting phonological development.

Chapter 5

CONCLUSION

5.0 Introduction

In this chapter, I present a summary of my thesis. I discuss the two main chapters in section 5.1, namely on the acquisition of stress in Québec French (chapter 3) and compensatory lengthening (chapter 4).

5.1 Summary of thesis

In this thesis, I examined the development of stress through a longitudinal study of a young female first language learner of Québec French, code-named EL, from the age of 1;01.07 to 2;04.17. I analyzed her productions, exploring data including and excluding extreme values, which lead to my proposal of three stages of acquisition, repeated here for convenience.

(35) Stages of stress development in Québec French (repeated from (27))

Stage 1: Unsystematic use of the potential correlates (1;01.7-1;07.7)

Stage 2: Emergence of the syntactic domain (1;08.4-1;10.2)

Stage 3: Adult-like attainment (1;11.22-2;04.17)

I further analyzed one of the influences causing extreme outliers, compensatory lengthening, to expose the context in which the influence occurs.

In chapter 3, I investigated the patterning of ratio values of fundamental frequency, intensity, and duration of the child's productions. The patterning of these correlates suggest that duration is the main cue utilized by EL to mark stress as it expresses high ratio values across sessions. The other two correlates fell near neutral values throughout most of EL's ages. However, I observed that fundamental frequency ratios patterned similar to duration ratios (although not quite as noticeably) during the child's early ages. This observation and examination of the entire compilation of data suggest that developmentally the child is acquiring the parameters of the larger prosodic system, including intonation (which is by definition marked by fundamental frequency) in the target language. I also observed that across sessions many extreme values occur. I accounted for these values through the identification of various grammatical and non-grammatical influences such as mood, word borrowing, context, aspiration, and compensatory lengthening.

In chapter 4, I examined the process of compensatory lengthening on EL's productions. A comparison of forms displaying deleted word-final consonants with target forms with word-final vowels was established across sessions. This revealed that the deletion process occurred with a compensatory process that lengthened the final vowel which, however, appeared much more markedly in the context of sonorants.

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Appendix A: Raw Data

Session 1 - Age 1;01.7									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
moo-moo	298.00	77.40	340.00	276.00	72.90	352.90	0.93	0.94	1.04
moo-moo	347.00	69.80	306.10	406.00	73.60	306.30	1.17	1.05	1.00
amis	313.00	82.90	452.60	396.00	81.40	441.30	1.27	0.98	0.98
minou	179.00	85.90	393.00	68.00	79.50	363.10	0.38	0.93	0.92
manger	316.00	70.70	381.60	340.00	75.30	419.70	1.08	1.07	1.10
manger	499.00	75.20	428.30	392.00	71.70	428.50	0.79	0.95	1.00
SD	102.98	6.46	54.33	129.54	3.88	52.86	0.32	0.06	0.06
AVE	325.33	76.98	383.60	313.00	75.73	385.30	0.93	0.99	1.01

Session 2 - Age 1;01.22									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
pipi	140.00	69.90	294.80	243.00	74.70	357.60	1.74	1.07	1.21
minou	176.00	72.30	317.10	226.00	70.50	560.90	1.28	0.98	1.77
minou	129.00	68.40	295.30	131.00	69.10	429.40	1.02	1.01	1.45

dodo	68.00	69.00	304.80	185.00	68.80	359.10	2.72	1.00	1.18
papa	107.00	57.40	277.30	212.00	71.70	356.60	1.98	1.25	1.29
pitou	169.00	71.60	359.90	226.00	73.10	433.90	1.34	1.02	1.21
tutu	127.00	70.90	348.40	166.00	76.40	399.00	1.31	1.08	1.15
tutu	80.00	57.80	300.10	214.00	66.40	363.40	2.68	1.15	1.21
banane	271.00	63.20	273.00	603.00	64.20	286.40	2.23	1.02	1.05
banane	53.00	63.60	286.10	912.00	68.50	361.00	17.21	1.08	1.26
ballon	102.00	58.60	243.90	649.00	65.00	319.40	6.36	1.11	1.31
ballon	119.00	64.80	276.20	410.00	67.70	419.40	3.45	1.04	1.52
banane	230.00	60.30	275.70	676.00	66.70	389.40	2.94	1.11	1.41

SD	62.47	5.48	31.44	251.80	3.70	67.04	4.33	0.07	0.19
AVE	136.23	65.22	296.35	373.31	69.45	387.35	3.56	1.07	1.31

Session 3 - Age 1;02.3									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
tracteur	171.00	73.30	374.60	122.00	63.60	299.40	0.71	0.87	0.80
minou	143.00	74.20	342.50	232.00	75.10	394.00	1.62	1.01	1.15
minou	241.00	61.00	288.10	188.00	69.00	359.60	0.78	1.13	1.25
minou	249.00	63.60	299.10	351.00	66.10	358.50	1.41	1.04	1.20
minou	204.00	66.20	311.10	220.00	67.10	380.70	1.08	1.01	1.22

papa	53.00	53.10	287.30	220.00	77.80	333.70	4.15	1.47	1.16
papa	94.00	53.20	287.50	216.00	60.80	313.70	2.30	1.14	1.09
minoux	260.00	73.90	315.10	284.00	70.60	387.70	1.09	0.96	1.23
minou	289.00	67.70	298.60	257.00	66.90	338.70	0.89	0.99	1.13
papa	140.00	66.50	272.50	278.00	70.00	343.50	1.99	1.05	1.26
garçon	117.00	61.10	306.50	459.00	62.40	428.20	3.92	1.02	1.40
auto	136.00	65.00	305.60	228.00	72.50	361.40	1.68	1.12	1.18
magique	140.00	69.20	309.10	148.00	67.30	377.40	1.06	0.97	1.22
minou	148.00	70.60	354.00	249.00	73.40	395.60	1.68	1.04	1.12
minoux	204.00	70.10	335.30	279.00	69.90	388.10	1.37	1.00	1.16
dodo	164.00	65.40	343.80	225.00	61.80	346.80	1.37	0.94	1.01
souris	93.00	66.50	299.10	262.00	70.90	380.10	2.82	1.07	1.27
minou	148.00	74.20	340.00	184.00	76.20	453.80	1.24	1.03	1.33
minou	132.00	62.80	297.30	386.00	66.60	423.00	2.92	1.06	1.42
minou	75.00	68.40	310.10	192.00	71.60	434.10	2.56	1.05	1.40
ici	78.00	59.30	326.10	199.00	69.30	427.50	2.55	1.17	1.31
Gigi	152.00	77.30	507.70	343.00	79.60	635.30	2.26	1.03	1.25
maman	119.00	67.40	356.00	276.00	68.30	356.50	2.32	1.01	1.00
papa	105.00	53.80	273.90	347.00	70.00	401.80	3.30	1.30	1.47

SD	61.61	6.68	47.70	77.61	4.84	65.38	0.96	0.12	0.15
AVE	152.29	65.99	322.54	256.04	69.45	388.30	1.96	1.06	1.21

Session 4 - Age 1;02.12									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
famille	136.00	59.60	303.60	264.00	63.30	342.60	1.94	1.06	1.13
catus	84.00	70.70	315.10	148.00	67.30	358.40	1.76	0.95	1.14
auto	121.00	56.80	304.90	248.00	63.40	305.10	2.05	1.12	1.00
bébé	154.00	67.00	329.00	180.00	68.60	438.40	1.17	1.02	1.33
bébé	79.00	61.00	373.50	106.00	60.10	338.80	1.34	0.99	0.91
poupée	99.00	60.80	282.40	145.00	67.80	284.80	1.46	1.12	1.01
bonhomme	141.00	60.00	238.10	208.00	67.60	297.70	1.48	1.13	1.25
bébé	129.00	62.40	286.00	202.00	64.70	350.40	1.57	1.04	1.23
minou	89.00	60.00	282.20	204.00	64.30	337.00	2.29	1.07	1.19
ici	67.00	67.50	349.50	116.00	67.10	350.50	1.73	0.99	1.00
poussette	200.00	62.30	254.30	211.00	68.70	375.40	1.06	1.10	1.48
Gigi	122.00	62.90	255.10	185.00	63.00	329.70	1.52	1.00	1.29
chien	112.00	63.30	258.50	209.00	66.40	306.20	1.87	1.05	1.18
jeudi	66.00	55.80	232.00	205.00	64.10	324.50	3.11	1.15	1.40
pipi	90.00	66.90	347.30	143.00	67.60	428.20	1.59	1.01	1.23
petit	134.00	62.90	266.20	209.00	60.40	317.50	1.56	0.96	1.19
papa	81.00	66.30	291.10	167.00	67.00	302.60	2.06	1.01	1.04
Gigi	80.00	62.30	287.90	209.00	71.80	386.30	2.61	1.15	1.34
ici	168.00	63.20	310.50	178.00	62.40	332.20	1.06	0.99	1.07
petit	118.00	61.10	299.50	231.00	66.20	303.00	1.96	1.08	1.01
ici	96.00	58.50	313.70	212.00	62.90	326.70	2.21	1.08	1.04
bateau	125.00	64.00	269.40	111.00	62.00	261.60	0.89	0.97	0.97

genou	180.00	66.10	287.20	237.00	64.60	339.60	1.32	0.98	1.18
Gigi	89.00	65.00	267.10	275.00	71.30	323.50	3.09	1.10	1.21
Gigi	74.00	60.50	285.40	115.00	66.30	308.80	1.55	1.10	1.08
dodo	223.00	50.50	290.70	181.00	54.10	337.80	0.81	1.07	1.16
Gigi	70.00	63.40	319.20	161.00	69.70	398.10	2.30	1.10	1.25
genoux	63.00	61.90	299.20	148.00	63.30	391.30	2.35	1.02	1.31

SD	42.00	4.03	32.98	45.66	3.71	41.22	0.59	0.06	0.14
AVE	113.93	62.24	292.81	186.00	65.21	339.17	1.77	1.05	1.17

Session 5 - Age 1;04.3									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
maman	270.00	76.60	345.20	340.00	70.70	418.70	1.26	0.92	1.21
minou	97.00	76.30	353.40	172.00	72.30	374.60	1.77	0.95	1.06
papa	122.00	70.50	328.20	253.00	70.90	330.00	2.07	1.01	1.01
papu	147.00	66.70	267.30	319.00	68.40	289.30	2.17	1.03	1.08
maman	119.00	76.40	342.50	199.00	73.80	368.70	1.67	0.97	1.08
bébé	185.00	72.50	334.40	319.00	76.10	315.00	1.72	1.05	0.94
ballon	171.00	70.70	338.60	199.00	75.60	314.50	1.16	1.07	0.93
minou	145.00	72.10	307.90	244.00	68.00	280.30	1.68	0.94	0.91
chandail	133.00	66.30	306.20	298.00	72.70	343.20	2.24	1.10	1.12

bébé	173.00	70.80	317.90	297.00	69.40	310.60	1.72	0.98	0.98
papa	182.00	64.30	290.00	216.00	71.20	351.80	1.19	1.11	1.21
bébé	132.00	68.20	315.60	317.00	72.80	300.30	2.40	1.07	0.95
moustique	147.00	66.10	313.30	316.00	73.20	410.00	2.15	1.11	1.31
bateau	244.00	70.30	302.90	268.00	70.50	413.40	1.10	1.00	1.36
dedans	165.00	76.40	359.40	188.00	72.20	340.00	1.14	0.95	0.95
banane	68.00	68.10	295.20	275.00	69.30	304.60	4.04	1.02	1.03
oranges	160.00	69.20	311.00	239.00	71.60	348.60	1.49	1.03	1.12
carottes	198.00	71.60	328.20	268.00	79.00	383.70	1.35	1.10	1.17
tomates	118.00	69.90	316.60	239.00	69.00	353.10	2.03	0.99	1.12
maman	201.00	72.30	350.40	271.00	70.80	381.50	1.35	0.98	1.09
cocos	156.00	61.80	293.20	289.00	71.30	371.50	1.85	1.15	1.27
dodo	248.00	78.40	398.50	268.00	75.90	405.70	1.08	0.97	1.02
minou	244.00	73.50	316.40	263.00	72.90	333.00	1.08	0.99	1.05
maman	135.00	55.10	311.80	357.00	56.40	305.90	2.64	1.02	0.98
minou	294.00	72.80	385.30	231.00	69.70	376.20	0.79	0.96	0.98
ballon	253.00	68.80	372.20	309.00	71.80	329.00	1.22	1.04	0.88

SD	56.75	5.08	30.45	48.43	3.99	39.97	0.68	0.06	0.13
AVE	173.35	70.22	326.98	267.46	71.37	348.20	1.71	1.02	1.07

Session 6 - Age 1;05.1									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
bobo	198.00	73.00	414.50	320.00	64.50	342.60	1.62	0.88	0.83
nounours	143.00	72.50	307.50	180.00	74.50	347.50	1.26	1.03	1.13
ballon	104.00	73.40	311.80	263.00	82.20	368.60	2.53	1.12	1.18
gâteaux	171.00	66.90	266.40	337.00	77.00	370.80	1.97	1.15	1.39
papa	92.00	62.10	298.10	290.00	69.00	335.70	3.15	1.11	1.13
bébé	114.00	75.00	331.20	180.00	73.60	317.70	1.58	0.98	0.96
papa	135.00	64.10	279.30	208.00	64.70	316.70	1.54	1.01	1.13
papa	164.00	66.50	312.10	310.00	69.20	304.50	1.89	1.04	0.98
magna	273.00	69.90	298.10	197.00	67.70	315.30	0.72	0.97	1.06
papa	127.00	63.30	320.00	237.00	68.80	315.70	1.87	1.09	0.99
cadeaux	228.00	69.70	312.30	255.00	68.30	293.90	1.12	0.98	0.94
papa	128.00	62.70	154.90	280.00	60.40	285.30	2.19	0.96	1.84
papa	100.00	54.30	264.00	261.00	60.60	300.20	2.61	1.12	1.14
minoux	187.00	76.80	344.00	320.00	71.20	310.60	1.71	0.93	0.90
minou	228.00	75.90	338.10	254.00	73.60	337.10	1.11	0.97	1.00
papa	124.00	63.80	319.40	233.00	67.70	322.30	1.88	1.06	1.01
papi	75.00	62.00	305.80	232.00	69.00	304.60	3.09	1.11	1.00
ballon	216.00	66.90	313.60	251.00	71.10	319.20	1.16	1.06	1.02
dodo	69.00	55.60	285.50	155.00	57.90	271.10	2.25	1.04	0.95
poisson	120.00	57.10	277.60	276.00	61.00	276.50	2.30	1.07	1.00
cadeaux	141.00	66.90	313.50	298.00	67.50	318.10	2.11	1.01	1.01

nounours	157.00	70.10	305.70	228.00	69.60	291.70	1.45	0.99	0.95
nounours	116.00	71.70	150.50	207.00	70.30	294.10	1.78	0.98	1.95
minoux	70.00	75.70	358.20	190.00	74.90	407.30	2.71	0.99	1.14
minoux	163.00	69.30	280.30	206.00	66.60	278.20	1.26	0.96	0.99

SD	53.11	6.32	53.96	49.40	5.55	32.06	0.63	0.07	0.26
AVE	145.72	67.41	298.50	246.72	68.84	317.81	1.87	1.02	1.10

Session 7 - Age 1;06.16									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
bébé	305.00	77.10	361.90	168.00	78.10	344.30	0.55	1.01	0.95
bébé	185.00	74.70	298.00	187.00	74.90	134.30	1.01	1.00	0.45
fourchette	145.00	72.30	333.30	210.00	65.00	257.60	1.45	0.90	0.77
bébé	118.00	68.90	290.40	198.00	70.70	320.00	1.68	1.03	1.10
minou	72.00	73.60	317.90	117.00	78.90	358.90	1.63	1.07	1.13
minou	154.00	73.70	321.50	174.00	73.50	324.00	1.13	1.00	1.01
minou	195.00	73.70	295.90	129.00	73.70	371.50	0.66	1.00	1.26
abeille	139.00	63.50	295.90	162.00	64.60	285.50	1.17	1.02	0.96
minou	80.00	81.20	348.80	174.00	75.00	359.40	2.18	0.92	1.03
minou	90.00	69.50	271.80	289.00	71.90	282.40	3.21	1.03	1.04
minou	54.00	69.00	279.80	255.00	68.80	270.80	4.72	1.00	0.97

maman	102.00	69.40	298.60	184.00	70.70	309.80	1.80	1.02	1.04
papa	53.00	60.10	271.00	212.00	69.30	291.90	4.00	1.15	1.08
papa	123.00	68.90	309.60	183.00	68.60	318.40	1.49	1.00	1.03
ballon	166.00	69.30	276.30	202.00	71.50	273.20	1.22	1.03	0.99
aple	118.00	63.20	297.50	239.00	68.40	320.80	2.03	1.08	1.08
papu	149.00	64.40	275.20	195.00	68.40	294.80	1.31	1.06	1.07
magna	104.00	70.70	307.20	204.00	72.00	379.30	1.96	1.02	1.23
café	238.00	61.80	242.90	220.00	67.80	256.20	0.92	1.10	1.05
café	160.00	65.50	275.00	228.00	67.80	273.60	1.43	1.04	0.99
bébé	125.00	68.20	285.40	192.00	70.70	296.70	1.54	1.04	1.04
manteau	131.00	71.60	296.90	179.00	67.10	309.90	1.37	0.94	1.04
ballon	108.00	63.60	283.20	211.00	64.40	320.90	1.95	1.01	1.13
ballon	136.00	67.80	298.60	133.00	66.80	293.50	0.98	0.99	0.98
papa	111.00	67.40	281.90	200.00	67.90	283.10	1.80	1.01	1.00
tracteur	103.00	62.60	234.60	215.00	69.50	274.50	2.09	1.11	1.17
maman pipi	123.00	67.80	303.00	151.00	65.40	319.00	1.23	0.96	1.05
cadeau	243.00	66.30	246.20	148.00	70.60	333.20	0.61	1.06	1.35

SD	56.80	4.88	28.58	37.90	3.75	46.80	0.94	0.05	0.16
AVE	136.79	68.78	292.80	191.39	70.07	302.05	1.68	1.02	1.04

Session 8 - Age 1;07.7									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
bateau	113.00	71.00	156.70	145.00	63.00	287.50	1.28	0.89	1.83
parterre	183.00	72.00	367.40	108.00	71.40	304.50	0.59	0.99	0.83
agneau	101.00	64.00	266.60	141.00	74.40	294.60	1.40	1.16	1.11
coco	43.00	65.80	303.40	135.00	67.20	262.20	3.14	1.02	0.86
auto	63.00	57.00	279.80	134.00	81.10	322.30	2.13	1.42	1.15
bébé	88.00	75.60	287.70	158.00	75.10	299.90	1.80	0.99	1.04
poisson	160.00	66.80	260.30	74.00	66.50	244.50	0.46	1.00	0.94
cocos	127.00	64.60	149.20	158.00	69.20	293.70	1.24	1.07	1.97
ourson	110.00	76.20	289.30	146.00	67.50	275.40	1.33	0.89	0.95
cheval	127.00	65.90	262.40	120.00	75.00	314.90	0.94	1.14	1.20
volant	101.00	71.20	151.20	172.00	71.60	289.90	1.70	1.01	1.92
cochons	128.00	66.40	255.10	105.00	75.30	307.90	0.82	1.13	1.21
cochon	162.00	68.80	266.70	123.00	64.40	267.20	0.76	0.94	1.00
hibou	197.00	66.10	333.00	166.00	75.60	331.60	0.84	1.14	1.00
ici	149.00	71.90	255.80	130.00	72.30	280.50	0.87	1.01	1.10
canard	117.00	65.50	263.90	102.00	60.40	274.90	0.87	0.92	1.04
abeille	66.00	56.60	271.30	150.00	67.90	328.70	2.27	1.20	1.21
gateau	142.00	67.40	259.80	85.00	74.20	311.70	0.60	1.10	1.20
patates	117.00	62.50	281.80	136.00	69.90	318.20	1.16	1.12	1.13
bateau	174.00	72.00	332.90	107.00	66.00	287.10	0.61	0.92	0.86
minou	264.00	63.40	290.50	171.00	73.90	346.40	0.65	1.17	1.19
minou	115.00	69.10	284.20	105.00	71.00	317.20	0.91	1.03	1.12

minou	163.00	67.70	171.70	171.00	75.40	316.50	1.05	1.11	1.84
bébé	135.00	66.40	382.70	161.00	72.30	408.40	1.19	1.09	1.07
bébé	131.00	69.80	171.10	669.00	68.20	384.30	5.11	0.98	2.25
manteau	239.00	67.50	262.60	178.00	73.30	319.40	0.74	1.09	1.22
manteau	178.00	69.30	259.60	215.00	73.00	261.30	1.21	1.05	1.01
manteau	122.00	64.50	259.40	285.00	66.90	268.50	2.34	1.04	1.04
polaire	95.00	71.30	265.10	148.00	76.30	262.70	1.56	1.07	0.99
panda	123.00	68.30	259.90	156.00	64.90	298.20	1.27	0.95	1.15
tombé	391.00	70.30	251.60	274.00	68.30	279.90	0.70	0.97	1.11

SD	65.89	4.39	55.89	104.13	4.61	35.08	0.93	0.11	0.36
AVE	142.71	67.58	262.99	165.42	70.69	301.94	1.34	1.05	1.21

Session 9 - 1;08.4									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
bonjours	196.00	51.50	241.10	365.00	58.70	284.70	1.86	1.14	1.18
mouton	96.00	63.60	285.90	276.00	65.50	263.20	2.88	1.03	0.92
auto	143.00	61.90	284.30	156.00	62.00	291.80	1.09	1.00	1.03
papi	221.00	65.70	295.30	224.00	62.50	271.30	1.01	0.95	0.92
bébé	144.00	66.90	315.90	768.00	64.30	243.10	5.33	0.96	0.77
bébé	161.00	61.10	264.30	540.00	60.10	242.70	3.35	0.98	0.92

garçon	175.00	64.00	271.00	159.00	68.60	260.30	0.91	1.07	0.96
papa	129.00	58.60	249.30	124.00	65.10	289.40	0.96	1.11	1.16
papa	143.00	57.50	247.30	233.00	62.30	287.30	1.63	1.08	1.16
maman	123.00	53.50	244.40	232.00	52.60	268.20	1.89	0.98	1.10
cadeau	209.00	67.70	277.40	183.00	63.50	264.80	0.88	0.94	0.95
ballon	167.00	64.80	258.90	280.00	70.10	311.10	1.68	1.08	1.20
chandelle	162.00	63.10	295.60	521.00	57.60	245.90	3.22	0.91	0.83
chandelle	81.00	59.30	296.50	558.00	55.40	253.10	6.89	0.93	0.85
oreille	148.00	66.20	325.40	367.00	63.00	276.90	2.48	0.95	0.85
oreille	234.00	58.60	262.90	316.00	62.20	273.30	1.35	1.06	1.04
cheval	193.00	61.40	272.90	286.00	52.70	248.90	1.48	0.86	0.91
cheval	128.00	58.50	242.20	413.00	59.20	222.00	3.23	1.01	0.92
café	127.00	51.10	258.20	396.00	56.60	219.90	3.12	1.11	0.85
papa	59.00	54.50	259.20	431.00	60.30	263.90	7.31	1.11	1.02
petits	105.00	58.30	236.40	377.00	53.90	215.10	3.59	0.92	0.91
dodo	161.00	61.90	248.50	193.00	61.40	256.60	1.20	0.99	1.03
poupée	178.00	61.80	274.90	477.00	62.80	234.90	2.68	1.02	0.85
bijou	116.00	56.80	249.90	235.00	63.10	241.50	2.03	1.11	0.97
papi	167.00	56.60	252.60	160.00	67.20	298.80	0.96	1.19	1.18
maman	172.00	58.10	216.30	492.00	57.40	239.80	2.86	0.99	1.11
maman	207.00	60.50	239.10	632.00	59.90	249.00	3.05	0.99	1.04
maman	159.00	60.80	225.20	243.00	61.60	283.90	1.53	1.01	1.26
maman	140.00	59.40	226.90	209.00	56.50	263.90	1.49	0.95	1.16

SD	40.96	4.31	26.62	161.17	4.42	24.02	1.66	0.08	0.13

AVE	153.24	60.13	262.68	339.52	60.90	260.87	2.48	1.02	1.00

Session 10 - Age 1;09.22									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
encore	115.00	85.80	369.10	135.00	83.90	314.70	1.17	0.98	0.85
encore	140.00	83.00	399.50	224.00	80.50	273.40	1.60	0.97	0.68
encore	107.00	83.70	361.80	161.00	75.80	244.20	1.50	0.91	0.67
salon	167.00	72.70	281.10	179.00	70.70	239.60	1.07	0.97	0.85
tapis	134.00	70.50	398.90	143.00	55.90	251.90	1.07	0.79	0.63
maman	107.00	77.70	393.90	289.00	78.30	386.20	2.70	1.01	0.98
fenêtre	136.00	76.30	331.10	147.00	70.80	275.00	1.08	0.93	0.83
moto	209.00	77.30	366.70	137.00	71.80	278.40	0.66	0.93	0.76
poussette	138.00	65.50	277.70	157.00	78.20	334.80	1.14	1.19	1.21
auto	102.00	76.30	342.50	149.00	69.70	254.90	1.46	0.91	0.74
poussette	142.00	63.40	266.90	178.00	71.10	335.60	1.25	1.12	1.26
poussette	156.00	66.90	298.70	209.00	70.40	347.30	1.34	1.05	1.16
auto	165.00	72.20	309.10	131.00	66.20	278.70	0.79	0.92	0.90
poppets	134.00	71.70	294.90	226.00	68.60	314.00	1.69	0.96	1.06
poppets	100.00	69.80	299.10	191.00	71.20	315.70	1.91	1.02	1.06
poppets	71.00	56.40	293.50	232.00	74.20	340.20	3.27	1.32	1.16
bobo	167.00	72.90	314.10	370.00	74.20	299.80	2.22	1.02	0.95
cadeau	174.00	75.20	356.90	190.00	77.20	295.80	1.09	1.03	0.83
moustache	196.00	69.30	345.40	169.00	71.50	333.20	0.86	1.03	0.96

cochon	136.00	65.60	316.50	176.00	74.60	376.60	1.29	1.14	1.19
moustique	204.00	82.80	465.20	344.00	83.10	465.50	1.69	1.00	1.00
lapin	110.00	68.60	310.40	208.00	80.90	421.80	1.89	1.18	1.36
cochon	143.00	72.40	310.80	156.00	76.40	291.20	1.09	1.06	0.94
fourchette	169.00	71.20	313.10	153.00	66.80	267.90	0.91	0.94	0.86
jello	159.00	75.50	393.80	73.00	71.20	286.70	0.46	0.94	0.73
tomates	142.00	75.30	354.50	228.00	75.70	327.50	1.61	1.01	0.92
cadeau	147.00	72.30	287.40	170.00	72.10	248.90	1.16	1.00	0.87
parti	196.00	74.60	335.50	250.00	69.00	333.50	1.28	0.92	0.99
parti	154.00	74.40	340.70	216.00	74.90	357.80	1.40	1.01	1.05
poussette	98.00	71.70	319.60	242.00	73.90	321.40	2.47	1.03	1.01
cochon	143.00	80.70	418.00	111.00	72.60	291.90	0.78	0.90	0.70

SD	33.17	6.29	46.60	63.22	5.48	52.08	0.61	0.10	0.18
AVE	143.90	73.28	337.63	191.74	73.27	313.04	1.42	1.01	0.94

Session 11 - Age 1;10.2									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
joujou	360.00	77.30	386.60	404.00	68.70	281.70	1.12	0.89	0.73
maman	121.00	69.50	336.50	246.00	69.90	294.50	2.03	1.01	0.88
cadeau	185.00	59.90	119.50	681.00	68.50	351.30	3.68	1.14	2.94

cadeau	192.00	71.50	260.90	391.00	74.70	362.00	2.04	1.04	1.39
miaou	259.00	63.60	407.80	341.00	73.80	433.10	1.32	1.16	1.06
papa	100.00	47.60	261.10	438.00	71.40	348.20	4.38	1.50	1.33
couteau	161.00	61.90	273.30	444.00	70.40	331.10	2.76	1.14	1.21
raisins	99.00	60.60	465.90	356.00	71.30	354.40	3.60	1.18	0.76
raisin	225.00	69.30	404.90	153.00	68.90	254.20	0.68	0.99	0.63
raisin	183.00	71.50	383.70	222.00	72.10	302.90	1.21	1.01	0.79
tambour	200.00	70.80	266.20	581.00	82.50	408.20	2.91	1.17	1.53
café	208.00	61.20	273.80	197.00	59.20	262.40	0.95	0.97	0.96
moto	175.00	60.70	228.60	467.00	79.30	365.40	2.67	1.31	1.60
moto	173.00	61.10	248.40	658.00	76.00	362.20	3.80	1.24	1.46
amie	186.00	70.40	417.70	211.00	74.20	304.70	1.13	1.05	0.73
auto	199.00	80.30	414.90	325.00	76.50	279.20	1.63	0.95	0.67
auto	148.00	78.60	436.10	264.00	71.90	287.20	1.78	0.91	0.66
vélo	183.00	72.00	286.20	516.00	70.00	374.40	2.82	0.97	1.31
moto	157.00	82.70	425.00	265.00	74.90	271.40	1.69	0.91	0.64
vélo	156.00	68.40	283.20	471.00	82.10	421.70	3.02	1.20	1.49
oiseau	189.00	80.50	408.50	264.00	75.50	256.50	1.40	0.94	0.63
canard	228.00	83.30	421.70	262.00	75.60	288.10	1.15	0.91	0.68
canard	190.00	69.90	297.60	416.00	78.50	387.90	2.19	1.12	1.30
poisson	133.00	69.80	297.70	403.00	72.70	384.70	3.03	1.04	1.29
mouton	156.00	73.10	368.90	568.00	73.80	419.30	3.64	1.01	1.14
cochon	93.00	60.50	258.50	368.00	81.80	406.00	3.96	1.35	1.57
mouton	117.00	55.60	222.00	290.00	66.20	381.50	2.48	1.19	1.72
montant	86.00	51.20	249.80	476.00	81.60	431.80	5.53	1.59	1.73
canard	126.00	60.60	295.70	595.00	67.80	498.80	4.72	1.12	1.69

SD	56.11	9.13	84.16	142.07	5.29	63.77	1.26	0.17	0.51
AVE	172.00	67.70	324.16	388.72	73.44	348.44	2.53	1.10	1.19

Session 12 - Age 1;11.22									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
girafe	154.00	69.30	393.30	212.00	72.80	324.30	1.38	1.05	0.82
tombé	244.00	77.30	286.80	474.00	74.90	306.10	1.94	0.97	1.07
lion	239.00	79.20	456.50	202.00	71.90	286.60	0.85	0.91	0.63
tombé	150.00	67.70	254.00	224.00	70.60	299.70	1.49	1.04	1.18

SD	51.74	5.72	93.82	130.98	1.81	15.68	0.45	0.07	0.25
AVE	196.75	73.38	347.65	278.00	72.55	304.18	1.41	0.99	0.92

Session 13 - Age 2;00.14									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
bonjour	283.00	63.10	335.80	605.00	58.50	285.40	2.14	0.93	0.85

bonjour	450.00	71.90	342.20	494.00	61.10	299.90	1.10	0.85	0.88
doucement	276.00	79.40	330.70	942.00	75.30	343.90	3.41	0.95	1.04
mardi	404.00	77.80	378.90	1041.00	69.20	278.60	2.58	0.89	0.74
jeudi	165.00	85.80	427.50	291.00	74.00	288.00	1.76	0.86	0.67
dimanche	234.00	81.80	475.50	480.00	81.20	385.90	2.05	0.99	0.81
énerves	299.00	77.90	376.20	682.00	76.60	323.20	2.28	0.98	0.86
maman	151.00	67.60	210.80	499.00	65.80	242.50	3.30	0.97	1.15
avril	315.00	86.30	417.50	466.00	79.00	308.00	1.48	0.92	0.74
boutons	187.00	75.40	330.20	623.00	81.40	484.10	3.33	1.08	1.47
fini	185.00	81.60	393.20	602.00	77.10	486.20	3.25	0.94	1.24
muguets	142.00	76.10	439.60	166.00	70.00	285.70	1.17	0.92	0.65
orteil	190.00	86.60	444.70	486.00	82.00	312.70	2.56	0.95	0.70
orteil	183.00	72.40	262.40	273.00	75.60	256.80	1.49	1.04	0.98
bobo	365.00	85.20	88.80	801.00	77.70	234.60	2.19	0.91	2.64
maman	402.00	79.70	394.30	462.00	74.10	387.10	1.15	0.93	0.98
mouton	236.00	80.10	378.50	710.00	80.50	413.90	3.01	1.00	1.09
papa	320.00	71.10	384.50	803.00	69.80	374.80	2.51	0.98	0.97
papa	102.00	76.90	396.90	200.00	80.20	475.20	1.96	1.04	1.20
papa	171.00	73.00	355.60	617.00	72.90	358.60	3.61	1.00	1.01
étoiles	156.00	63.90	249.40	331.00	79.80	426.40	2.12	1.25	1.71
tutus	170.00	63.30	322.90	274.00	71.30	352.40	1.61	1.13	1.09
canard	242.00	79.90	208.70	444.00	77.60	358.80	1.83	0.97	1.72
tombé	220.00	78.50	421.40	304.00	75.60	341.70	1.38	0.96	0.81
peanut	348.00	79.70	481.80	450.00	73.70	365.50	1.29	0.92	0.76
fromage	278.00	80.90	301.70	221.00	74.80	344.80	0.79	0.92	1.14
papa	118.00	72.90	420.40	208.00	81.90	486.60	1.76	1.12	1.16
fermé	152.00	77.30	414.30	162.00	72.60	318.90	1.07	0.94	0.77

papa	130.00	66.70	293.60	355.00	75.40	351.50	2.73	1.13	1.20
aussi	161.00	79.00	383.00	219.00	68.20	311.70	1.36	0.86	0.81

SD	93.89	6.65	86.57	233.28	5.85	70.52	0.80	0.09	0.41
AVE	234.50	76.39	355.37	473.70	74.43	349.45	2.08	0.98	1.06

Session 14 - Age 2;01.20									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
bonjour	279.00	65.80	292.30	326.00	57.70	239.50	1.17	0.88	0.82
quatorze	163.00	83.20	465.90	994.00	67.70	116.40	6.10	0.81	0.25
dix-sept	142.00	73.00	271.30	142.00	73.50	512.80	1.00	1.01	1.89
dix-huit	162.00	69.70	421.10	156.00	81.00	480.70	0.96	1.16	1.14
dix-neuf	126.00	74.20	334.40	277.00	83.90	518.70	2.20	1.13	1.55
vingt-deux	145.00	81.10	394.20	399.00	78.70	261.90	2.75	0.97	0.66
vingt-trois	102.00	76.60	303.90	309.00	73.70	300.50	3.03	0.96	0.99
vingt-cinq	226.00	70.00	353.50	575.00	63.50	239.10	2.54	0.91	0.68
vingt-six	198.00	71.60	379.50	260.00	69.90	293.70	1.31	0.98	0.77
vingt-sept	223.00	77.60	362.40	450.00	72.50	251.90	2.02	0.93	0.70
papa	78.00	67.30	309.20	184.00	71.20	326.30	2.36	1.06	1.06
biscuits	87.00	66.20	308.70	136.00	59.90	237.70	1.56	0.90	0.77
ouvert	119.00	60.70	219.80	243.00	60.60	245.20	2.04	1.00	1.12

ouvert	111.00	63.60	210.80	149.00	62.80	199.50	1.34	0.99	0.95
ouvert	183.00	64.60	241.30	197.00	61.00	209.50	1.08	0.94	0.87
peanut	168.00	70.20	310.10	70.00	63.40	220.50	0.42	0.90	0.71
ici	193.00	76.10	293.20	161.00	72.60	322.20	0.83	0.95	1.10
minous	168.00	74.70	273.90	178.00	73.80	491.50	1.06	0.99	1.79
boutons	152.00	60.90	249.30	30.00	53.60	227.40	0.20	0.88	0.91
maman	197.00	57.70	183.80	96.00	62.50	76.75	0.49	1.08	0.42
papa	99.00	67.90	352.60	142.00	63.70	348.40	1.43	0.94	0.99
château	212.00	82.10	400.20	190.00	76.70	289.50	0.90	0.93	0.72
musique	240.00	65.70	222.00	221.00	63.00	217.60	0.92	0.96	0.98
chanté	132.00	65.20	223.30	186.00	57.20	200.70	1.41	0.88	0.90
dodo	209.00	70.80	321.10	209.00	70.90	321.20	1.00	1.00	1.00

SD	51.57	6.80	72.10	195.98	7.94	113.60	1.19	0.08	0.37
AVE	164.56	70.26	307.91	251.20	67.80	285.97	1.60	0.97	0.95

Session 15 - Age 2;03.8									
Orthography	**Penultimate Syllable**			**Final Syllable**			**Ratio**		
	Dur	**Int**	**FØ**	**Dur**	**Int**	**FØ**	**Dur**	**Int**	**FØ**
côté	175.00	73.00	356.30	155.00	70.60	380.20	0.89	0.97	1.07
cadeaux	222.00	71.90	351.60	532.00	68.20	263.00	2.40	0.95	0.75
cadeaux	231.00	80.20	480.50	264.00	83.90	483.60	1.14	1.05	1.01

parti	144.00	78.90	468.10	209.00	67.50	372.40	1.45	0.86	0.80
soleil	231.00	73.20	328.70	292.00	72.40	332.80	1.26	0.99	1.01
aple	225.00	73.40	359.20	165.00	64.70	455.50	0.73	0.88	1.27
gentils	247.00	73.90	306.20	140.00	67.20	292.70	0.57	0.91	0.96
lutins	205.00	71.50	486.10	190.00	73.80	303.00	0.93	1.03	0.62
lutins	185.00	70.10	375.20	256.00	73.70	305.50	1.38	1.05	0.81
ranger	231.00	68.90	334.50	203.00	64.70	312.20	0.88	0.94	0.93
dodo	190.00	72.00	387.30	147.00	69.80	343.90	0.77	0.97	0.89
Caillou	242.00	71.70	360.90	377.00	68.30	499.10	1.56	0.95	1.38
histoire	147.00	74.90	381.50	186.00	77.70	358.60	1.27	1.04	0.94
ranger	77.00	72.30	277.00	118.00	68.50	257.60	1.53	0.95	0.93
monsieur	176.00	76.00	283.60	211.00	72.70	282.00	1.20	0.96	0.99
facteur	225.00	73.20	352.40	305.00	73.80	310.20	1.36	1.01	0.88
penguin	193.00	71.60	296.70	239.00	71.30	283.00	1.24	1.00	0.95
moustique	266.00	69.80	391.60	170.00	69.00	489.90	0.64	0.99	1.25
cacas	275.00	79.10	372.00	253.00	77.20	380.40	0.92	0.98	1.02
vélo	192.00	76.90	316.40	244.00	74.40	329.60	1.27	0.97	1.04
tomber	295.00	69.80	344.60	205.00	76.80	326.00	0.69	1.10	0.95
tomber	391.00	77.60	322.10	263.00	77.40	328.10	0.67	1.00	1.02
glissade	166.00	72.80	354.70	325.00	77.60	463.80	1.96	1.07	1.31
balai	237.00	82.80	422.30	243.00	75.40	318.20	1.03	0.91	0.75
cochon	164.00	71.80	346.80	185.00	77.50	353.00	1.13	1.08	1.02
gâteau	199.00	74.20	398.80	150.00	64.60	359.70	0.75	0.87	0.90
gâteau	161.00	75.00	321.80	146.00	75.70	352.30	0.91	1.01	1.09
poulet	204.00	76.00	459.10	164.00	69.70	259.40	0.80	0.92	0.57
fromage	134.00	76.10	459.60	128.00	68.20	391.20	0.96	0.90	0.85
bateaux	240.00	77.20	416.30	185.00	74.70	310.70	0.77	0.97	0.75

lion	401.00	66.30	319.50	167.00	77.80	356.90	0.42	1.17	1.12

SD	66.18	3.58	57.41	84.65	4.74	67.40	0.42	0.07	0.19
AVE	215.19	73.94	368.75	219.90	72.41	350.15	1.08	0.98	0.96

Session 16 - Age 2;04.17									
Orthography	Penultimate Syllable			Final Syllable			Ratio		
	Dur	Int	FØ	Dur	Int	FØ	Dur	Int	FØ
bonjour	336.00	77.10	446.80	758.00	64.80	224.60	2.26	0.84	0.50
vingt-cinq	170.00	71.60	335.30	484.00	59.10	209.90	2.85	0.83	0.63
affaire	221.00	72.80	339.70	228.00	73.90	325.90	1.03	1.02	0.96
affaire	115.00	69.40	284.40	154.00	67.50	315.60	1.34	0.97	1.11
bonjour	417.00	71.50	271.20	222.00	83.10	419.60	0.53	1.16	1.55
partir	191.00	85.40	404.40	330.00	80.10	373.20	1.73	0.94	0.92
dessin	91.00	77.20	248.30	272.00	66.20	390.40	2.99	0.86	1.57
papa	122.00	71.90	253.30	311.00	71.70	247.10	2.55	1.00	0.98
cadeau	239.00	71.90	282.00	192.00	71.30	344.20	0.80	0.99	1.22
manger	255.00	69.70	222.30	562.00	65.60	264.50	2.20	0.94	1.19
biscuits	153.00	69.90	309.80	219.00	65.30	295.10	1.43	0.93	0.95
fromage	184.00	72.90	279.40	285.00	72.10	262.60	1.55	0.99	0.94
biscuits	181.00	65.20	270.50	70.00	54.50	53.80	0.39	0.84	0.20
café	184.00	80.70	444.80	624.00	70.80	327.10	3.39	0.88	0.74

vaisselle	116.00	74.70	392.50	204.00	69.00	267.70	1.76	0.92	0.68
auto	194.00	68.60	251.90	145.00	75.90	385.90	0.75	1.11	1.53
vélo	149.00	62.10	188.10	175.00	72.90	321.90	1.17	1.17	1.71
moto	75.00	58.90	170.00	608.00	75.90	422.50	8.11	1.29	2.49
papi	156.00	73.90	309.10	182.00	68.40	294.40	1.17	0.93	0.95
bâteau	170.00	75.50	276.10	167.00	73.50	308.80	0.98	0.97	1.12
fromage	129.00	62.90	199.90	137.00	60.90	194.70	1.06	0.97	0.97
moutons	152.00	65.80	347.70	190.00	62.80	273.10	1.25	0.95	0.79
cochon	130.00	74.60	349.40	180.00	71.70	280.50	1.38	0.96	0.80
toilet	130.00	79.90	356.40	168.00	69.70	254.10	1.29	0.87	0.71
ballon	152.00	73.50	322.20	296.00	69.50	255.80	1.95	0.95	0.79
papa	201.00	86.50	439.10	237.00	86.40	453.80	1.18	1.00	1.03
maman	177.00	73.40	374.70	183.00	73.10	422.30	1.03	1.00	1.13
ballon	180.00	73.60	262.10	324.00	70.90	325.80	1.80	0.96	1.24
ballon	156.00	72.80	248.70	182.00	60.30	167.60	1.17	0.83	0.67
ballon	319.00	85.20	419.10	801.00	70.80	380.70	2.51	0.83	0.91
maman	189.00	69.60	233.90	180.00	65.40	230.70	0.95	0.94	0.99

SD	71.70	6.44	76.39	188.39	6.76	85.58	1.39	0.11	0.42
AVE	181.74	72.86	307.52	292.58	69.78	299.80	1.76	0.96	1.03

Averages and Standard Deviations of Correlates (Ratios)								
Age	**Session**	**Number**	**Duration**	**SD Dur**	**Intensity**	**SD Int**	**F0**	**SD F0**
1;01.7	1	6	0.93	0.32	0.99	0.06	1.01	0.06
1;01.22	2	13	3.56	4.33	1.07	0.07	1.31	0.19
1;02.3	3	24	1.96	0.96	1.06	0.12	1.21	0.15
1;02.12	4	28	1.77	0.59	1.05	0.06	1.17	0.14
1;04.3	5	26	1.71	0.68	1.02	0.06	1.07	0.13
1;05.1	6	25	1.87	0.63	1.02	0.07	1.10	0.26
1;06.16	7	29	1.68	0.94	1.02	0.05	1.04	0.16
1;07.7	8	31	1.34	0.93	1.05	0.11	1.21	0.36
1;08.4	9	29	2.48	1.66	1.02	0.08	1.00	0.13
1;09.22	10	31	1.42	0.61	1.01	0.10	0.94	0.18
1;10.2	11	29	2.53	1.26	1.10	0.17	1.19	0.51
1;11.22	12	4	1.41	0.45	0.99	0.07	0.92	0.25
2;00.14	13	31	2.08	0.80	0.98	0.09	1.06	0.41
2;01.20	14	26	1.60	1.19	0.97	0.08	0.95	0.37
2;03.8	15	31	1.08	0.42	0.98	0.07	0.96	0.19
2;04.17	16	31	1.76	1.39	0.96	0.11	1.03	0.42
Total	16	394	1.94	1.14	0.95	0.09	1.07	0.24

Appendix B: 'Papa' Data

Penultimate Vowel Reduction of 'Papa'				
Age	**Session**	**Penult**	**Final**	**Ratio**
1;01.22	2	107.00	212.00	1.98
1;02.3	3	105.00	347.00	3.30
1;02.3	3	94.00	216.00	2.30
1;02.3	3	140.00	278.00	1.99
1;02.3	3	105.00	347.00	3.30
1;02.12	4	81.00	167.00	2.06
1;02.12	4	70.00	161.00	2.30
1;04.3	5	122.00	253.00	2.07
1;04.3	5	182.00	216.00	1.19
1;05.1	6	92.00	290.00	3.15
1;05.1	6	135.00	208.00	1.54
1;05.1	6	164.00	310.00	1.89
1;05.1	6	127.00	237.00	1.87
1;05.1	6	128.00	280.00	2.19
1;05.1	6	100.00	261.00	2.61
1;05.1	6	124.00	233.00	1.87
1;06.16	7	53.00	212.00	4.00
1;06.16	7	123.00	183.00	1.49
1;06.16	7	111.00	200.00	1.80
1;08.4	9	129.00	124.00	0.96

1;08.4	9	143.00	233.00	1.63
1;08.4	9	59.00	431.00	7.30
1;10.2	11	100.00	438.00	4.38
2;00.14	13	320.00	803.00	2.51
2;00.14	13	102.00	200.00	1.96
2;00.14	13	171.00	617.00	3.61
2;00.14	13	118.00	208.00	1.76
2;00.14	13	130.00	355.00	2.73
2;01.20	14	78.00	184.00	2.35
2;01.20	14	99.00	142.00	1.43
2;04.17	16	122.00	311.00	2.55
2;04.17	16	201.00	237.00	1.18

Appendix C: Compensatory Lengthening Data

Sonorants						
Age	**Session**	**Target**	**Deleted**	**Penultimate**	**Final**	**Ratio**
1;01.22	2	banane	n	271.00	603.00	2.23
1;01.22	2	banane	n	53.00	912.00	17.21
1;01.22	2	banane	n	230.00	676.00	2.94
1;02.12	4	bonhomme	m	141.00	208.00	1.48
1;04.3	5	banane	n	68.00	275.00	4.04
1;05.1	6	nounours	rs	143.00	180.00	1.26
1;05.1	6	nounours	rs	157.00	228.00	1.45
1;05.1	6	nounours	rs	116.00	207.00	1.78
1;06.16	7	abeille	j	139.00	162.00	1.17
1;07.7	8	cheval	l	127.00	120.00	0.94
1;07.7	8	canard	r	117.00	102.00	0.87
1;07.7	8	abeille	j	66.00	150.00	2.27
1;07.7	8	polaire	r	95.00	148.00	1.56
1;08.4	9	bonjours	r	196.00	365.00	1.86
1;08.4	9	chandelle	l	162.00	521.00	3.22
1;08.4	9	chandelle	l	81.00	558.00	6.89
1;08.4	9	cheval	l	193.00	286.00	1.48
1;08.4	9	cheval	l	128.00	413.00	3.23
1;9.22	10	encore	r	115.00	135.00	1.17
1;9.22	10	encore	r	140.00	224.00	1.60

1;9.22	10	encore	r	107.00	161.00	1.50
1;10.2	11	tambour	r	200.00	581.00	2.91
1;10.2	11	canard	r	228.00	262.00	1.15
1;10.2	11	canard	r	190.00	416.00	2.19
1;10.2	11	canard	r	126.00	595.00	4.72
2;0.14	13	bonjour	r	283.00	605.00	2.14
2;0.14	13	bonjour	r	450.00	494.00	1.10
2;0.14	13	avril	l	315.00	466.00	1.48
2;0.14	13	canard	r	242.00	444.00	1.83
2;01.20	14	bonjour	r	279.00	326.00	1.17
2;01.20	14	quatorze	rz	163.00	994.00	6.10
2;01.20	14	ouvert	r	119.00	243.00	2.04
2;01.20	14	ouvert	r	111.00	149.00	1.34
2;01.20	14	ouvert	r	183.00	197.00	1.08
2;03.8	15	histoire	r	147.00	186.00	1.27
2;03.8	15	facteur	r	225.00	305.00	1.36
2;04.17	16	affaire	r	221.00	228.00	1.03
2;04.17	16	affaire	r	115.00	154.00	1.34
2;04.17	16	bonjour	r	417.00	222.00	0.53
2;04.17	16	vaisselle	l	116.00	204.00	1.76

Obstruents						
Age	**Session**	**Target**	**Deleted**	**Penultimate**	**Final**	**Ratio**
1;02.3	3	magique	k	140.00	148.00	1.06
1;02.3	3	giraffe	f	152.00	343.00	2.26
1;02.12	4	catus	s	84.00	148.00	1.76
1;02.12	4	poussette	t	200.00	211.00	1.06
1;04.3	5	moustique	k	147.00	316.00	2.15
1;04.3	5	oranges	ʒ	160.00	239.00	1.49
1;04.3	5	carottes	t	198.00	268.00	1.35
1;04.3	5	tomates	t	118.00	239.00	2.03
1;06.16	7	fourchette	t	145.00	210.00	1.45
1;07.7	8	patates	t	117.00	136.00	1.16
1;9.22	10	fenêtre	t	136.00	147.00	1.08
2;01.20	14	dix-sept	t	142.00	142.00	1.00
2;01.20	14	vingt-cinq	k	226.00	575.00	2.54
2;01.20	14	vingt-sept	t	223.00	450.00	2.02
2;04.17	16	vingt-cinq	k	170.00	484.00	2.85
2;04.17	16	toilet	t	130.00	168.00	1.29

Vowels					
Age	**Session**	**Target**	**Penultimate**	**Final**	**Ratio**
1;01.7	1	amis	313.00	396.00	1.27
1;01.7	1	minou	179.00	68.00	0.38
1;01.22	2	pipi	140.00	243.00	1.74
1;01.22	2	minou	176.00	226.00	1.28
1;01.22	2	minou	129.00	131.00	1.02
1;01.22	2	dodo	68.00	185.00	2.72
1;01.22	2	papa	107.00	212.00	1.98
1;01.22	2	pitou	169.00	226.00	1.34
1;01.22	2	tutu	127.00	166.00	1.31
1;01.22	2	tutu	80.00	214.00	2.68
1;01.22	2	ballon	102.00	649.00	6.36
1;01.22	2	ballon	119.00	410.00	3.45
1;02.3	3	minou	143.00	232.00	1.62
1;02.3	3	minou	241.00	188.00	0.78
1;02.3	3	minou	249.00	351.00	1.41
1;02.3	3	minou	204.00	220.00	1.08
1;02.3	3	papa	53.00	220.00	4.15
1;02.3	3	papa	94.00	216.00	2.30
1;02.3	3	minoux	260.00	284.00	1.09
1;02.3	3	minou	289.00	257.00	0.89
1;02.3	3	papa	140.00	278.00	1.99
1;02.3	3	garçon	117.00	459.00	3.92
1;02.3	3	auto	136.00	228.00	1.68

1;02.3	3	minou	148.00	249.00	1.68
1;02.3	3	minoux	204.00	279.00	1.37
1;02.3	3	dodo	164.00	225.00	1.37
1;02.3	3	souris	93.00	262.00	2.82
1;02.3	3	minou	148.00	184.00	1.24
1;02.3	3	minou	132.00	386.00	2.92
1;02.3	3	minou	75.00	192.00	2.56
1;02.3	3	ici	78.00	199.00	2.55
1;02.3	3	Gigi	152.00	343.00	2.26
1;02.3	3	maman	119.00	276.00	2.32
1;02.3	3	papa	105.00	347.00	3.30
1;02.12	4	famille	136.00	264.00	1.94
1;02.12	4	auto	121.00	248.00	2.05
1;02.12	4	bébé	154.00	180.00	1.17
1;02.12	4	bébé	79.00	106.00	1.34
1;02.12	4	poupée	99.00	145.00	1.46
1;02.12	4	bébé	129.00	202.00	1.57
1;02.12	4	minou	89.00	204.00	2.29
1;02.12	4	ici	67.00	116.00	1.73
1;02.12	4	Gigi	122.00	185.00	1.52
1;02.12	4	chien	112.00	209.00	1.87
1;02.12	4	jeudi	66.00	205.00	3.11
1;02.12	4	pipi	90.00	143.00	1.59
1;02.12	4	petit	134.00	209.00	1.56
1;02.12	4	papa	81.00	167.00	2.06
1;02.12	4	Gigi	80.00	209.00	2.61
1;02.12	4	ici	168.00	178.00	1.06

1;02.12	4	petit	118.00	231.00	1.96
1;02.12	4	ici	96.00	212.00	2.21
1;02.12	4	bateau	125.00	111.00	0.89
1;02.12	4	genou	180.00	237.00	1.32
1;02.12	4	Gigi	89.00	275.00	3.09
1;02.12	4	Gigi	74.00	115.00	1.55
1;02.12	4	dodo	223.00	181.00	0.81
1;02.12	4	Gigi	70.00	161.00	2.30
1;02.12	4	genoux	63.00	148.00	2.35
1;04.3	5	dedans	165.00	188.00	1.14
1;04.3	5	maman	270.00	340.00	1.26
1;04.3	5	minou	97.00	172.00	1.77
1;04.3	5	papa	122.00	253.00	2.07
1;04.3	5	papu	147.00	319.00	2.17
1;04.3	5	maman	119.00	199.00	1.67
1;04.3	5	bébé	185.00	319.00	1.72
1;04.3	5	ballon	171.00	199.00	1.16
1;04.3	5	minou	145.00	244.00	1.68
1;04.3	5	chandail	133.00	298.00	2.24
1;04.3	5	bébé	173.00	297.00	1.72
1;04.3	5	papa	182.00	216.00	1.19
1;04.3	5	bébé	132.00	317.00	2.40
1;04.3	5	maman	201.00	271.00	1.35
1;04.3	5	cocos	156.00	289.00	1.85
1;04.3	5	dodo	248.00	268.00	1.08
1;04.3	5	minou	244.00	263.00	1.08
1;04.3	5	maman	135.00	357.00	2.64

1;04.3	5	minou	294.00	231.00	0.79
1;04.3	5	ballon	253.00	309.00	1.22
1;05.1	6	bobo	198.00	320.00	1.62
1;05.1	6	ballon	104.00	263.00	2.53
1;05.1	6	gâteaux	171.00	337.00	1.97
1;05.1	6	papa	92.00	290.00	3.15
1;05.1	6	bébé	114.00	180.00	1.58
1;05.1	6	papa	135.00	208.00	1.54
1;05.1	6	papa	164.00	310.00	1.89
1;05.1	6	magna	273.00	197.00	0.72
1;05.1	6	papa	127.00	237.00	1.87
1;05.1	6	cadeaux	228.00	255.00	1.12
1;05.1	6	papa	128.00	280.00	2.19
1;05.1	6	papa	100.00	261.00	2.61
1;05.1	6	minoux	187.00	320.00	1.71
1;05.1	6	minou	228.00	254.00	1.11
1;05.1	6	papa	124.00	233.00	1.88
1;05.1	6	papi	75.00	232.00	3.09
1;05.1	6	ballon	216.00	251.00	1.16
1;05.1	6	dodo	69.00	155.00	2.25
1;05.1	6	poisson	120.00	276.00	2.30
1;05.1	6	cadeaux	141.00	298.00	2.11
1;05.1	6	minoux	70.00	190.00	2.71
1;05.1	6	minoux	163.00	206.00	1.26
1;06.16	7	bébé	305.00	168.00	0.55
1;06.16	7	bébé	185.00	187.00	1.01
1;06.16	7	bébé	118.00	198.00	1.68

1;06.16	7	minou	72.00	117.00	1.63
1;06.16	7	minou	154.00	174.00	1.13
1;06.16	7	minou	195.00	129.00	0.66
1;06.16	7	minou	80.00	174.00	2.18
1;06.16	7	minou	90.00	289.00	3.21
1;06.16	7	minou	54.00	255.00	4.72
1;06.16	7	maman	102.00	184.00	1.80
1;06.16	7	papa	53.00	212.00	4.00
1;06.16	7	papa	123.00	183.00	1.49
1;06.16	7	ballon	166.00	202.00	1.22
1;06.16	7	papu	149.00	195.00	1.31
1;06.16	7	magna	104.00	204.00	1.96
1;06.16	7	café	238.00	220.00	0.92
1;06.16	7	café	160.00	228.00	1.43
1;06.16	7	bébé	125.00	192.00	1.54
1;06.16	7	manteau	131.00	179.00	1.37
1;06.16	7	ballon	108.00	211.00	1.95
1;06.16	7	ballon	136.00	133.00	0.98
1;06.16	7	papa	111.00	200.00	1.80
1;06.16	7	pipi	123.00	151.00	1.23
1;06.16	7	cadeau	243.00	148.00	0.61
1;07.7	8	bateau	113.00	145.00	1.28
1;07.7	8	agneau	101.00	141.00	1.40
1;07.7	8	coco	43.00	135.00	3.14
1;07.7	8	auto	63.00	134.00	2.13
1;07.7	8	bébé	88.00	158.00	1.80
1;07.7	8	poisson	160.00	74.00	0.46

1;07.7	8	cocos	127.00	158.00	1.24
1;07.7	8	ourson	110.00	146.00	1.33
1;07.7	8	volant	101.00	172.00	1.70
1;07.7	8	cochons	128.00	105.00	0.82
1;07.7	8	cochon	162.00	123.00	0.76
1;07.7	8	hibou	197.00	166.00	0.84
1;07.7	8	ici	149.00	130.00	0.87
1;07.7	8	gateau	142.00	85.00	0.60
1;07.7	8	patates	117.00	136.00	1.16
1;07.7	8	bateau	174.00	107.00	0.61
1;07.7	8	minou	264.00	171.00	0.65
1;07.7	8	minou	115.00	105.00	0.91
1;07.7	8	minou	163.00	171.00	1.05
1;07.7	8	bébé	135.00	161.00	1.19
1;07.7	8	bébé	131.00	669.00	5.11
1;07.7	8	manteau	239.00	178.00	0.74
1;07.7	8	manteau	178.00	215.00	1.21
1;07.7	8	manteau	122.00	285.00	2.34
1;07.7	8	panda	123.00	156.00	1.27
1;07.7	8	tombé	391.00	274.00	0.70
1;08.4	9	mouton	96.00	276.00	2.88
1;08.4	9	auto	143.00	156.00	1.09
1;08.4	9	papi	221.00	224.00	1.01
1;08.4	9	bébé	144.00	768.00	5.33
1;08.4	9	bébé	161.00	540.00	3.35
1;08.4	9	garçon	175.00	159.00	0.91
1;08.4	9	papa	129.00	124.00	0.96

1;08.4	9	papa	143.00	233.00	1.63
1;08.4	9	maman	123.00	232.00	1.89
1;08.4	9	cadeau	209.00	183.00	0.88
1;08.4	9	ballon	167.00	280.00	1.68
1;08.4	9	café	127.00	396.00	3.12
1;08.4	9	papa	59.00	431.00	7.31
1;08.4	9	petits	105.00	377.00	3.59
1;08.4	9	dodo	161.00	193.00	1.20
1;08.4	9	poupée	178.00	477.00	2.68
1;08.4	9	bijou	116.00	235.00	2.03
1;08.4	9	papi	167.00	160.00	0.96
1;08.4	9	maman	172.00	492.00	2.86
1;08.4	9	maman	207.00	632.00	3.05
1;08.4	9	maman	159.00	243.00	1.53
1;08.4	9	maman	140.00	209.00	1.49
1;09.22	10	salon	167.00	179.00	1.07
1;09.22	10	tapis	134.00	143.00	1.07
1;09.22	10	maman	107.00	289.00	2.70
1;09.22	10	moto	209.00	137.00	0.66
1;09.22	10	auto	102.00	149.00	1.46
1;09.22	10	auto	165.00	131.00	0.79
1;09.22	10	bobo	167.00	370.00	2.22
1;09.22	10	cadeau	174.00	190.00	1.09
1;09.22	10	cochon	136.00	176.00	1.29
1;09.22	10	lapin	110.00	208.00	1.89
1;09.22	10	cochon	143.00	156.00	1.09
1;09.22	10	jello	159.00	73.00	0.46

1;09.22	10	cadeau	147.00	170.00	1.16
1;09.22	10	parti	196.00	250.00	1.28
1;09.22	10	parti	154.00	216.00	1.40
1;09.22	10	cochon	143.00	111.00	0.78
1;10.2	11	joujou	360.00	404.00	1.12
1;10.2	11	maman	121.00	246.00	2.03
1;10.2	11	cadeau	185.00	681.00	3.68
1;10.2	11	cadeau	192.00	391.00	2.04
1;10.2	11	miaou	259.00	341.00	1.32
1;10.2	11	papa	100.00	438.00	4.38
1;10.2	11	couteau	161.00	444.00	2.76
1;10.2	11	raisins	99.00	356.00	3.60
1;10.2	11	raisin	225.00	153.00	0.68
1;10.2	11	raisin	183.00	222.00	1.21
1;10.2	11	café	208.00	197.00	0.95
1;10.2	11	moto	175.00	467.00	2.67
1;10.2	11	moto	173.00	658.00	3.80
1;10.2	11	amie	186.00	211.00	1.13
1;10.2	11	auto	199.00	325.00	1.63
1;10.2	11	auto	148.00	264.00	1.78
1;10.2	11	vélo	183.00	516.00	2.82
1;10.2	11	moto	157.00	265.00	1.69
1;10.2	11	vélo	156.00	471.00	3.02
1;10.2	11	oiseau	189.00	264.00	1.40
1;10.2	11	poisson	133.00	403.00	3.03
1;10.2	11	mouton	156.00	568.00	3.64
1;10.2	11	cochon	93.00	368.00	3.96

1;10.2	11	mouton	117.00	290.00	2.48
1;10.2	11	montant	86.00	476.00	5.53
1;11.22	12	tombé	244.00	474.00	1.94
1;11.22	12	lion	239.00	202.00	0.85
1;11.22	12	tombé	150.00	224.00	1.49
2;00.14	13	doucement	276.00	942.00	3.41
2;00.14	13	mardi	404.00	1041.00	2.58
2;00.14	13	jeudi	165.00	291.00	1.76
2;00.14	13	maman	151.00	499.00	3.30
2;00.14	13	boutons	187.00	623.00	3.33
2;00.14	13	fini	185.00	602.00	3.25
2;00.14	13	pieds	457.00	122.00	0.27
2;00.14	13	bobo	365.00	801.00	2.19
2;00.14	13	maman	402.00	462.00	1.15
2;00.14	13	mouton	236.00	710.00	3.01
2;00.14	13	papa	320.00	803.00	2.51
2;00.14	13	papa	102.00	200.00	1.96
2;00.14	13	papa	171.00	617.00	3.61
2;00.14	13	tutus	170.00	274.00	1.61
2;00.14	13	tombé	220.00	304.00	1.38
2;00.14	13	fermé	152.00	162.00	1.07
2;00.14	13	papa	130.00	355.00	2.73
2;00.14	13	aussi	161.00	219.00	1.36
2;01.20	14	vingt-deux	145.00	399.00	2.75
2;01.20	14	vingt-trois	102.00	309.00	3.03
2;01.20	14	papa	78.00	184.00	2.36
2;01.20	14	biscuits	87.00	136.00	1.56

2;01.20	14	ici	193.00	161.00	0.83
2;01.20	14	minous	168.00	178.00	1.06
2;01.20	14	boutons	152.00	30.00	0.20
2;01.20	14	maman	197.00	96.00	0.49
2;01.20	14	papa	99.00	142.00	1.43
2;01.20	14	château	212.00	190.00	0.90
2;01.20	14	chanté	132.00	186.00	1.41
2;01.20	14	dodo	209.00	209.00	1.00
2;03.8	15	côté	175.00	155.00	0.89
2;03.8	15	cadeaux	222.00	532.00	2.40
2;03.8	15	cadeaux	231.00	264.00	1.14
2;03.8	15	parti	144.00	209.00	1.45
2;03.8	15	soleil	231.00	292.00	1.26
2;03.8	15	lutins	205.00	190.00	0.93
2;03.8	15	lutins	185.00	256.00	1.38
2;03.8	15	ranger	231.00	203.00	0.88
2;03.8	15	dodo	190.00	147.00	0.77
2;03.8	15	Caillou	242.00	377.00	1.56
2;03.8	15	ranger	77.00	118.00	1.53
2;03.8	15	penguin	193.00	239.00	1.24
2;03.8	15	cacas	275.00	253.00	0.92
2;03.8	15	vélo	192.00	244.00	1.27
2;03.8	15	tomber	295.00	205.00	0.69
2;03.8	15	tomber	391.00	263.00	0.67
2;03.8	15	balai	237.00	243.00	1.03
2;03.8	15	cochon	164.00	185.00	1.13
2;03.8	15	gâteau	199.00	150.00	0.75

2;03.8	15	gâteau	161.00	146.00	0.91
2;03.8	15	poulet	204.00	164.00	0.80
2;03.8	15	bateaux	240.00	185.00	0.77
2;03.8	15	lion	401.00	167.00	0.42
2;03.8	15	monsieur	176.00	211.00	1.20
2;04.17	16	dessin	91.00	272.00	2.99
2;04.17	16	papa	122.00	311.00	2.55
2;04.17	16	cadeau	239.00	192.00	0.80
2;04.17	16	manger	255.00	562.00	2.20
2;04.17	16	biscuits	153.00	219.00	1.43
2;04.17	16	biscuits	181.00	70.00	0.39
2;04.17	16	café	184.00	624.00	3.39
2;04.17	16	auto	194.00	145.00	0.75
2;04.17	16	vélo	149.00	175.00	1.17
2;04.17	16	moto	75.00	608.00	8.11
2;04.17	16	papi	156.00	182.00	1.17
2;04.17	16	bâteau	170.00	167.00	0.98
2;04.17	16	moutons	152.00	190.00	1.25
2;04.17	16	cochon	130.00	180.00	1.38
2;04.17	16	ballon	152.00	296.00	1.95
2;04.17	16	papa	201.00	237.00	1.18
2;04.17	16	maman	177.00	183.00	1.03
2;04.17	16	ballon	180.00	324.00	1.80
2;04.17	16	ballon	156.00	182.00	1.17
2;04.17	16	ballon	319.00	801.00	2.51
2;04.17	16	maman	189.00	180.00	0.95