THE ACQUISITION OF STRESS IN NORTHERN EAST CREE: A CASE STUDY

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The Acquisition of Stress in Northern East Cree: A Case Study

by

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Abstract

In this thesis I discuss the phonetic and metrical properties of stress in Northern East Cree, a relatively under-documented language, and I offer a preliminary investigation of their acquisition, based on the longitudinal case study of one NE Cree learning child (aged 2;02 to 4;01). I first demonstrate that pitch is the primary cue for marking stress in NE Cree, and argue that the child is able to use this cue from the very first recording session. Acoustic analysis of her speech productions suggests that, similar to adult speakers, the child primarily uses an increase in pitch on stressed syllables. Further, I show that the child has already acquired all but one of the relevant metrical parameter settings for her language at the onset of the study. This study is theoretically significant in light of previous claims that children are born with a universal set of default metrical parameter settings. The current investigation rather supports a neutral start in the acquisition of stress.

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Chapter 1 — Introduction

1. Aims

Researchers in linguistics strive to reach a universal understanding of how languages function and, from a developmental perspective, how they are typically acquired with such apparent ease by young children. However, in order to achieve these research goals, all the structural commonalities and differences of the world's languages must be recognized and then correlated with observations from speech patterns produced by language learners. One challenge for research in these areas is the relative lack of documentation of aboriginal languages. The goal of this thesis is to contribute to this area of research by investigating stress and the development of stress in a relatively under-documented dialect of the Cree-Montagnais-Naskapi language continuum.[1] The dialect under investigation is Northern East (NE) Cree, as it spoken in Chisasibi, Québec. While there has been some work done on the stress systems of Cree (Wolfart 1989; Brittain 2000; Piggott 2004; Dyck et al. 2006; Wood 2006) this is the first investigation into the acquisition of stress in any CMN language.

2. Stress and the Acquisition of Stress

Stress makes a particular syllable more salient in a word or phrase. Acoustically, stress is realized through an increase in fundamental frequency (pitch), vowel duration (length), or intensity (loudness) (Hayes 1995). The use of each of these phonetic cues to mark stress varies across languages; a language can use one or more of these cues and can attribute different degrees of importance to them. From a phonological perspective, a set of metrical parameters regulate the size, shape and parsing of linguistic constituents and determine the stress pattern of a language.

Within the context of language development, most of the research done on the

1 The Cree-Montagnais-Naskapi language continuum is discussed in detail in chapter 2, section 4.

acquisition of stress has focused on learners of Indo-European languages such as English (Allen and Hawkins 1980; Pollock, Brammer and Hagerman 1993; Kehoe, Stoel-Gammon and Buder 1995; Schwartz, Petinou, Goffman, Lazowski and Cartusciello 1996), Spanish (Hochberg 1988a,b) and Dutch (Fikkert 1994;1995), with some research involving the bilingual acquisition of French (LaBelle 2000; Rose and Champdoizeau 2007a,b). From a metrical perspective two competing approaches to stress acquisition are currently supported in this literature. Firstly, much of the research describing metrical acquisition supports the claim that children acquire stress with the help of default parameter settings. Within the framework of Universal Grammar, Dresher and Kaye (1990) have proposed a number of metrical parameters which are universally set to a default. These proposed default parameters have been tested and supported by research focused on Dutch speaking children (Fikkert 1994), and English speaking children (Allen and Hawkins 1980; Kehoe 1998). However, since the languages discussed in the available literature supporting these metrical defaults are typologically similar Indo-European languages, looking at a language which has substantially different metrical parameter settings, such as NE Cree, contributes significantly to this field.

Although much of the research in stress acquisition is consistent with metrical parameter defaults, other research supports a neutral start hypothesis (Hochberg 1988a), whereby children are initially influenced by the stress system of the ambient language. Rather than early influence coming from innate parameter settings, within the context of the neutral start hypothesis, the earliest stress information comes directly from the child's target language.

In order to address this theoretical issue, I first look at the adult system. I compare two different metrical analyses of NE Cree (by Wood 2006 and Dyck et al. 2006), and based on these works, as well as my own investigation into the language, I determine the parameter settings relevant for NE Cree. Secondly, I provide a case study on one NE Cree speaking child, noting her stress errors over a period of two years (from age 2;02.02 to 4;01.30). In the data I find that the child has acquired the correct metrical parameter settings for her language from an early age, and the errors she does produce are a result of unsystematic input from the ambient language. The child's early acquisition of the metrical system of NE Cree offers support for the proposal that children are initially neutral to stress, as no evidence is found to support the parametric defaults attested in the literature.

In addition to looking at the acquisition of metrical structure in NE Cree, and how it supports a neutral approach to stress acquisition, the current thesis also focuses on how a NE Cree speaking child acquires the phonetic cues for stress in her language. Previous research on the acquisition of the phonetic cues for stress suggests that young children's cues can often differ significantly from those used by adult speakers (e.g. Pollock et al. 1993). However, by looking at the acoustic cues relevant for stress in a young speaker of NE Cree, I determine that the child is in fact sensitive to the stress cues relevant for her language from the initial stages of acquisition (chapter 5). By conducting acoustic analysis on speech samples of NE Cree speaking adults, I found that pitch is the primary cue for stress, and that it is often accompanied by an increase in intensity. From the first recording session with the child speaker, the child is consistently using an adult-like pitch increase to mark stress. Her use of intensity, however, becomes more target-like over time. Since this pattern is also found in English speaking children, I note that the increase in intensity over time may be related to physiological development. As a child grows, his or her lung capacity increases, and with it the ability to produce louder syllables.

3. Thesis Organization

This thesis is organized as follows. In chapter 2 I review the relevant literature on Metrical Stress Theory (Hayes 1995) and stress acquisition, and provide an introduction to NE Cree as well as to the methodology used to carry out the current study. In chapter 3, I describe the phonetics of stress and the metrical structure of NE Cree based on previous studies as well as my own investigation. In chapter 4 I build on the metrical analysis of NE Cree discussed in chapter 3 by providing further detail on extrametricality and I discuss the development of metrical structure in one NE Cree speaking child. Based on the developmental patterns observed in the child's speech productions, in chapter 4 I also argue for a neutral start hypothesis. In chapter 5 I focus on the child's acquisition of the phonetic cues for stress and compare her phonetic development to patterns observed in English speaking children. Finally, in chapter 6, I provide concluding remarks and suggestions for future research.

Chapter 2 — Background Literature and Methodology

1. Introduction

In this chapter, I provide background for the current study. In section 2, I outline the theoretical framework used for the metrical analysis of Cree, based primarily on Hayes (1995). In section 3, I provide a sketch of previous studies completed on the acquisition of stress, from both phonetic and phonological perspectives. In section 4 of this chapter I give a brief description of Northern East (NE) Cree and the context for my research. Lastly, in section 5, I describe the methodology used for investigating both the adult and child language.

2. Metrical Stress Theory

It is widely held in the field of linguistics that all normally developing children have an innate ability to learn language (e.g. Chomsky 1972). This ability is what linguists generally refer to as the Language Faculty, or Universal Grammar (UG). Chomsky (1975: 29) defines UG as “the system of principles, conditions and rules that are elements or properties of all human languages”. Within Chomsky's model of UG, children are equipped with an inborn acquisition device. This device consists of a set of principles and parameters. Principles are linguistic constraints regulating all of the world's languages, whereas parameters are grammatical settings which are given a value based on the language being acquired (i.e. what varies across languages) (Cook 1988). How and when children acquire the parameter settings required for accurate production of stress is of particular relevance to my research. Halle and Vergnaud (1978), Hayes (1995), and Dresher and Kaye (1990) identify possible universal parameters involved in acquiring the metrical structure of language. The proposed parameters govern the size, shape and parsing of the linguistic constituents which regulate stress patterns.

The theory of Metrical Stress, as proposed by Hayes (1995) provides several metrical parameters which can be used to account for the stress rules of a language. These parameters are listed below:

(1) Hayes' (1995) metrical parameters

a. **Foot Domain:** Bounded/Unbounded
b. **Quantity Sensitive:** Yes/No
c. **Degenerate Feet:** Yes/No
d. **Headedness:** Left/Right-headed
e. **Direction of Footing:** Left-to-right/Right-to-left
f. **Foot Construction:** Iterative/Non-iterative
g. **Extrametricality:** Yes/No
h. **End Rule:** Right/Left

In the following subsections I provide a brief description of each of these parameters. Hereafter, all definitions come from Hayes (1995), unless otherwise indicated.

2.1. Foot Domain

The parameter for foot domain determines the maximum size of the domain for stress. This parameter permits either a maximally binary (bounded) or maximally unlimited number of syllables (unbounded).

2.2. Quantity Sensitivity

Some languages are quantity sensitive. This means that the rules relevant for stress placement are dependent on syllable weight. A unit of syllable weight is called a 'mora'. Universally, a full (non-shwa) vowel is moraic. This means that a CV syllable is monomoraic and therefore light. Bimoraic syllables are CVV and, in languages where codas (tautosyllabic, post-vocalic consonants) are assigned moras, CVC. Languages can also differ in terms of which coda segments carry weight. Zec (1994) proposes a classifications system for how languages assign moras. These classes are illustrated below.

(2) Zec's (1994) Sonority Scale

obstruents				
nasals				D
glides		B	C	
vowels	A			

The above classification system represents the levels at which languages allow classes of segments to be moraic. Subset A represents languages in which only long vowels make a syllable bimoraic, or heavy. Other languages allow both long vowels and glides in the coda position to create a heavy syllable (Subset B). Less restrictive languages have moraic vowels, glides and nasals (Subset C), and some languages allow any coda consonant to carry syllable weight (D). Quantity sensitive languages vary in what can carry syllable weight; however, universally these languages must assign stress to a heavy syllable.

2.3. Degenerate Feet

Whether a language has restrictions on the minimum size of a foot is another parameter which is relevant for metrical structure. This parameter determines whether or not the language allows degenerate feet. A degenerate foot is a "single light syllable in systems that respect syllable weight [...] and single syllables in quantity insensitive systems" (Hayes 1995:86). In some languages degenerate feet are freely allowed. That is not to say that such languages would parse a word as (σ)(σ)(σ)(σ)(σ). Rather, any syllable that remains stray after foot parsing may itself be parsed as a foot, for example: (σσ)(σσ)(σ). On the other hand, some of the world's languages display either strong or weak prohibition on degenerate feet. Languages with a strong prohibition on degenerate feet do not allow degenerate feet in any circumstance: these languages do not parse stray syllables and do not allow monosyllabic words consisting of only a light syllable. Languages with a weak prohibitions do not freely allow degenerate feet, but do allow them under limited circumstances, for example, such languages allow monosyllabic words to be parsed as a degenerate foot.

2.4. Headedness

In cases where languages have bounded feet, maximally made up of two syllables, it is important to determine which syllable can be stressed. The headedness parameter determines whether a language has right- or left-headed feet. According to Hayes' (1995) typology, iambic languages, i.e. languages that are right dominant, allow the following feet: (LL), (LH), (H), and (L) if the language allows degenerate feet ('L' represents a 'light syllable' and 'H' represents a 'heavy syllable'). Trochaic languages, by contrast, are left dominant. Two types of trochees have been attested: moraic trochees and syllabic trochees. Moraic trochees are quantity sensitive and allow the following feet: (H), (LL), and (L) if the language allows degenerate feet. Syllabic trochees, by contrast, are quantity insensitive, and as such allow any disyllabic foot, and monosyllabic foot, if the language allows degenerate feet.

2.5. Direction of Footing

The directionality parameter determines the edge from which foot parsing begins. Feet are built from left-to-right or right-to left. Hayes, however, claims that iambic (right-headed) languages appear to universally build feet from left-to-right (1995:262). This point is discussed in further detail in chapter 3, section 4.1.3.

2.6. Foot Construction

This parameter determines whether a language has iterative or non-iterative foot construction. Iterative languages allow for more than one stressed syllable in a prosodic word, a prosodic word being defined as the domain for word stress, phonotactics and segmental word-level rules (e.g. Peperkamp 1997). Non-iterative languages, on the other hand, only build one foot and thus allow for only one stress in a prosodic word.

2.7. Extrametricality

This parameter, first proposed by Liberman and Prince (1977), makes a prosodic constituent invisible to stress assignment. Hayes (1995) explains that an extrametrical constituent must be a segment, a syllable, a foot, a phonological word or an affix, in other words, a clearly defined prosodic unit. Furthermore, extrametricality must be peripheral, meaning that an extrametrical constituent must be at the edge of a domain, such as at the end of a prosodic word or phrase. Extrametricality must also be non-exhaustive. This means that extrametricality is blocked if it would make the entire domain unstressable.

2.8. The End Rule

This parameter determines which end of the domain will have primary stress (Hayes 1995). In the case of iterative foot parsing, several feet are built, each of which has a stressable syllable. However, a domain, especially the word, can only bear one primary stress. The End Rule determines whether or not it is the rightmost or leftmost stressable syllable that is assigned primary stress.

In order to illustrate the parameters described above, I now discuss how they are used to derive the stress rule in a hypothetical language, Language X, which rounds up all of the metrical properties relevant for the current discussion.

2.9. Metrical Analysis: An Illustration

Language X illustrates the metrical parameters discussed in the previous subsections. This hypothetical language builds on patterns found across languages but which, to my knowledge, are not all found together in any natural language. This does not imply that this unattested language presents any theoretically impossible properties; quite the contrary, its existence is indeed predicted by the theory. The suggestion here is that this language belongs to the set of potential languages, a set which is logically larger than the set of existing languages. I introduce an organized set of lexical items from Language X below, followed by the list of metrical parameters to be discussed in this excursion.

(3) Example lexical items from Language X

a.	$\underline{\sigma}$	rít
b.	$\underline{\sigma}\sigma$	tá.ka
c.	$\underline{\sigma}\sigma\sigma$	hés.ti.ga
d.	$\underline{\sigma}\sigma\sigma$	lá.mit.kup
e.	$\underline{\sigma}\sigma\underline{\sigma}\sigma$	á.va.rè.lan
f.	$\underline{\sigma}\sigma\underline{\sigma}\sigma$	pí.kun.tò.fa
g.	$\underline{\sigma}\sigma\underline{\sigma}\sigma\sigma$	bó.te.rà.fi.lat
h.	$\underline{\sigma}\sigma\underline{\sigma}\sigma\sigma$	lé.kin.tàp.to.pin
i.	$\underline{\sigma}\sigma\underline{\sigma}\sigma\underline{\sigma}\sigma$	kó.ba.bò.ka.sà.fen

(4) Metrical parameter settings for Language X

a. **Foot Domain:** Bounded
b. **Quantity Sensitive:** No
c. **Degenerate Feet:** Yes
d. **Headedness:** Left-headed
e. **Direction of Footing:** Left-to-right
f. **Foot Construction:** Iterative
g. **Extrametricality:** Yes
h. **End Rule:** Left

In the following subsections I discuss how these parameters interact to yield the patterns exemplified above for Language X.

2.9.1. Foot Domain

In Language X, feet are bounded and maximally binary. This is revealed through words with stress on more than one syllable. Looking at (5) for example, regardless of whether the feet are left- or right-headed, there must be a maximally binary foot.

(5) Evidence for binary feet in Language X

trochaic	$(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)$	á.va.rè.lan
	$(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)$	pí.kun.tò.fa
iambic	$(\underline{\sigma})(\sigma\underline{\sigma})\sigma$	á.va.rè.lan
	$(\underline{\sigma})(\sigma\underline{\sigma})\sigma$	pí.kun.tò.fa

2.9.2. Quantity Sensitivity

The data given in (3) point toward a language which is quantity insensitive. Hayes (1995) explains that in quantity sensitive languages, a heavy syllable must be stressed. A heavy syllable, as defined by Zec (1994), must minimally be a long vowel (Subset A language). Additionally, quantity sensitive languages may assign syllable weight to glides (Subset B language) and nasals (Subset C language). In the Language X data (3), there is no evidence of heavy vowels or glides and syllables which contain a nasal coda are always unstressed. As a result of his pattern, Language X is analysed as a quantity insensitive language.

2.9.3. Degenerate Feet

Language X cannot have strong prohibition on degenerate feet. Evidence against a strong prohibition comes from the fact that this language allows monosyllabic words. This is illustrated through the monosyllabic stressed word in (3a): *rít* is monomoraic and thus a degenerate foot. Assuming Language X has final syllable extrametricality (marked using angular brackets), discussed further in section 2.9.6, provides further evidence that this language freely allows degenerate feet. Examples are given in (6) below.

(6) Evidence that Language X freely allows degenerate feet

	Degenerate feet allowed	Degenerate feet prohibited
á.va.rè.lan	$(\underline{\sigma}\sigma)(\underline{\sigma})<\sigma>$	$*(\underline{\sigma}\sigma)\sigma<\sigma>$
pí.kun.tò.fa	$(\underline{\sigma}\sigma)(\underline{\sigma})<\sigma>$	$*(\underline{\sigma}\sigma)\sigma<\sigma>$
kó.ba.bò.ka.sà.fen	$(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)(\underline{\sigma})<\sigma>$	$*(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)\sigma<\sigma>$

In each form above the penultimate syllable is stressed and as a result, must be parsed as a foot. If degenerate feet were prohibited, there would be no stress on the penultimate syllable.

2.9.4. Headedness

Iambic languages are universally quantity sensitive. Given that Language X is quantity insensitive, it would have to build syllabic trochees (left-headed feet).

2.9.5. Direction of Footing

Footing in Language X must be left-to-right. If foot parsing were right-to-left, incorrect stress placement would result. Both parses are illustrated below. In the table below I assume the final syllable is extrametrical. I discuss evidence for extrametricality later in this section.

(7) Evidence for left-to-right footing in Language X

	Right-to-left	Left-to-right	
a.	$*(\underline{\sigma})(\underline{\sigma}\sigma)<\sigma>$	$(\underline{\sigma}\sigma)(\underline{\sigma})<\sigma>$	á.va.rè.lan
b.	$*(\underline{\sigma})(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)<\sigma>$	$(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)(\underline{\sigma})<\sigma>$	kó.ba.bò.ka.sà.fen

Based on the above example, left-to-right parsing yields the correct stress in Language X.

2.9.6. Extrametricality

Evidence for extrametricality comes from words with an odd number of syllables. Example (8) have two unstressed syllables word finally. I have already shown that Language X allows degenerate feet. If there were no extrametricality, the final syllable would have to be stressed.

(8) Evidence for extrametricality in Language X

	No extrametricality	Extrametricality	
a.	$*(\underline{\sigma}\sigma)(\underline{\sigma})$	$(\underline{\sigma}\sigma)<\sigma>$	héf.ti.ga
b.	$*(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)(\underline{\sigma})$	$(\underline{\sigma}\sigma)(\underline{\sigma}\sigma)<\sigma>$	bó.te.rà.fi.lat

Above in (8) a final extrametrical syllable predicts the correct stress assignment in Exlandic.

2.9.7. End Rule

Primary stress is always the first stressed syllable in a prosodic word, an observation which supports the left End Rule parameter for this hypothetical language.

I have now described metrical parameters and how they are used to derive the stress rule of a simulated language. The metrical parameter settings required for accurate stress placement in NE Cree are discussed in the next chapter. I now review the existing literature on the acquisition of stress.

3. The Acquisition of Stress

3.1. Phonetic Acquisition of Stress

The majority of the research on the monolingual acquisition of the phonetic cues for stress focuses on English speaking children (e.g. Allen and Hawkins 1980; Kehoe et al. 1995; Pollock et al. 1993; Schwartz et al. 1996).

Allen and Hawkins (1980) measured the duration and fundamental frequency of syllables produced by English speaking children of approximately three years of age. Based on these measurements they found positional effects on stress. Final stress in child speech is marked by duration, whereas non-final stress is marked by an increase in pitch. Allen and Hawkins (1980) also noted that children often have unreduced unstressed syllables. They concluded that learning to reduce weak syllables represents an important step in the acquisition of stress.

Kehoe, Stoel-Gammon and Buder (1995) examined the question of whether young children (in this case 18-30 months) have the same acoustic correlates of stress as adults, or if they acquired these acoustic correlates over time. This study was conducted with English speakers. English stress is marked by an increase in pitch, intensity, and duration. Unlike Allen and Hawkins (1980), the authors found that children have the same stress correlates as adults at an early age. They note, however, that the difference in the amplitude of stressed syllables compared with unstressed syllables increases significantly with age. At 18 months of age the mean difference between stressed and unstressed syllables is 3.5dB, whereas at 30 months the mean difference is 5.6dB. Kehoe et al. (1995) also note that all children produce relatively long unstressed syllables in disyllabic words.

Pollock, Brammer and Hagerman (1993) conducted a study where they looked at the acoustic correlates of syllables in nonsense words, produced by two-, three-, and four-year-old children. They found that children at three and four years of age produce target-like stress, whereas two-year-old children use only one cue for stress: duration. Pollock et al. (1993) also found that the duration of stressed syllables remains steady over time, but that the duration of unstressed syllables decreases with age.

Most recently, Schwartz, Petinou, Goffman, Lazowski and Cartuciello (1996) conducted a study involving children aged 22-28 months. Similar to the results of Allen and Hawkins (1980) they found positional effects for duration in child speech, finding that final stress is marked mainly through duration. As well, Schwartz et al. (1996) found that children do not reduce unstressed syllables to the same degree as adult speakers do.

The studies completed on English in some ways present conflicting results. Both Allen and Hawkins (1980) and Schwartz et al. (1996) find positional effects on the phonetic cues for stress, whereas Pollock et al. (1993) find that younger children use only duration to mark stress. Kehoe (1995), by contrast, observes that children have target stress cues from an early age. Aside from these differences, all of these studies find that children up to three years of age do not reduce unstressed syllables to the same degree as adults. These works all suggest that the reduction of weak syllables is something that develops gradually over time.

I have summarized research done on the acquisition of the phonetic cues for stress. However, it is also important to understand how children acquire the appropriate metrical parameters for their target language. I address this issue in the next subsection.

3.2. Phonological Acquisition of Stress

Within the field of phonological acquisition, relatively little research is available on the development of suprasegmental aspects such as those stress parameters discussed above. In spite of this, relatively clear theoretical claims are made about how stress systems should be acquired. Firstly, some research (e.g. Klein 1981; 1984) supports a lexical approach for stress acquisition, such that stress is learned on a word-by-word basis, while other researchers support a grammatical, or rule based, approach (e.g. Hochberg 1988a; Fikkert 1994,1995; Archibald 1996; Kehoe 1998).While the majority of the literature supports a grammatical approach to stress acquisition, there is further debate surrounding the question as to whether children are born with default stress parameter settings. Research by Dresher and Kaye (1990), Fikkert (1994; 1995) and Kehoe (1998) suggests that children are born with specific metrical parameter settings, which they can change based on positive evidence from the ambient language. However, other research (e.g. Leopold 1947; Hochberg 1988a; Rose and Champdoizeau 2007a,b) supports a neutral start hypothesis whereby children are not biased by any parametric defaults.

Taking a strong stance for a universally biased grammatical acquisition of stress, Dresher and Kaye (1990) link the acquisition of stress to metrical stress theory (as outlined in section 2), hypothesizing that children are equipped with default parameter settings and that evidence from stress errors in child language would provide evidence for these default settings. They propose that by looking at the acquisition of metrical parameters, the developmental stages in stress acquisition can be understood. Furthermore, Dresher and Kaye (1990) suggest that different metrical parameter settings are acquired at different stages, in which case stress errors should be systematic in specific age groups. Some default parameter settings they propose are listed below.

(9) Dresher and Kaye's (1990) default parameter settings

a. **Foot Domain:** Unbounded
b. **Quantity Sensitive:** No
c. **Headedness:** Left-headed
d. **Direction of Footing:** Left-to-right
e. **Extrametricality:** No
f. **End Rule:** Left

A small number of studies have tested Dresher and Kaye's (1990) hypothesis, by trying to identify developmental stages in the acquisition of metrical parameters. Fikkert (1994; 1995) and Kehoe (1998) formalized these developmental stages by looking at child data from Dutch, and English respectively.

Fikkert (1994; 1995) was the first to employ Dresher and Kaye's (1990) hypothesis through a longitudinal study of twelve Dutch speaking children. Based on these children's production of stress patterns, Fikkert described four stages in the acquisition of stress. At stage 1 the child maps everything onto a trochaic foot. In his or her production of SW words, the child can produce a disyllabic word. In the production of WS and SWS words, however, the child initially produces only the strong syllables. At stage 2, the child can still only produce one foot. During this stage, the child can produce a disyllabic foot for WS and SWS words, however, he or she produces it with a trochaic stress pattern. For example, the word meaning 'guitar' is pronounced [χiː'taː] in the target language, but in the child language at this stage it is produced with initial stress (['siːtaː]). At stage 3, the child can produce two feet, but assigns equal stress to each foot. Fikkert (1994; 1995) explains that at this stage, the child has expanded his/her prosodic template to two feet, but has not yet acquired the End Rule. At the fourth stage, the child has acquired the End Rule, and can thus produce a target-like stress pattern. Based on the patterns found in the development of Dutch stress, Fikkert (1995) finds that some of the initial parameter settings are as follows:

(10) Initial parameter setting in Dutch-speaking children (Fikkert 1995)

a. **Quantity sensitivity:** No
b. **Headeness**: Left-headed
c. **Direction of Footing:** Right-to-left
d. **End Rule**: Right

In contrast to Fikkert's longitudinal approach, Kehoe (1998) adopts a cross-sectional method to studying the acquisition of stress in English speaking children, in order to test Fikkert's (1994) hypotheses on the acquisition of metrical parameter settings. Kehoe (1998) reckoned that since English and Dutch have similar stress systems, Fikkert's (1994; 1995) observations about Dutch should provide good predictions for English stress development. Looking at data from English speaking children, Kehoe (1998) finds evidence for some of the developmental stages proposed by Fikkert (1994; 1995), and provides three stages in the acquisition of stress. Stage 1, the 'Trochaic Constraint Stage' (at approximately 22 months) is consistent with Fikkert's (1994; 1995) stages 1 and 2, in which the child mapped words onto a trochaic template. Kehoe, however, explains that there were a small proportion of *<u>S</u>WS* words in which the child produces final stress. Kehoe's (1998) second stage is labelled the 'Experimental Stage'. At this stage (approximately 28 months), the child produces more stress errors, and equal stress on both syllables (where one syllable should be more prominent). The child often moves penultimate and antepenultimate stress to the final syllable, indicating that he or she has not yet acquired extrametricality (Kehoe 1998:19). The final stage of stress development is 'The Consistent Stress Pattern Stage' in which the child (aged 34 months) produces a target-like stress placement, having acquired extrametricality and the End Rule.

The findings from Fikkert (1994; 1995) and Kehoe (1998) do not provide full support for Dresher and Kaye's (1990) hypothesis regarding default parameter settings. However, from a theoretical standpoint, Dresher and Kaye's (1990) hypothesis is not uncontroversial; as previously mentioned, there are others that prefer the neutral start hypothesis which assumes that children do not show a preference for any stress type (e.g. Hochberg 1988a,b; Klein 1984; Pollock et al. 1993; Rose and Champdoizeau 2007a,b). As pointed out by Fikkert (1994) and Rose and Champdoizeau (2007a), one obvious problem with the studies testing Dresher and Kaye's (1990) hypothesis is that they are all based on trochaic languages. It is thus possible that in the early stages children do not produce iambs simply because their language displays evidence for trochaic footing. Investigating the acquisition of stress in NE Cree will contribute to this area of research, as many of the metrical parameter settings in this language are marked, with respect to Dresher and Kaye's (1990) proposed defaults. If metrical parameters are initially set to the defaults presented by Dresher and Kaye (1990), consistent errors in stress placement in young speakers of NE Cree would be expected.

Thus far this chapter has underlined the theoretical approach to my research, and outlined related work in this field. In the following section I introduce the properties of NE Cree which are pertinent to my investigation.

4. Northern East Cree: Language and Context

East Cree is an Algonquian language spoken by approximately 13 000 people on the east side of James Bay, in Northern Québec (MacKenzie and Junker 2004). East Cree is a member of a linguistic continuum known as the Cree-Montagnais-Naskapi (CMN) complex (MacKenzie 1980). This linguistic continuum is divided into non-palatalized, and palatalized dialects, as shown in the map below in Figure 1 (Mackenzie 2003). This palatalization refers to whether or not velar stops from Proto-Algonquian are realized as /tʃ/ before front vowels. East Cree, Montagnais and Naskapi do have this change whereas western dialects of Cree do not (MacKenzie 1980). The palatalized dialects of the CMN can be subdivided further based on stress placement. MacKenzie (1980) explains that East Cree and Western Naskapi are both non-final stress palatalized dialects, whereas other palatalized dialects have final stress. MacKenzie (1980:46) notes that final stress may be a result of French influence in these communities. NE Cree is a subdialect of East Cree and is spoken in the communities of Whampagoostui, Chisasibi and Wemindji. The current study focuses on NE Cree as it is spoken in Chisasibi.

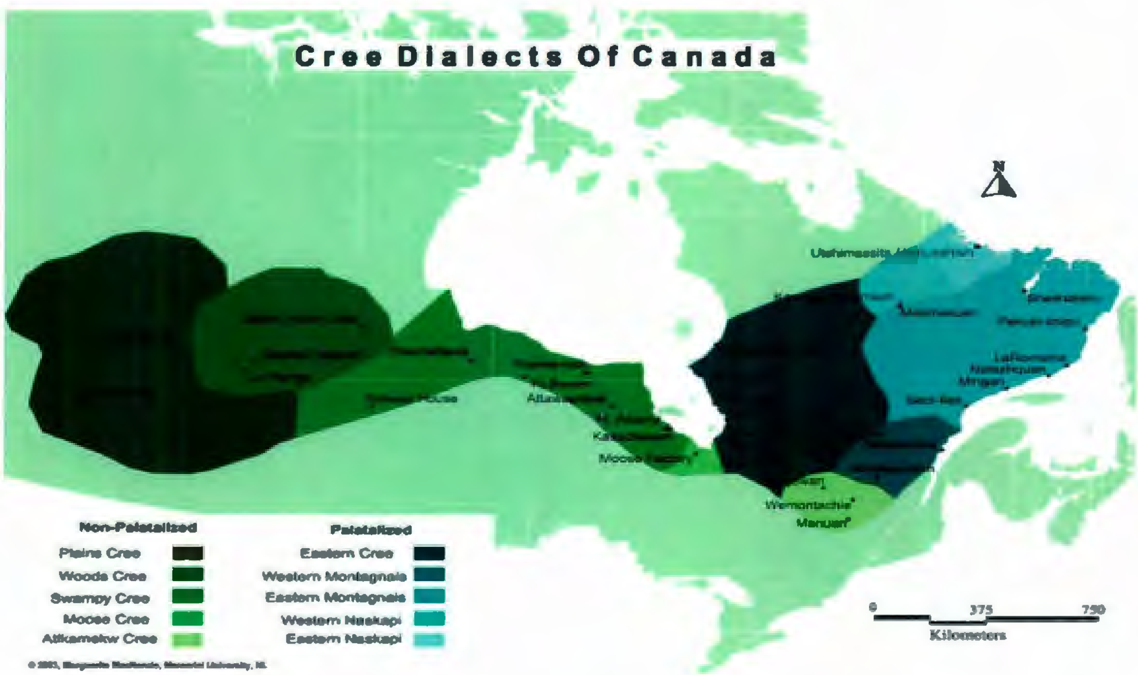

Figure 1. Cree dialects of Canada: Map showing the dialects within CMN, and the division between non palatalized and palatalized dialects (MacKenzie 2003).

Language variation also exists between the coasters and the inlanders within the community of Chisasibi. Within NE Cree communities, this distinction between coasters and inlanders is related to social patterning and material culture (MacKenzie 1980: 24). MacKenzie notes that the coasters were more involved with exploitation of the seal and walrus hunt and thus travelled to posts more frequently and came into contact with other linguistic communities more often than the inlanders (MacKenzie 1980: 24). In her thesis, MacKenzie (1980) acknowledges that there may be linguistic variation between the coasters and inlanders in Cree speaking communities, however, she does not address this issue further. Linguistic differences are, however, documented by Dyck et al. (2006) who note discrepancies in stress placement between a coastal and inland speaker of NE Cree.

Thus far I have introduced the language in question. In the following section, I provide further detail on the language's phonemic inventory.

4.1. Phonemic Inventory of NE Cree

Dyck et al. (2006) and Wood (2006) have provided the first segmental descriptions of NE Cree. The consonant inventory of NE Cree is given below.

(11) NE Cree consonant inventory

p	t	ch (tʃ)	k, k^w	
	s	sh (ʃ)		h
m	n			
w	y			

Obstruent voicing is not contrastive in NE Cree. As a result only the voiceless counterparts are given above (though phonetically these segments are often voiced). Wood (2006) also notes that /tʃ/ often surfaces as [ts] but does not explore whether they are in free variation or in complementary distribution.

Below are the orthographic representations for the vowels of NE Cree. I have omitted the phonetic transcriptions as they vary depending on environment and speaker pronunciation. This is for the most part evident in the historically short vowels, which have a range of overlapping pronunciations, for example the short vowels a and *i* can surface as [ɪ] or [ə] . Furthermore, NE Cree appears to assign syllable weight based on historical length. Presently the difference between long vowels (marked with a circumflex) and short vowels is a difference of vowel quality more so than vowel length (MacKenzie 1980). Historically long vowels are tense and historically short vowels are lax. Even though these vowel length contrasts may no longer exist, there is evidence indicating that tense vowels pattern as heavy. For example, historically long vowels never undergo syncope (deletion), while historically short vowels do, in metrically weak positions.

(12) Orthographic vowel inventory

Heavy			Light		
î		û	i		u
	â			a	

Many dialects of Cree, including SE Cree, also have the long vowel *ê*. In NE Cree, however, this vowel has merged with *â* (MacKenzie 1980:98). This is similar to the overlapping phonetic representations of the short vowels *i* and *a*, discussed above. Since these two vowels can be pronounced in exactly the same way, it appears that they have, as well, undergone a merger (Dyck et al. 2006).

Dyck et al. (2006) and Wood (2006) both provide detailed analyses of the metrical structure of NE Cree. Their analyses are presented in the following chapter. In the next section, I provide more information about the context within which my research is taking place.

4.2. Context for Research: Chisasibi Child Language Acquisition Study

The current research has been conducted under the auspices of an ongoing SSHRC-funded project being carried out by several faculty members in the Department of Linguistics at Memorial University: Drs. Julie Brittain, Carrie Dyck, Marguerite MacKenzie and Yvan Rose. This project, "Phonological and morphosyntactic development in a polysynthetic language: the acquisition of Cree as a first language" also known as the Chisasibi Child Language Acquisition Study (CCLAS), is the first in-depth naturalistic study of the acquisition process in any Algonquian language.

The CCLAS project involves long-distance data collection (regular video-recording of children) and data processing (electronic tagging, translation and analysis of the child language recorded in the movies). Generally, researchers have to be on the ground to undertake acquisition research, living in the community for a period of time. This means that filming can only be done during shorts stays (e.g., over a few weeks in the summer). The CCLAS project is a sequentially designed study, such that two age cohorts of children over a period of 36 months are being filmed, enabling the team to acquire a relatively detailed picture of how a Cree learning child's language develops. The research team has been able to undertake this long-distance research through using software called *Phon* (Rose et al. 2006, 2007) that is tailor-made for acquisition projects.

The child language data obtained by the CCLAS project has provided me with the necessary empirical ground to investigate the development of stress cues and metrical parameter settings in NE Cree, whose methodology I discuss in further detail in the following section.

5. Methodology

In order to describe the development of stress in a young speaker of NE Cree, it is important to have an understanding of the target language, for example, what cues for stress, and metrical parameter settings are relevant for the adult language. In order to address this, in the following subsections I describe the methodology used for collecting and analysing the adult language, and for preparing and analysing the child language data.

5.1. Adult Language

The main goal of studying adult NE Cree was to attain a description of the acoustic cues for stress, and the metrical parameter settings relevant for this language. This information would then, in turn, provide a foundation for research into the acquisition of NE Cree. In this section I discuss the adult participants as well as my approach to collecting their word productions which I used for metrical analysis of the NE Cree system.

5.1.1. Participants

The primary adult consultant is Darlene Bearskin (hereafter DB), an inland speaker of NE Cree. DB was selected because she, like the child participant, is an inland speaker of NE Cree, thus she provides a definite target for the child's speech.

The second consultant Luci Bobbish-Salt (hereafter LBS) is a coastal speaker of

NE Cree. Data provided by LBS is used only in the analysis of the acoustic cues for stress. The analysis of her speech helps ensure reliability of the acoustic cues found in DB's speech. I did not analyse the metrical parameter settings in LBS's speech as she is a coastal speaker, and as a result does not fully represent the target for the child's system.

5.1.2. Data Collection

Both of the initial interviews were those used by Dyck et al. (2006). The primary interview with DB was conducted in January 2006, and the interview with LBS was prior to that. Both interviews were based on the reading of word lists that were almost identical across the two interviews.[2] Acoustic analyses and preliminary metrical analyses were conducted on both interviews. These analyses resulted in questions regarding some forms with irregular stress placement and specific word shapes that were lacking in the data. As a result, I compiled a new word list of 217 forms with seemingly irregular stress patterns and words with series of light syllables (which were lacking in the previous interviews). Once the word list was complete, I conducted fieldwork in Chisasibi where I carried out another interview with DB. In this interview DB was asked to repeat each word three times. The second repetition was used whenever possible, as it is presumed to be more representative of normal speech than the first one, which often contains hesitations, and the last one, which is often pronounced in a less careful manner, especially with regard to intonation (which could skew results pertaining to pitch production).

2 The wordlist used for LBS' interview is the same as the wordlist used for DB's interview, only DB was also asked to provide the plural form of each word, or other possible homophones for each form.

5.1.3. Data Analysis

All the acoustic measurement were made using *Praat* (Boersma and Weenink 2008), a software program that enables the acoustic analysis of recorded speech segments. Three measurements were taken from each vowel: maximum pitch in hertz (Hz), maximum intensity in decibels (dB) and vowel duration in milliseconds (ms). Vowels followed by an intervocalic glide were not measured for duration, as it is difficult to determine where one vowel ends and the other begins in this context. Both maximum pitch and maximum intensity values were taken using automatic functions in *Praat* which output exact measurements. The duration measurements were somewhat more impressionistic. Vowels produce periodic waves in a wave form, as such the vowel measurement was taken from the initial voicing burst of the vowel, until the periodic waves ceased. Each measurement was then entered into a spreadsheet along with word orthography, transcriptions and translations. The acoustic analysis of these utterances not only provided me with the acoustic cues for stress, but also contained evidence for stress placement. Once the acoustic analysis was complete, stress placement was identified and the cues used to mark stress were highlighted on each form.

I continued with the metrical analysis of the adult language. Taking stress placement, vowel syncope, and previous metrical descriptions of NE Cree stress into account, I determined which parameter settings were in place. This is discussed further in Chapter 3.

5.2. Child Language

The description of NE Cree stress which I arrived at from studying the adult language provides a target for the child language. Thus by looking at the child language over time compared to the target or adult NE Cree, developmental patterns could be observed. The developmental data used for my research come from the CCLAS project, thus the methodology is tailored for the kind of study presented in this thesis.

5.2.1. Participant

The Chisasibi Child Language Acquisition Study provides the child language data used in the current study. Six children are participating in the study. They are separated into two groups: the children in Cohort A are aged 12 to 48 months; the children in Cohort B are aged 36 to 72 months. As discussed in section 3.2 it appears that stress is acquired relatively early. As a result, the current study focuses on the younger cohort. More specifically, I conducted a case study on one young female speaker of Cree: A1 (cohort A, speaker number 1), an inland speaker of NE Cree. At the beginning of the study A1 was 1;9 and, in the final video 4;3.

I have chosen 5 video recordings from the CCLAS corpus, based on the number of utterances, and timing of the videotaping. The first two videos taken from very early recordings, in the first year of filming (ages 2;02.02 and 2;08.28), and the second two videos are taken from the second year of filming (ages 3;04.09 and 3;06.23). The fifth and final video was taped during year three of the study (age 4;01.30). These five videos, as a result, provide data that enable an approximation of how the stress cues and metrical parameter settings developed over time in A1's speech.

5.2.2. Data Preparation

The methods for the CCLAS project had already been applied to the child data. Using *Phon* (Rose et al. 2006; 2007), the videos were segmented such that all linguistic utterances were tagged and numbered into records. Next, each record was transcribed separately by two transcribers, and then validated by a team of two transcribers to ensure transcription accuracy.[3] Since the validation of the videos used in the current study had not yet begun when I started data analysis, I chose the most appropriate transcriptions based on my own impressions. This is, however, fairly inconsequential since my study is primarily based on acoustic measurements, not on phonetic transcriptions.

The target form for each utterance was also provided. DB listened to each record and provided the target form as well as the translation of each utterance. The target utterances were transcribed by one transcriber, and were acoustically analysed with *Praat* in order to ensure accurate stress placement was marked on each utterance.

Once the target forms and translations were entered into each video transcript in *Phon*, I began entering the roman orthography. This process is crucial because of vowel syncope in NE Cree. As I explain in the following chapter, vowels are often devoiced or deleted in metrically weak positions. As a result it is often impossible to determine where underlying syllables exist—as such, it is difficult to determine the metrical structure of each utterance. Once the child transcriptions, translations and orthography were entered into the database, I was in a position to undertake the required acoustic and metrical analyses.

It should be noted that since the videos are taken from a naturalistic environment, I had to discard many utterances where sound quality was compromised as a result of background noise or other interruptions. Furthermore, all English utterances were also discarded for the purpose of this study. Although A1 is not bilingual, she knows some English words and songs—mostly from exposure to English television. English forms

3 The transcribers are not NE Cree speakers but have completed courses in phonetics and have been trained specifically in transcribing NE Cree child speech.

were systematically excluded from the study.

5.2.3. Data Analysis

The current study requires both an acoustic analysis and a metrical analysis of the child language. Firstly, in order to complete the acoustic analysis of the child language, I began with exporting each utterance that could be used. I then used the same methodology as used in the adult language: I noted the maximum pitch, maximum intensity and duration measurements for each vowel. However, *Praat* is designed for the analysis of adult speech, and since young children have a much higher fundamental frequency (i.e. pitch), the pitch tracking function was occasionally inaccurate. In order to ensure accuracy of the given pitch tracking value, each vowel was also manually checked within the spectrographic representation of the pitch curve to ensure the measurement was correct. The measurements were entered into a spreadsheet, and the acoustic cues used to stress the prominent syllable of each word were highlighted. Additionally, since previous literature on the acquisition of the acoustic cues for stress suggests that children have different stress cues for final and non-final stress, I also extracted all disyllabic words from the data and divided them into words with phonetically final or non-final stress. Each of the measurements were pasted into another spreadsheet and the difference in maximum pitch, maximum intensity and duration were calculated for each form.

Secondly, I carried out the metrical analysis first by creating a spreadsheet for each session with the orthography, target IPA, and actual IPA. Based on the orthographic transcription each form was coded as having initial stress (I), antepenultimate stress (A), penultimate stress (P) or final stress (F) in the target form and then in the actual form.[4]

4 It should be noted that stress almost consistently fell on one of the final three syllables. The (I) category was used only once to describe initial stress on a word with four syllables.

Whenever there was a discrepancy between the target and actual stress placement, the form was highlighted such that the errors in A1's speech could easily be identified and counted. The patterns found in A1's speech reflect her acquisition of the metrical parameter settings of the ambient language, which is discussed in chapter 4. Before I tackle this issue, I first address the metrical structure of the adult language, in the next chapter.

Chapter 3 — Stress in Northern East Cree

1. Introduction

In order to better understand how a child's stress system develops, it is important to first establish the functioning of the adult system. In section 2 of this chapter I outline previous literature describing stress and metrical structure in Algonquian languages. Extending on this research, in section 3, I discuss the acoustic cues for stress in NE Cree, and the metrical structure of this language as it is described in previous studies. Building on the findings from the past literature with those from my own empirical work, I then propose a metrical analysis of the NE Cree stress system.

2. Stress in Algonquian

2.1. The Phonetics of Stress in Algonquian

There is relatively little literature describing the acoustic cues for stress in Algonquian languages. Thus far, the acoustic correlates for stress have only been described for Ojibwa (Swierzbin 1993; Valentine 1996), Naskapi (Scott 2000) and Blackfoot (van der Mark 2002). In each of these studies pitch is considered to be the most important cue. For example, van der Mark (2002) completed a detailed acoustic analysis of Blackfoot and found that pitch was the most highly correlated cue for stress. However, she found that intensity was also correlated with marking stress, but to a lesser degree. As Ladefoged (2005) points out, there is a physiological relationship between pitch and intensity. According to Ladefoged, a higher pitch can be produced in one of two ways: through greater force in the respiratory muscles (resulting in a larger puff of air) or through greater tension in the vocal folds. The former also results in a syllable with a higher intensity. Thus, in languages where pitch is the main marker of stress, intensity is also likely to play a role. This may provide an explanation for van der Mark's (2002) findings.

2.2. Metrical Structure in Algonquian

The metrical structure of several Algonquian languages is described in the scientific literature. These languages include Unami Delaware (Goddard 1979), Munsee Delaware (Goddard 1982), Malacite-Passamaquoddy (Stowell 1979), Eastern Ojibwa (Bloomfield 1957; Kaye 1973; Piggott 1980; Piggott 1983), Menomini (Pesetsky 1979), Potawatomi (Hockett 1939) and NE Cree's closest relative, Southern East (SE) Cree (Brittain 2000). These languages have very similar metrical parameter settings. The general parameter settings for these Algonquian languages are provided below, after Hayes' (1995) survey.

(1) General parameter settings for Algonquian languages

a. **Foot Domain:** All of the above mentioned Algonquian languages have bounded, maximally binary feet.

b. **Quantity Sensitive:** All of these Algonquian languages are quantity sensitive, though they do differ in what segments can be assigned moras. For example, in SE Cree nasals and glides are moraic in the coda position, whereas in Delaware, any consonant is moraic in the coda position.

c. **Headedness:** Based on the analyses, these Algonquian languages have iambic feet.

d. **Direction of Footing:** All of these Algonquian languages have been analysed with left-to-right footing.

e. **Extrametricality:** All of the Algonquian languages discussed here have an extrametrical constituent. They do, however, differ in which constituent is extrametrical. Delaware, Malacite-Passamaquoddy and Southern East Cree, have an extrametrical foot, Eastern Ojibwa has both an extrametrical foot and syllable, while Menomini has an extrametrical consonant.

f. **End Rule:** All of these Algonquian languages have stress at the right edge.

The similarities in Unami and Munsee Delaware, Malacite-Passamaquoddy, Eastern Ojibwa, Menomini, Potawatomi and SE Cree suggest that NE Cree will also have bounded feet, quantity sensitivity, right headed feet, left-to-right footing, an extrametrical constituent, and End Rule Right.

3. Stress in Northern East Cree

Two descriptions of the stress system of NE Cree have thus far been proposed in the literature by Wood (2006) and Dyck et al. (2006). While the former is based on impressionistic transcriptions only, the latter incorporates preliminary data based on acoustic analysis. This study thus provides a basic description of the phonetic realization of stress in this language. In section 3.1, I outline the acoustic properties in NE Cree based on both Dyck et al. (2006) and my own acoustic investigation. In section 3.2, I describe the metrical structure of NE Cree, based Dyck et al.'s (2006) analysis, and outline how Wood's (2006) analysis differs. The discussion of each of these studies together provides a foundation for my own metrical description, proposed in section 4, which combines aspects from both Dyck et al.'s (2006) and Wood's (2006) analyses.

3.1. Phonetics of Stress in NE Cree

In their investigation of the metrical structure of NE Cree, Dyck et al. (2006) discovered forms in which stress placement appeared to be irregular. As a result, they conducted acoustic analysis, measuring the pitch, intensity and duration of the vowels in forms with irregular stress patterns. Based on these acoustic measurements, Dyck et al. (2006) found pitch to be the most highly correlated cue for stress, and found intensity to be correlated as well, but to a lesser degree. These results are similar to those of van der Mark (2002) for Blackfoot.

In my research, I also conducted an acoustic analysis firstly to describe the acoustic cues for stress in NE Cree based on a larger data set, but also to ensure accurate transcriptions of stress. I measured maximum pitch, maximum intensity and vowel duration for every syllable in 97 word forms from DB, an inland speaker of NE Cree, and 107 word forms from LBS, a coastal speaker of NE Cree.

The acoustic measurements taken from the 97 forms from DB yielded the results shown in (2).

(2) Speaker DB: Phonetic cues for stress (out of 97 spoken forms)

a. Pitch only: 21 forms (21.6 %)
b. Intensity only: 10 forms (10.3%)
c. Duration only: 0 forms (0 %)
d. Pitch and intensity: 62 forms (63.9%)
e. Vowel devoicing: 4 forms (4.1%)

The measurements taken from DB's forms show that pitch and intensity most often correlate to mark stress, but that pitch is overall a stronger predictor for stress placement. There is a higher pitch peak on 85.5 percent of stressed vowels, while there is an intensity peak on stressed vowels 74.2 percent of the time. These results are in line with the likely interplay between pitch and intensity noted above from Ladefoged (2005). Vowel devoicing, which leaves the stressed vowel as the only phonetically-realized (thus, acoustically measurable for pitch and intensity) vowel in the word, accounts for the remaining 4.1 percent of the data.

Duration is not a strong marker of stress in DB's speech. It never marks stress on its own, but in 18 (18.6 percent) of the forms, it does accompany a higher pitch, a higher intensity, or both. Of these 18 forms, 13 come from historically long vowels, therefore the increased duration of these vowels may be an artifact of historical remnants, although this behaviour cannot be generalized over the data set.

Similar results are found in the 107 words from a second consultant: LBS, a coastal speaker of NE Cree.

(3) Speaker LBS: Phonetic cues for stress

a. Pitch only: 20 forms (18.7%)
b. Intensity only: 2 forms (1.9%)
c. Duration only: 0 forms
d. Pitch and intensity: 85 forms (79.4%)

Similar to what was observed in DB's forms, most frequently, pitch and intensity mark stress together in LBS's speech. However, since intensity alone only marks stress on two forms, pitch is a much better predictor of stress placement. LBS's use of pitch to mark stress is more consistent than that of DB. LBS uses a pitch increase on 98.1% of the forms, whereas DB only does so only on 85.5% of the forms.

Based on the acoustic analysis completed on two speakers of NE Cree, I conclude that most frequently pitch and intensity are used together to mark stress in this language, with pitch used as a sole marker of stress more often than intensity. This suggests that pitch is a better predictor for stress in this language, and that the use of intensity may originate from a physiological effect of producing higher pitch. Indeed, based on Ladefoged's (2005) claim about the relationship between pitch and intensity discussed above, it is conceivable that both NE Cree speakers use greater respiratory strength, as opposed to tension in the vocal folds, when producing higher pitch. Aerodynamic analysis would however be required to conclusively support this claim. Such a topic, which extends beyond the scope of this thesis, is left for future research.

In addition to the determination that pitch is the relevant cue for marking stress in NE Cree, I also found no evidence of secondary stress in this language. This finding is consistent with Wood (2006) who also failed to detect evidence for secondary stress.

3.1.1. Vowel Devoicing and Deletion in NE Cree

Pitch and intensity are the phonetic cues used to mark stress in NE Cree, however, vowel devoicing and syncope (or deletion) are processes which often mark short vowels in metrically weak positions.[5] These processes often yield an asymmetry between the number of syllables in the orthographic representation and the phonetic form of the word. Another outcome of vowel (and, thus, syllable) deletion is the question of whether these vowels (syllables) are underlyingly present. However, given that vowel devoicing and syncope are often optional, in prior metrical analyses of Northern East Cree, and in my own analysis, syncopated vowels are assumed to be underlyingly present.

Further research into the presence of underlying vowels (with regard to deletion or syncope) should be verified through an independent study on the rate of deletion in weak vowels in NE Cree. Ideally, such a study would compare adult NE Cree with child-directed speech to better characterize the shape of the input the child is exposed to.

3.2. Metrical Structure of NE Cree

As previously mentioned, two analyses of the metrical properties of NE Cree have been proposed in the literature: Dyck et al. (2006) and Wood (2006). I outline Dyck et al.'s (2006) analysis, in section 3.2.1, and then, based on this description, discuss how Wood's (2006) analysis differs, in section 3.2.2.

5 See recent work by Dyck, Brittain, MacKenzie and Rose (2008) for a detailed discussion of the environments yielding vowel syncope.

3.2.1. Dyck et al. 's (2006) analysis

Based on Hayes' (1995) Metrical Stress Theory, Dyck et al. (2006) provide the following metrical parameter settings to account for stress placement in NE Cree.

(4) Metrical parameters for NE Cree (Dyck et al. 2006)

a. **Foot Domain:** Bounded
b. **Quantity Sensitive:** Yes
c. **Degenerate Feet:** No
d. **Headedness:** Right-headed
e. **Direction of Footing:** Right-to-left
f. **Extrametricality:** Yes
g. **End Rule:** Right

Each parameter is described in more detail in the following subsections.

3.2.1.1. Foot Domain

NE Cree has a bounded, maximally binary foot. An unbounded analysis can be ruled out by examples such as the one in (5) (the stressed syllable is underlined).

(5) Evidence for a bounded foot domain (example from Dyck et al. 2006:5)

pi.<u>chi</u>.wi.yân *cloth*

In the above example, stress occurs on the antepenultimate syllable. Assuming syllable extrametricality (to be discussed in 3.2.1.2) this word would have stress on the initial syllable if NE Cree had left-headed unbounded feet, or on the penultimate syllable if NE Cree had right-headed unbounded feet (Dyck et al. 2006:5).

3.2.1.2. Quantity Sensitivity

NE Cree is quantity sensitive; however, codas are not moraic. In this dialect, historically long vowels are heavy, while historically short vowels are light. Historically long vowels are marked with a circumflex in standard Cree orthography, which is used in the data descriptions throughout this thesis. Evidence for this weight distinction comes from the fact that historically long vowels never undergo syncope, while historically short vowels do in metrically weak positions. Further evidence for quantity sensitivity comes from the fact that NE Cree assigns stress to the penultimate syllable if it is heavy; otherwise the antepenultimate heavy syllable is stressed. This is illustrated below in (6).

(6) Evidence for quantity-sensitivity (examples from Dyck et al. 2006:4)

a.	î.ti.nim	*hold like so*
b.	ni.pâ.win	*bed*
c.	wâ.pu.shuch	*rabbits*
d.	a.wâ.shish	*child*

3.2.1.3. Headedness

Dyck et al. (2006) note that many Algonquian languages have been described as iambic, a fact that suggests that Proto-Algonquian was also iambic. The stress system of NE Cree also appears to conform to this parameter. Assuming an extrametrical syllable, to be discussed later in this section, most data collected from NE Cree can be analysed as iambic, as illustrated by the examples below.

(7) Evidence for right-headed feet (examples from Dyck et al. 2006: 9)

a.	a.si.nî	(LL)<H>	*stone*
b.	a.ni.ku.châsh	L(LL)<H>	*squirrel*

The above examples provide evidence for a right-headed foot form, as the right syllable in a (LL) foot is stressed. There are, however, some words for which Dyck et al. (2006) posit syllabic trochees[6]. Given a word with a series of light syllables, with an extrametrical syllable, stress should fall on the penultimate syllable. However, in some cases such words have antepenultimate stress, such as those listed in (8).

(8) Evidence for exceptional syllabic trochees (examples from Dyck et al. 2006:10)

a.	mis.chi.shin	(LL)<L>	*shoe*
b.	mi.ku.shân	(LL)<H>	*feast*

To justify this analysis, Dyck et al. (2006) cite MacKenzie (1980). MacKenzie (1980) explains that the dialect of Cree spoken in Chisasibi is undergoing a stress shift in order to avoid homophony. The stress shift causes a word that is otherwise identical to another to have a different stress pattern. In (9) below, the word for 'nine' and the word for 'there's one object sitting over there' are orthographically the same. However, the latter has the predicted penultimate stress, while the former displays the exceptional antepenultimate stress.

(9) Example of stress shift to avoid homophony (examples from Dyck et al. 2006:11)

a.	pâ.yi.kush.tâw	(H)(LL)<H>	*nine*
b.	pâ.yi.kush.tâw	(H)(LL)<H>	*there's one object sitting over there*

3.2.1.4. Degenerate Feet

Dyck et al. (2006) propose that there are no degenerate feet in NE Cree. There are, however, cases where degenerate feet can occur, namely in all occurrences of words composed of a single, light syllable. This is illustrated in (10).

6 It should be noted that in their latest work Dyck et al. (2008) have revised their analysis. In this work, they propose that NE Cree has final foot extrametricality instead of final syllable extrametricality and exceptional trochaic feet.

(10) Examples of degenerate feet (examples from Dyck et al. 2006:5)

a.	<u>miht</u>	(<u>L</u>)	*firewood*
b.	<u>pit</u>	(<u>L</u>)	*soon*

3.2.1.5. Direction of Footing

Hayes (1995) claims that iambic languages are universally built from left to right. Contradicting this claim, Dyck et al. (2006) state that footing is right-to-left in NE Cree, as represented in the examples provided above. They however do not discuss this theoretical issue.

3.2.1.6. Extrametricality

The final syllable in NE Cree is extrametrical. Since extrametricality is non-exhaustive (Hayes 1995:48), it is blocked in monosyllabic words, as it would render the word unstressable. In such cases degenerate feet are allowed, as discussed in section 3.2.1.4.

3.2.1.7. End Rule

Based on the data presented in this section, there is evidence that End Rule right assigns main stress in NE Cree. This is made evident by the fact that stress occurs closer to the right edge than to the left edge in multisyllabic words, as shown below.

(11) Evidence for End Rule right (examples from Dyck et al. 2006:9)

a.	pâ.chi.<u>si</u>.kin	*gun, rifle*
b.	ti.pâ.chi.<u>mu</u>.win	*story*

The metrical parameters discussed in the section are used to derive stress for the word meaning 'story'. The metrical parameters described thus far derive the correct stress placement for NE Cree, in this and most cases.

(12) Using the assigned metrical parameters to derive stress

End Rule				*	
Foot level		*		*	
Syllable level	(*	*)	(*	*)	<*>
	ti	pâ	chi	mu	win

3.2.2. Alternatives offered by Wood's (2006) Analysis

Wood (2006) provides a slightly different analysis of NE Cree. Starting with the description above, I discuss three areas in which Wood (2006) takes a different approach: direction of footing, extrametricality and degenerate feet.

Firstly, Wood (2006) claims that stress in NE Cree is assigned from left-to-right. He does not provide evidence for this. He cites Hayes' (1995) claim that all iambic languages are built from left-to-right, and indicates that this direction of footing predicts the correct stress placement in his transcriptions. As I discussed in section 3.2.1.5, Dyck et al. (2006) choose right-to-left footing and do not comment on Hayes' (1995) claim. This theoretical issue is discussed in section 4.4.3, alongside explicit evidence for right-to-left footing in NE Cree.

A second difference in Wood's (2006) analysis relates to his treatment of apparent trochaic feet in a portion of the data. Dyck et al. (2006) propose that forms like those given in (8) are built with a trochaic foot to avoid homophony. In contrast to this, Wood (2006) proposes an explanation based on historical facts. He claims that NE Cree has maintained an extrametrical foot in some lexical forms. The motivation for such an extrametrical foot comes from the fact that Southern East (SE) Cree, a closely related dialect, consistently displays foot extrametricality (Brittain 2000). Furthermore, Wood (2006) also notes that several other, closely-related Algonquian languages have extrametrical feet, including Passamaquoddy and Ojibwa. This proposal, which is based on independent motivation, as opposed to that of Dyck et al. (2006), which can be criticized for lacking such motivation, accounts for the exceptional data discussed by Dyck et al. (2006), as illustrated below.

(13) Comparing two analyses for exceptional stress patterns in NE Cree

	Dyck et al.	Wood	
mis.chi.shin	(LL)<L>	(L)<LL>	*shoe*
mi.ku.shân	(LL)<H>	(L)<LH>	*feast*

Based on this analysis, the exceptional stress patterns observed in the data are interpreted as remnants from the metrical system of an older state of East Cree, rather than as an innovation to avoid homophony, as proposed by Dyck et al. (2006). As a rejoinder, it must be noted that Wood's (2006) analysis does not exclude the possibility that the extrametrical foot remains in a number of forms for the same reason, suggesting that perhaps NE Cree retained it in these forms to avoid homophony.

Related to this issue, a third dissimilarity emerges between the two analyses. This issue, which pertains to the status of degenerate feet, is also illustrated in (13) above. In order to have an extrametrical foot in these trisyllabic words, Wood's (2006) analysis imposes fewer restrictions on degenerate feet. Indeed, in the analysis by Dyck et al. (2006), degenerate feet may only occur in monosyllabic words consisting of one light syllable. In Wood's (2006) analysis, a degenerate foot can also occur when it is the only metrically visible syllable in a word, as illustrated in his parsing of the lexical items in (13). Note that this difference between the two analyses is not crucial since both allow for degenerate feet in the language. Because extrametrical syllables or feet are irrelevant for stress assignment purposes, the difference in where a degenerate foot is allowed according to either analysis is merely predicted from the other parameter settings proposed, both of which allow for degenerate feet.

4. Further Investigation into NE Cree Stress

In the previous section, I outlined the metrical analyses of NE Cree based on Dyck et al. (2006). Most parameter settings proposed by Dyck et al. (2006) have been supported through their data, however, there are some areas which may not be theoretically sound. These issues revolve around the treatment of direction of footing and foot headedness.

Firstly, Hayes (1995) claims that all iambic languages build feet from left-to-right. This issue is not addressed by Dyck et al. (2006). If NE Cree does in fact build feet from right to left, it is important to provide evidence to support this claim.

Secondly, Dyck et al. (2006) posit a syllabic trochee in exceptional forms with antepenultimate stress which, based on the parameters, should display penultimate stress. Wood (2006) explains these exceptional examples through positing extrametrical feet. Since, in his analysis, feet are built from left to right, it is difficult to predict whether an extrametrical foot will also account for the exceptional cases in Dyck et al.'s analysis.

Both of these issues are addressed in the current analysis of NE Cree. The metrical parameter settings proposed by Dyck et al. (2006), shown below in (14) are also the foundation for my own analysis, and account for stress placement in most of the data. The unexceptional data are outlined with further description in 4.1. There are however, principled exceptions, which are accounted for in 4.2.

(14) Metrical parameters for NE Cree (current analysis)

a. **Foot Domain:** Bounded; Maximally Binary
b. **Quantity Sensitive:** Yes
c. **Degenerate Feet:** No
d. **Headedness:** Right-headed
e. **Direction of Footing:** Right-to-left
f. **Extrametricality:** Yes, the final syllable is extrametrical[7]
g. **End Rule:** Right

The data used to support the above parameter settings come from my analysis of the data produced by consultant DB. Dyck et al. (2006) noted some difference between coastal and inland speakers of NE Cree. Since the acquisition data in the next chapter come from a inland speaking child, DB's stress system is expected to provide a more representative version of the target system.

4.1. Unexceptional Data

4.1.1. Disyllabic Words

The disyllabic words in the data do not provide much information with regards to the metrical parameters used to derive stress. They do, however, illustrate where extrametricality is blocked, and where it is allowed. In words where a final extrametrical syllable would leave behind a light syllable, extrametricality is blocked, as shown in (15).

7 Although I propose an extrametrical syllable in the analysis, it should be noted that extrametricality is lexically determined. As discussed later in this chapter, a selection of words have foot extrametricality. Furthermore, another subset of words have no extrametricality. There are no words with final stress in the current corpus, however, they will be discussed in chapter 4 in light of the child corpus.

(15) Extrametricality is blocked: (LH) and (LL) words

	Orthography	IPA	Translation
a.	asâm	ə'sæm	*snow shoe*
b.	pishiu	pɪ̥'ʃo	*lynx*
c.	kushtim	kɪ̥ʃ'dʌm	*s/he fears it*

In these examples, the initial syllable is light and thus requires the presence of a second syllable to build a well-formed (non-degenerate) foot. These data also suggest that NE Cree disallows degenerate feet.

In cases where a final extrametrical syllable leaves behind a heavy syllable (i.e. in NE Cree a syllable with a long vowel, or an off-glide), extrametricality is allowed as one heavy syllable constitutes a well-formed foot. Examples are shown below (<S> represents a final extrametrical syllable).

(16) Extrametricality allowed: (H)<S> words

	Orthography	IPA	Translation
a.	pâyikw	'bajɪ̥kʷ	*one*
b.	yûskâw	'yuskaw	*soft*
c.	kânchî	'kæntʃi	*sweater*

4.1.2. Trisyllabic Words

The examples below provide evidence for the metrical parameters posited in the current analysis. The final syllable is never stressed and may be devoiced or deleted, and the penult consistently receives stress, indicating that feet are right headed.

(17) Headedness: (LL)<S> words

	Orthography	IPA	Translation
a.	achihkush	ɪ'dʒʊk_ʃ	*star*
b.	akuchin	a'gʊdʒɪn	*it (anim) is hanging up*
c.	akunim	a'gunʌm	*s/he holds onto it*
d.	akutin	ɛ'kudɪn	*it is stuck to something*
e.	asinî	ə'səni	*stone*
f.	atimuch	ɛ'dom_tʃ	*dogs*
g.	atipis	_'tɪp_s	*snow shoe netting*
h.	ayikich	i'jɛkɪtʃ	*frogs*
i.	ishkutâu	iʃ'kudaw	*fire*
j.	ispikun	ɪ̥'spəgʊn	*taste*
k.	itikun	_'tɪgʊn	*there is*
l.	muskumî	mɪs'kumi̯	*ice*
m.	pishiwich	p_'ʃowɪ̯tʃ	*lynxes*
n.	uchimâu	ʊ'dzɪmaw	*boss*
o.	utinâw	ʊ'dn̩ʔaw	*s/he takes him/her/it (anim.)*
p.	utinim	ʊʔdn̩õm	*s/he takes it*
q.	utinim	ʊʔdn̩õm	*host*
r.	chishtuhkin	tʃɪ̥ʃ'tʊʰkɪn	*door*

These are all examples of words in which the visible portion of the word is made up of

8 The underscore ( ) represents a deleted vowel. Vowel deletion optionally occurs on light vowels in metrically weak positions. For further research on vowel deletion see Dyck et al. (2008).

light syllables, and therefore syllable weight is not a factor. The following examples in (18) have stressed, heavy penults. Stress is also predicted for these forms under an iambic foot analysis.

(18) Heavy penults: (H)(H)<S> or (LH)<S>

	Orthography	IPA	Translation
a.	kâhkâchiu	kæʰˈkædʒo̰	*raven*
b.	nâpâshish	næˈbæʃ_ʰ	*boy*
c.	ishkwâshish	ɪsˈɡɔʃɪ̥ʃ	*girl*

As illustrated above, in NE Cree, if the penult is a historically long vowel, it is stressed. However, if the penult is light and the antepenultimate syllable is heavy, the antepenultimate syllable will receive main stress. This is illustrated below in (19). These examples provide evidence for quantity sensitivity: the language prevents the building of (HL) iambs In such cases, stress occurs on the heavy antepenult, and the light penult is left unfooted, which yields a (H)L<S> metrical structure for these words. As opposed to this, if NE Cree were quantity insensitive, stress would fall on the penultimate syllable.

(19) Quantity Sensitivity: (<u>H</u>)L<S>

	Orthography	IPA	Translation
a.	âmihkwân	'æm_^{h}kɒn	*spoon*
b.	âshimwâkw	'æʃɪmɑːk̥ʷ	*red-throated loon*
c.	âtisim	'æt_sɔm	*s/he dyes it*
d.	mîchiwahp	'midzuwap	*tent*
e.	mûhkumân	'mu^{h}kumi̯	*ice*
f.	nîpisi	'nip_si	*willow*
g.	nûtinâu	'nud_n̩ʔaw	*to catch/take someone*
h.	pâyiku	'paj_go̯	*one person*
i.	wâpushuch	'wap_sʊ̥tʃ	*rabbits*
j.	wâpuyân	'wabʊjæn	*blanket*
k.	îtinâu	'iʔɪna̰w	*how he holds it*
l.	îtinim	'iʔɛnom	*hold it like so*
m.	mâskiniu	'mæskɪno	*road*
n.	mûshkamî	'muʃgɪmi̯	*broth*
o.	pâyikun	'baj_gʊn	*one thing*

4.1.3. Four Syllable Words

Thus far, from the disyllabic and trisyllabic data, I have proposed that NE Cree is a quantity sensitive iambic language that has an extrametrical syllable, and does not allow degenerate feet. The word forms made up of four syllables provide further insight into this language's metrical structure, as they illustrate the direction of footing as well as the End Rule.

As discussed earlier in this section, Dyck et al. (2006) posit right-to-left footing without explicitly discussing evidence for this direction of footing. In (20) below, each word is made up of a series of light syllables, and in each of these forms the penult receives main stress. If feet were built from left to right, stress should fall on the antepenultimate syllable.

(20) Direction of footing: L(LL̲)<S>

	Orthography	IPA	Translation
a.	anikuchâsh	æniˈgudʒɛɩʃ	*squirrel*
b.	amishkushish	æmɪ̥ʃˈgʊʃ_ʰ	*beaver kit*
c.	uhpisikin	ʊ̥p_ˈsɪgɪn	*baking powder*
d.	nituhkuyin	n̩tʰʷˈkʊjɪn	*doctor*
e.	ashpishimun	ɛpɪ̥ˈʃʌmʊn	*mattress*
f.	mishtikuwit	mɪʃətˈgʊwət	*wooden box/trunk*
g.	nichihtimin	n̩ts_ˈtɪmɪn	*I am lazy*

This analysis is thus compatible with that of Dyck et al. (2006), with the addition that it provides explicit evidence for the directionality of foot parsing. In this respect, it contradicts both Wood (2006) and Hayes' (1995) about the universality of left-to-right parsing in iambic systems.

Four syllable words also provide enough information to determine the End Rule of the language—whether the language stresses the rightmost or leftmost stressable syllable.

(21) End Rule: (H)(LL)<S>, (H)(LH)<S>, (H)(H)L<S> and (H)(H)(H)<S>

	Orthography	IPA	Foot structure	Translation
a.	âpihtuwin	æpi̥h'tuʔn̩	(H)(LL)<S>	*half; it is Wednesday*
b.	âyihkunâu	aj_ç̩g'unaw	(H)(LL)<S>	*bannock*
c.	nûchupitân	nudʒɪ'bɪdæn	(H)(LL)<S>	*I pull it*
d.	pâschisikin	basts_'sɪgɪn	(H)(LL)<S>	*gun/rifle*
e.	pîtuhsinân	biʔt_'sʌnæn	(H)(LL)<S>	*ammunition pouch*
f.	shâpuhtiwân	ʃap_^{h}'tuwan	(H)(LL)<S>	*long tents with two doors*
g.	tâhtipuwin	tæ^{h}tɪ'buwn̩	(H)(LL)<S>	*chair*
h.	îtshinâpish	idʒə'næp_ʃ	(H)(LH)<S>	*baby rabbit*
i.	mâmâpisun	mæ'mæp_sʊn	(H)(H)L<S>	*cradle*
j.	nâpâshishich	næ'bæʃ_^{h}ɪtʃ	(H)(H)L<S>	*boys*
k.	pûtâchikin	bu'dadʒəgɪn	(H)(H)L<S>	*mouth organ*
l.	kâhkâchiwich	kæ'kædzuʔʊtʃ	(H)(H)L<S>	*ravens*
m.	tâwâhîkin	tæwa'higɪn	(H)(H)(H)<S>	*drum*

Each of the above words has a minimum of two feet, and in all cases main stress falls on the right most visible foot. This is evidence that End Rule right predicts correct stress placement in NE Cree.

The remaining four syllable words in the data set contain only one visible foot, therefore they do not provide further evidence for direction of footing or the End Rule. However, the proposed parameter settings do predict the correct stress placement in these words as well.

(22) Other four syllable words: (LH)L<S> and L(LH)<S>

	Orthography	IPA	Translation
a.	ishkwâshishich	iʃ'gwɑʃ_ɪ^{h}tʃ	*girls*
b.	utâmihau	ṵdæ'm_a^{h}	*hit him/her/it (anim)*
c.	utâmihu	u'dæm_ʔo	*hit it*
d.	piyâshikin	bi'jɑʃəgin	*duffle sock*
e.	uchimâshish	ʌ̥dʒɪ'mæʃɪ̥ʃ	*supervisor*

4.1.4. Five and Six Syllable Words

There are few five and six syllable words in the data set investigated. The stress for each of the forms below in (23) is also predicted by the metrical parameter settings outlined at the beginning of section 4.

(23) Unexceptional five and six syllable words

	Orthography	IPA	Foot structure	Translation
a.	tâwâhikinich	dawahi'gɪn_tʃ	(H)(H)(LL)<S>	*drums*
b.	tipâchimuwin	dɪbɑdʒə'mʊən	(LH)(LL)<S>	*story*
c.	anikuchâshishich	ænɪgu'dʒæʃɪ̥ʃ_tʃ	(LL)(LH)L<S>	*squirrels*
d.	uchimihtiwâu	ɔdʒɪm_^{h}tuwa̰w	(LL)(LL)<S>	*A tree stump that has been chewed by a beaver.*

4.2. Exceptional Data

The metrical parameter settings outlined in the section account for 75/97 (77%) of the forms from the consultant DB. There are 22 forms which cannot be accounted for with the metrical parameters proposed. In Section 3.2, I discussed how Dyck et al. (2006) and Wood (2006) accounted for the exceptional data found in their respective analyses. In order to account for exceptional data, Dyck et al. (2006) propose that NE Cree forms syllabic trochees in exceptional cases, while Wood (2006) proposes that examples, such as those given below, are the result of final foot extrametricality.

(24) Examples of syllabic trochees (examples from Dyck et al. 2006:10)

		Dyck et al.'s analysis	Wood's analysis	
a.	mis.chi.shin	(LL)<L>	(L)<LL>	'shoe'
b.	mi.ku.shân	(LL)<H>	(L)<LH>	'feast'

Based on the 22 exceptional cases found in my data, 16 can be accounted for with Dyck et al.'s (2006) analysis. However, a modified version of Wood's (2006) analysis accounts for a larger percentage of the data. Assuming that footing is right-to-left, as opposed to Wood's (2006) left-to-right footing, introducing an extrametrical foot accounts for 18 of these exceptional cases. The foot parsing I propose for most of the exceptional forms is given below.

(25) Exceptional extrametrical foot

	Orthography	IPA	Foot structure	Translation
a.	apishîsh	'ɛp_ʃiʃ	(L)<LL>	*little*
b.	ituhim	'ɪt_hɑm	(L)<LL>	*s/he points at it*
c.	mischisin	'mɪst_sɪn	(L)<LL>	*shoe*
d.	uhpiham	'uhp_ʰɑm	(L)<LL>	*s/he lifts it with an instrument*
e.	mihkushân	'mʊʰk_ʃæn	(L)<LL>	*food eaten at a feast*
f.	pichiwiyân	pɪ'dzʊ_jæn	(LL)<LH>	*cloth*
g.	pîsimuhkân	'pisʊmçkæn	(H)L<LH>	*clock*
h.	pûhtinikin	'pʊʰtɪnəgɪn	(H)L<LL>	*thimble*
i.	kishkinichish	k_ʃ'gɪnədʒiʃ	(LL)<LL>	*rock ptarmigan*
j.	ukuhtushkui	ɔ'gʊt_ʃgʊj	(LL)<LH>	*his/her throat*
k.	nipichistikw	nɪ'bɪtʃ_stɪkʷ̥	(LL)<LL>	*floor*
l.	nituchikin	ən'dʊdʒəgɪn	(LL)<LL>	*thermometer*
m.	kishkiwinich	kɪ̥ʃ'guwən_tʃ	(LL)<LL>	*clouds*
n.	mishkumishî	mɪʃ'gʊm_ʃɛ̨	(LL)<LH>	*mountain ash*
o.	ûchipichichau	uʃə'pɪ_tʃaw	(H)(LL)<LH>	*s/he pulls on moosehide*
p.	ushihtimuwau	ʊʃ_'ɪmuɑ	L(LL)<LH>	*s/he makes it for him/her*
q.	tâhtipuwinis	tætə'buwən_	(H)(LL)<LL>	*baby chair*
r.	chiniskumitin	tʃɪn̩'skɔmədn̩	L(LL)<LL>	*thank you*

The above data complicate the earlier proposed degenerate foot parameter. In 4.1, I proposed that degenerate feet are not allowed. Recall that evidence came from disyllabic words in which extrametricality was blocked. In such cases, a degenerate foot was not permitted. Here in (25a-d), however, the only visible part of the word is a light syllable—a degenerate foot.

This phenomenon relates to Hayes' (1995) discussion of degenerate feet. He states that there are two types prohibition on degenerate feet: strong prohibition and weak prohibition (Hayes 1995:87). A language with a strong prohibition will not have monosyllabic words made of a light syllable, whereas a language with a weak prohibition will display such words. In section 2 I found that monosyllabic words made of one light syllable do exist in NE Cree. This reveals that NE Cree is a language with a weak prohibition on degenerate feet. It allows degenerate feet in some cases, the vast majority of them having an additional property (an extrametrical foot) accounting for their behaviours.

The fact that there are sometimes degenerate feet is not limited to the forms with extrametrical feet given in (25). This also arises with some of the disyllabic words in the data set. Earlier in this section, I proposed that extrametricality is blocked in disyllabic words where the visible part of the word would be a degenerate foot. This is true in some cases, however there are three examples in which degenerate feet are permitted.

(26) Exceptional degenerate feet

	Orthography	IPA	Foot structure	Translation
a.	atim	'ɛdʌm	(L)<S>	*dog*
b.	pichiu	'bɪtsoː	(L)<S>	*gum*
c.	ayikw	'ijɪk̥ʷ	(L)<S>	*frog*

Hayes (1995) claims that languages that do not allow degenerate feet often deal with them in an ad hoc fashion. In this respect, NE Cree appears to revoke extrametrical material to prevent degenerate feet but, in some exceptional cases, allow for them.

An analysis that allows extrametrical feet and a weak prohibition on degenerate feet accounts for all but one form in the data from DB, that is for 98.9% of the data. The only form for which the given metrical parameters cannot predict stress placement is given below. This word shows an exceptional pattern which I cannot account for based on any of the parameters utilized above.

(27) An unprincipled example

a. niwîchâwâkinich nəwidʒa̰wa̰ ˈkɪni̥ʃ *my friends*

This example is problematic because it displays stress on the light penultimate syllable, when a heavy syllable precedes it. Since NE Cree is quantity sensitive, stress would be expected to fall on the heavy antepenultimate syllable, but it does not.

4.3. Extrametrical Foot Versus Exceptional Trochaic Footing

Thus far I have discussed Dyck et al. (2006) and Wood's (2006) analyses of NE Cree. Building on this discussion, I proposed the current analysis, which incorporates the metrical parameters offered by Dyck et al. (2006) and the proposal for exceptional data provided by Wood (2006). However, it is important to discuss the motivation for an extrametrical foot over a syllabic trochee. Such motivation comes from cases where positing a trochaic foot would not account for exceptional stress placement, and from historical facts.

As previously mentioned, an extrametrical foot accounts for more of the current exceptional data than a syllabic trochee. Below are examples in the data where an extrametrical foot enables an account of the data but where positing trochaic footing would fail.

(28) Data supporting an extrametrical foot

	Orthography	IPA	Trochaic foot	Extrametrical foot	Translation
a.	pîsimuhkân	ˈpisʊm_çkæn	(H)(LL)<S>*	(H)L<LL>	*clock*
b.	pûhtinikin	ˈpʊ^{h}tɪnəgɪn	(H)(LL)<S>*	(H)L<LL>	*thimble*

As illustrated through these examples, analysing the above word forms with a trochaic foot does not predict the correct stress placement. If there were a trochaic foot, stress would fall on the antepenultimate syllable. However, assuming an extrametrical foot, stress is correctly predicted on the word's initial syllable.

Furthermore, there exists additional historical motivation for the analysis based on foot extrametricality advocated here. As discussed in section 1.2, many Algonquian languages have been analysed as having an extrametrical foot, including NE Cree's closest linguistic relative, SE Cree. This suggests that an earlier version of East Cree had foot extrametricality. Finally, the positing of an extrametrical foot accounts for a slightly larger portion of the data discussed. I therefore find this a superior analysis for describing the exceptional data found in my corpus.

5. Conclusion

In this chapter, I have provided empirical evidence for the acoustic cues which mark stress in NE Cree. Additionally, I have discussed the metrical parameter settings which determine stress placement in this language. I claim that the metrical parameter settings outlined in section 4 provide the best analysis of this language in terms of the predictions it makes, despite some exceptional cases, the vast majority of which behave together as one general exception. Now that I have established the acoustic and metrical properties of adult NE Cree, I can proceed to discuss their acquisition in the case study detailed in the next chapter.

Chapter 4 — The Acquisition of Metrical Structure: A Case Study

1. Introduction

In this chapter, I discuss how the stress system of NE Cree develops in the speech of one young female child learner of this language code-named A1. In section 2, based on A1's stress productions at ages 2;02.02, 2;08.28, 3;04.09, 3;06.23 and 4;01.30, I provide a description of her use of stress and how it develops. In order to determine patterns in A1's metrical development, I outline her rate of accuracy and detail her stress errors over time. In section 3 I focus on the acquisition of extrametricality in NE Cree. I then discuss, in section 4, A1's stress patterns in light of a body of previous research on metrical development in other languages. Concluding remarks are offered in section 5.

2. The Development of Stress in A1's Productions

In this section, I provide a description of A1's stress pattern productions over time. The number of forms attempted and the number of errors made at each age in the corpus are given below in (1). The rightmost column provides the percentage of errors in stress production at each age. As the table in (1) illustrates, A1's overall accuracy rate at producing target stress patterns generally improves over time.

(1) Stress accuracy over time

Age	Attempts	Errors	Target-like stress
2;02.02	45	15	66.7%
2;08.28	93	21	77.4%
3;04.09	71	30	57.3%
3;06.23	85	18	81.8%
4;01.30	83	10	87.9%

Her general accuracy in stress production evolves from 66.7% in the first recording to 87.9% in the final recording, approximately two years later. There is however a notable drop in performance at age 3;04.09, where the child displays only a 57.3% accuracy rate, down from 77.4% at 2;08.28. Interestingly, this drop in performance co-occurs with a sharp increase in her Mean Length of Utterance (MLU). The MLU was calculated by enumerating the number of words A1 produced in each utterance of the recorded session, and then calculating the mean number of words per utterance for every session. A word in this case is defined as an independent form in the orthography. Since NE Cree is polysynthetic, an increase of .66 of a word is taken as a more significant increase than it would be in a language such as English. A1's MLU for each session are given in (2).

(2) A1's Mean Length of Utterance (MLU)

Age	Mean Length of Utterance
2;02.02	1.3
2;08.28	1.31
3;04.09	1.78
3;06.23	1.81
4;01.30	1.96

As the table in (2) highlights, there is a relatively large increase in A1's MLU at age 3;04.09. While more research would be needed to characterize the exact nature of A1's increased productivity at that age,[9] it is possible that the additional processing involved in producing longer utterances has partially hindered her ability to cope with stress information at that moment. This issue, which lies beyond the scope of this thesis, is set

9 The sharp increase in A1's MLU at age 3;04.09 could be attributed to factors such as additional vocabulary or better handling of the morphosyntax of the language.

aside as a topic for future research.

The accuracy of A1's stress placement is also dependent on stress position within the word. In the following subsections I discuss A1's accuracy with final, penultimate and antepenultimate stress respectively.

2.1. The Development of Word-Final Stress

One of the most striking observations to be made about A1's stress productions is that she almost consistently produces correct stress when it is on the final syllable in the target. Although the analysis of the metrical structure of NE Cree given in the previous chapter posits the final syllable as extrametrical, some examples with exceptional final stress were also found in the child corpus. As shown in (3), only one example of incorrect placement of final stress is attested in the entire A1 corpus, and this one example is from a relatively early stage in her development.

(3) Percentage of accuracy in words with final stress

Age	Attempts	Errors	Target-like stress
2;02.02	14	1	92.9%
2;08.28	47	0	100%
3;04.09	14	0	100%
3;06.23	16	0	100%
4;01.30	32	0	100%

Examples of target-like final stress in A1's speech are provided in (4).

(4) A1's correct production of final stress at age 2;02.2 and 2;08.28

Orthography	Translation	Target IPA	IPA Actual	Metrical Structure	Age
chipiha	*close it*	tə'ba	ə'ba	L(LL)	2;02.2
ihtâyû	*s/he is there*	da'jo	dæ'na	(LH)(H)	2;02.2
châkwân	*someone who...*	tə'gʌn	dʌ'no	(H)(H)	2;02.2
tâpâ	*no*	də'bæ	'bʊ	(H)(H)	2;08.28
pichihtin	*it falls down*	bɪts'tɪn	'dʒʊn	L(LL)	2;08.28

Based on her excellent performance with such forms across all sessions, I infer that A1 has acquired word final stress at an early age.

2.2. The Development of Penultimate Stress

Although the statistics presented in (3) strongly support the view that A1 has acquired word final stress early on, her attempts at forms with penultimate stress indicate that these latter forms present a greater learning challenge. As shown in (5) below, A1's overall accuracy with penultimate stress is generally much lower.

(5) Percentage of accuracy in words with penultimate stress

Age	Attempts	Errors	Target-like stress
2;02.02	24	9	62.5%
2;08.28	35	14	60%
3;04.09	41	19	53.7%
3;06.23	33	11	66.7%
4;01.30	39	6	84.6%

At age 2;02.02 A1 accurately produces penultimate stress at a rate of only 62.5%. By age 4;01.30, this rate increases to 84.6%.This increase in accuracy suggests that A1 has only progressively, but not quite completely, acquired penultimate stress over this relatively long period of time (over 2 years). Examples of target-like penultimate stress production from ages 2;02.02 and 2;08.28 are provided in (6).

(6) A1's correct production of penultimate stress at age 2;02.2 and 2;28.8

Orthography	Target Structure	Target IPA	IPA Actual	Translation	Age
kûhkûm	(H)<H>	'gʊkum	'gʌgo	*grandma*	2;02.2
minihkwâkin	(LH)<L>	mɪn_ 'gɑgɪn	_ _'dodu	*cup*	2;02.2
mânâtih	(H)(H)<L>	mə'nʌt_^{h}	wɪ'nɛt_^{h}	*over there*	2;08.28
âkush	(H)<L>	'agos	'ɛdʌ	*it's all right*	2;08.28

Furthermore, when A1's realization of target penultimate stress is incorrect she most frequently shifts stress rightward to the final syllable. The number of erroneous penultimate stresses shifted to the final syllable are given below in (7).

(7) The percentage of penultimate stress shifted to the final syllable

Age	Attempts	Errors	Shifted to final stress	% final stress shift
2;02.2	24	9	9	100%
2;08.28	35	14	14	100%
3;04.09	41	19	17	89.5%
3;06.23	33	11	10	90.1%
4;01.30	39	6	6	100%

Examples of words where A1 shifts penultimate stress to the final syllable are provided below.

(8) Examples of penultimate stress shifted to the final syllable

Orthography	Target Structure	Target IPA	Actual Structure	IPA Actual	Translation	Age
iyâwâu	(L<u>H</u>)<H>	_'jawo	(LH)(<u>H</u>)	_ʔo'ʔo	*have it*	2;02.2
chûchû	(<u>H</u>)<H>	'dʒodʒo	(H)(<u>H</u>)	do'dʒo	*breast feed*	2;02.2/ 2;08.28
nâtâ	(<u>H</u>)<H>	'nadɑ	(H)(<u>H</u>)	dɛp'tɛ̃	*over there*	2;02.2/ 2;08.28
kûhkûm	(<u>H</u>)<H>	'gʊkum	(H)(<u>H</u>)	gʊ'go	*grandma*	2;02.2
pîpîsh	(<u>H</u>)<H>	'bibiʃ	(H)(<u>H</u>)	bi'biʃ	*little baby*	2;08.28
chîhtû	(<u>H</u>)<H>	'dʒido	(H)(<u>H</u>)	dʒi'jo	*it works*	2;08.28
kîkî	(<u>H</u>)<H>	'gigi	(H)(<u>H</u>)	gɪ'gi	*it hurts*	2;08.28
mîmîu	(<u>H</u>)<H>	'mimjaw	(H)(<u>H</u>)	mi'mi	*sleep*	2;08.28

Three counter-examples are however attested in which stress is shifted leftward, to the antepenultimate positions. These forms are listed in (9).

(9) Target penultimate stress not realized on the penultimate or final syllable.

Orthography	IPA Target	IPA Actual	Translation	Age
mâuyâyû	ma'jɛjo	'mahe_	*This one belongs to*	3;04.09
nikimtâu	nɛ'gomdaw	'ne_daw	*Let's sing!*	3;04.09
âihkunáu	aj'konaw	'mikonaw	*bread*	3;06.23

These words are exceptional. There is however nothing in the overall shape of their target or actual forms that can possibly help expllaining their exceptionality. The low frequency of these words should nonetheless not detract us away from the clear error pattern illustrated in (7) and (8) above.

2.3. The Development of Antepenultimate Stress

In the following subsection, I examine A1's use of antepenultimate stress. The numbers presented in (10) highlight that A1's accuracy with antepenultimate stress is initially very low but generally improves over time.

(10) Percentage of accuracy in words with antepenultimate stress

Age	Attempts	Number of errors	% target-like stress
2;02.02	7	6	14.3%
2;08.28	12	6	50%
3;04.09	16	12	25%
3;06.23	32	5	84.4%
4;01.30	12	3	75%

Initially, at age 2;02.02 A1 only produces 1 of 7 such stress patterns correctly. In the two final sessions, she attains target antepenultimate stress in the majority of the forms.

In the above table there also appears to be a sharp increase in performance at age 2;08.28 which drops again at age 3;04.09. This fluctuation can be attributed to two factors. Firstly, the increase in accuracy at age 2;08.28 can be partially attributed to the fact that 3 of the 6 correct productions of antepenultimate stress are attempts at the same lexical item: *pwâchikî*, meaning 'boogieman'. Also, the seemingly large drop in A1's accuracy at age 3;04.09 appears to coincide with the generally poor performance in stress productions for this session, which, as suggested earlier (section 2), may be attributable to the noticeable increase in MLU. Examples of A1's target-like productions of antepenultimate stress are provided in (11).

(11) A1's correct usage of antepenultimate stress at age 2;02.2 and 2;08.28

Orthography	Target Structure	Target IPA	IPA Actual	Translation	Age
âkutâh	(<u>H</u>)L<H>	'agoda	'ɛ_dʌ	*right here*	2;02.2
anitâ	(<u>L</u>)<LH>	'ɪn_də	'ʊn_mə	*over there*	2;08.28
îtuhtâu	(<u>H</u>)L<H>	'ɪdɛno	'gidʌ	*going*	2;08.28
pwâchikî	(<u>H</u>)L<H>	'bʌdʒəgi	'dʒogjɪ	*boogieman*	2;08.28

As I pointed out in section 2.2, A1 often shifts penultimate stress to the final syllable. This is also true of antepenultimate stress, as illustrated in (12).

(12) The percentage of antepenultimate stresses shifted to the final syllable

Age	Attempts	Errors	Shift to final stress	% final stress shift
2;02.2	7	6	6	100%
2;08.28	12	7	7	100%
3;04.09	16	12	12	100%
3;06.23	32	5	4	80%
4;01.30	12	3	3	100%

Forms in which A1 shifts stress to the final syllable are listed below in (13).

(13) Examples of antepenultimate stress shifted to the final syllable

Orthography	Target Structure	Target IPA	Target Structure	IPA Actual	Translation	Age
mânitâh	(H)L<H>	'mæn_də	(H)L<H>	_ən'dʌ	*like that*	2;02.2
âkutâh	(H)L<H>	'agoda	(H)L<H>	ɛ_'de	*right there*	2;02.2
pwâchikî	(H)L<H>	'bʌdʒəgi	(H)L<H>	dib_'di	*boogieman*	2;02.2
ituhtâu	(L)<LH>	'i_dɛn	(L)<LH>	dæ_'da	*it goes*	2;08.28
pîtihwâu	(H)L<H>	'bit_ʰo	(H)L<H>	_ _'do	*put it in pocket*	2;08.28
minitûsh	(L)<LH>	'min_doʃ	(L)<LH>	mi_'noʃ	*insect*	2;08.28

As can be observed at 3;06.23 (see below), one example is also attested where A1 shifts stress to the penultimate syllable.

(14) Example of target antepenultimate stress shifted to the penultimate syllable

Orthography	IPA Target	IPA Actual	Translation	Age
anachî	'ɪn_dʒi	_'nədʒi	*them*	3;06.23

In chapter 3, section 3.2. I discussed the presence of an extrametrical foot on a subset of exceptional forms in NE Cree. The form *anachî* in (14) is underlyingly trisyllabic with stress on the antepenultimate syllable in the target form. As such, based on the analysis presented in chapter 3, *anachî* is an exceptional form which has an extrametrical foot in the target form. Since A1 produces penultimate stress on this word, it appears that she has acquired extrametricality for this form, but has not applied the proper domain (she uses an extrametrical syllable instead of an extrametrical foot).

In general, A1's stress errors illustrate that she has not learned extrametricality as a systematic rule. Instead, the data suggest that A1 has learned extrametricality on a word by word basis, as evidenced by the fact that she has non-word-final stress in some words at age 2;02.2 and 2;08.28 but not in others. The preferred method for tracking the acquisition of extrametricality in specific lexical forms would be to look at the production of the same lexical items over time. However, since the data under investigation come from a naturalistic study, such specific forms were never artificially elicited. As a result, only a few examples of the same lexical items across sessions are available. These items will be discussed in the next section.

3. The Acquisition of Extrametricality in NE Cree

Thus far, I have illustrated that A1's accuracy with stress production improves over time. Based on A1's early acquisition of word-final stress, and her erroneous productions of words with penultimate and antepenultimate stress, I conclude that A1's default system places stress on the final syllable. This pattern suggests that A1 has not acquired extrametricality as a systematic rule, but instead on a word by word basis. Since A1 has difficulty with the extrametricality parameter, I consider it in more detail in this section. Firstly, in section 3.1, I provide a more in depth description of extrametricality in target NE Cree, building on the metrical analysis presented in section 4 of chapter 3. An account of A1's acquisition of this parameter over time is offered in section 3.2.

3.1. Accounting for Final Stress in NE Cree

In chapter 3, I argued that NE Cree generally has, in its adult forms, final syllable extrametricality. The adult corpus used to describe the metrical system of NE Cree contains very few words with final stress, providing full support for an analysis with an extrametrical syllable. However, based on the current investigation of A1's productions, several cases of final stress were identified in the target language. In fact, 33.7%

(127/377) of the child corpus is composed of target words which, on the surface, appear to have final stress. Since this relatively high frequency of words with final stress is at least in appearance consequential to the analysis of extrametricality presented in chapter 4, it must be addressed.

Firstly, many of these apparent final stresses are in fact penults in their underlying forms. A1 frequently uses demonstrative and question pronouns, many of which are marked with obviative endings (*-h*). This obviative marker synchronically represents what was historically a short *-a* vowel. The obviative *-h*, which may or may not appear in the orthography, has been analysed as a final extrametrical syllable (Wood 2006, Dyck et al. 2006). This analysis provides an account for many words which, on the surface, appear to have final stress.

(15) Pronouns where *-h* holds the extrametrical syllable position

Orthography	Metrical Structure	Target IPA	Translation
mânâ(h)	(H)(H)<h>	mɔ'na	*there (yonder) is*
mâutâ(h)	(H)(H)<h>	mo'da	*here is*
mânâtâ(h)	(H)(H)(H)<h>	mɔna'da	*there (yonder) is*

In the examples in (15), stress appears to be final on the surface, however, taking into account the fact that obviative marker *-h* can be analysed as occupying a syllabic position, stress in these words can in fact be analysed as phonologically penultimate.

A second reason for the relatively large proportion of stress-final words attested in this corpus relates the fact that A1 primarily attempts disyllabic words, especially in the first two sessions under investigation. As detailed in the previous chapter, NE Cree generally disallows degenerate feet. As a result, many words surface with final stress, as illustrated by the examples below.

(16) Disyllabic words with final stress due to the constraint on degenerate feet[10]

Orthography	Metrical Structure	Target IPA	Translation
ihtâu	(LH)	_'daw	*s/he is (loc.)*
pichiu	(LL)	bɪ'dzo	*gum*
atim	(LL)	ɪ'dʌm	*dog*
nichî	(LH)	ən'dʒi	*I was talking*
apit	(LL)	[ʌ]'bɪt	*sitting*
awân	(LH)	[a]'wʌn	*who*
nimui	(LH)	[nə]'mi	*no/not*
ashtâch	(LH)	_ʃ'tædʒ	*it is sitting over there*

Finally, the occurrence of a few stress-final target words in the data cannot be attributed to the presence of the final obviative *-h* or to the constraint on degenerate feet. These target stress final words are given below.

10 Note that square brackets indicate an optionally deleted syllable. These syllables are present in some pronunciations, and not in others.

(17) Words with target final stress[11]

Orthography	Translation	Target IPA	Metrical Structure
âpiha	*open it*	əˈb_a	(H)(LL)
chipiha	*close it*	təˈb_a	L(LL)
ihtâyû	*s/he is there*	_ daˈjo	(LH)(H)
châkwân	*someone who...*	təˈgʌn	(H)(H)
tâpâ	*no*	dəˈbæ	(H)(H)
pichihtin	*it falls down*	bɪts_ˈtɪn	L(LL)
nânâ	*food*	naˈna	(H)(H)
wâpâu	*it is white*	waˈbaw	(H)(H)
wiyipâu	*it is black*	wi_ˈbaw	(LL)(H)
yâkâw	*look out!*	jæˈgɑ	(H)(H)
âhtiyin	*you do*	ajˈt_in	(H)(LL)
chiwâpihtân	*you see*	dʒ_o_ˈhæn	(LH)(LH)

All of the lexical items in (17) have final stress and, as a result, cannot be analysed with final extrametricality. This exceptionality cannot be attributed to the presence of the obviative suffix nor to any constraint on degenerate feet. This further suggests that extrametricality is, at least to some extent, lexically determined in NE Cree. Furthermore, extrametricality in NE Cree does not pattern in the same manner as in other languages such as English. In English, for example, nouns have an extrametrical syllable (Hayes 1995), while in NE Cree, extrametricality is not predictable based on word class. This unsystematic use of an extrametrical syllable (and sometimes an extrametrical foot, as discussed in the chapter 3, section 4.2), has the effect of creating a moving target for the

11 It is possible that some of these word forms have lost a final abstract syllable. A comparison of the forms in (17) with closely related dialects would help answer this question and perhaps reduce the number of unexplainable final stressed syllables. Regardless of whether or not these forms have historical final syllables that have been deleted, this type of diachronic abstraction is not available to the child learning the language. As a result, this question is left for future research.

Cree learning child, who has to not only infer the stress parameters of the language, but also memorize a series of exceptional forms. In the face of the evidence available, an analysis assuming iambic footing and lexically determined extrametricality appears to offer a phonologically more straightforward system than one relying on two foot forms (trochees for non-final and iambs for final stress). Indeed, while languages with lexical extrametricality are well documented in the literature (see Hayes 1995:59), languages with different foot forms are relatively rare, with only a couple of documented cases such as Yidiny (see Dixon 1977; Halle and Vergnaud 1978; Hayes 1995) and Guahibo (Kondo 2001). The current proposal for optional extrametricality is further supported by patterns in A1's stress acquisition. A1 clearly shows a generalized preference for final stress from an early age, and perfects non-final stress later in development. This strongly suggests that A1 understands the regularity of her metrical system (i.e. iambic footing) but does not fully grasp the more abstract—and variable—part of her system (i.e. extrametricality), until later in development.

3.2. The Acquisition of Extrametricality: A Lexical Analysis

In order to look at the acquisition of extrametricality, I now consider all target words that have non-final stress and that are repeated over two or more sessions. The table in (18) contains forms that have penultimate stress in the target form and shows how they are produced by A1 over time.

(18) Production of words with target penultimate stress

Orthography	Translation	IPA Target	IPA Actual	Actual Stress	Age
a. nâtâ	*Over there*	'nadɑ	dɛp'tɛ̃	Final	2;02.2
			da'da	Final	2;08.28
			mɪ'da	Final	2;08.28
b. pîpîsh	*little baby*	'bibiʃ	wi'biʃ	Final	2;08.28
			bi'biʃ	Final	2;08.28
			bi'bi	Final	2;08.28
			bi'biʃ	Final	2;08.28
			ə'biʃ	Final	2;08.28
			'bibis	Penult	3;04.09
			bit'biʃ	Final	3;04.09
			'mibiʃ	Penult	3;04.09
c. pâyikutûshtâu[12]	*one week*	'baj_ko'duʃdaw	baj_ go_ 'daw	Final	3;04.09
			baj_go_'daw	Final	3;04.09
			baj_ _ _ʃ'da	Final	3;06.23
			waj'_ _ʃutdaw	Penult	3;06.23
d. ashtutin	*hat*	_ʃ'tudən	_ _'dɪn	Final	3;06.23
			_ʃ'tudə	Penult	4;01.30
			_ʃs'tudən	Penult	4;01.30

For the four lexical items in (18), I find evidence that A1 is gradually learning the stress for words with extrametricality. It is my contention that A1 learns to accurately stress three out of four of the above words; however, she often reverts to word-final stress in the process. On the first lexical item (18a), *nâtâ* ['nadɑ], A1 initially produces word final stress with no improvement in the next session. However, in the other three examples

12 *pâyik-u-tûshtâu* is a compound and has two stresses.

((18b), *pîpîsh* ['bibiʃ]; (18c), *pâyikutûshtâu* [bajko'duʃdaw] and (18d) *ashtutin* [ʃ'tudən]), A1 initially begins by placing stress on the final syllable but later corrects her stress placement by stressing the penultimate syllable. Even when A1 appears to have the correct stress placement, in the same session she may revert to applying final stress. This is illustrated in example (18b), *pîpîsh* ['bibiʃ], which shows that A1 has correct penultimate stress in two attempts at age 3;04.09, but incorrectly applies final stress on another attempt.

The above examples illustrate that A1's stress accuracy is improving, but that she struggles with some tension between the regularity of her basic stress system and the abstractness imposed by extrametricality for a noticeably long period of time. On the one hand, A1 is learning an iambic (right headed) system which imposes her default final stress placement. On the other hand, she is exposed to a variable extrametricality parameter, which contradicts her default final stress placement. Based on this evidence, A1 initially acquires systematic iambic footing while gradually learning extrametricality on a word by word basis.

Turning now to words with target antepenultimate stress, examples of A1's development of antepenultimate stress over time are given in the table in (19). Note that due to syncope many of these forms appear monosyllabic or disyllabic, however, as discussed in chapter 3, section 3.1.1, the orthography is a considered the underlying representation as syncope is optional in this language.

(19) Production of words with target antepenultimate stress over time

Orthography	Translation	IPA Target	IPA Actual	Actual Stress	Age
a. mânitâh	*like that*	'mæn_ da /'mænəta	ɛn_'dʌ	Final	2;02.02
			ɪn_'dʌ	Final	2;02.02
			mən_'da	Final	3;04.09
			'owɪda	Antepenult	3;04.09
			mʌ_'dʌj	Final	3;04.09
			mənə'da	Final	3;04.09
			'mə_da	Antepenult	3;04.09
			'man_də	Antepenult	3;06.23
			'əmnɪdə	Antepenult	3;06.23
			'man_də	Antepenult	3;06.23
			'bɑtdə	Antepenult	3;06.23
			'un_də	Antepenult	3;06.23
			'ma_də	Antepenult	3;06.23
			'mæ_dæ	Antepenult	3;06.23
			'mɛn_də	Antepenult	3;06.23
			'wun_də	Antepenult	3;06.23
			mæn_də	Antepenult	3;06.23
b. âkutâh	*it's all right*	'agoda	ɛ_'də	Final	2;02.02
			'ɛ_ de	Antepenult	2;02.02
			awa'do	Final	2;02.02
			'ajɟəda	Antepenult	3;04.09
			hago'da	Final	4;01.30
			'ajgəda	Antepenult	4;01.30
c. pwâchikî	*boogieman*	'bʌdʒəgi	_dɪb'di	Final	2;02.02
			_'dʒogjɪ	Antepenult	2;08;28
			'bʌdəgi	Antepenult	2;08.28
			'bʌdʒəgi	Antepenult	2;08.28

Orthography	Translation	IPA Target	IPA Actual	Actual Stress	Age
d. anitâ	*there*	'ɪn_da	'ɪn_mə	Antepenult	2;08.28
			_ _'da	Final	3;04.09
			_ _'ta	Final	3;04.09
			ɪnu'də	Final	3;04.09
			'ɪ_də	Antepenult	3;04.09
			_ _'da	Final	4;01.30
e. aniyâ	*his/hers that is there*	'ɪnija	'ən_ja	Antepenult	2;08.28
			'ajn_jə	Antepenult	4;01.30
f. minitûsh	*insect*	'mɪn_doʃ	mi_ 'noʃ	Final	2;08.28
			'mɪ_ditʰ	Antepenult	3;04.09
g. awâshishich	*children*	_'wɑ_ʃitʃ	_bɛ_'sɪtʃ	Final	3;04.09
			_'wɑ_ʃɪts	Antepenult	3;04.09
			_'wɑ:_ʃɪts	Antepenult	3;04.09
			_wɑ'_ʃɪts	Final	3;04.09
			_'wɑ_ʃʌts	Antepenult	4;01.30
			_'wɑ_ʃɪts	Antepenult	4;01.30

Similar to A1's production of penultimate words discussed in (18), her accuracy with target antepenultimate stressed words fluctuates, but shows overall improvement. The data also demonstrate that A1 can have trouble with particular forms over a long period of time. For example in the above table, the words *âkutâh* ['agoda] (19b) and *anitâ* ['ɪnda] (19d) are produced with incorrect stress even at age 4;01.30. In contrast to this, other forms such as *mânitâh* ['mænda] or ['mænəta] (19a), *pwâchikî* ['bʌdʒəgi] (19c), and *awâshishich* ['wɑʃitʃ] (19g) are produced correctly by that age or earlier.

Overall the antepenultimate data pattern consistently with the penultimate data. These data further support my argument that A1 has accurately acquired the iambic foot form of her language, but learns extrametricality later on a word by word basis.

3.3. Interim Summary

The data outlined thus far in this chapter support the viewpoint that stress is learned as a system, and that its unsystematic components are acquired on a word by word basis. Indeed, the data provide evidence that specific parameters within this system can be lexically determined. A1 has largely acquired the correct metrical parameter settings for her language, however, her difficulty with extrametricality suggests that this parameter is acquired slowly, on a word by word basis. If extrametricality had been learned systematically, like the other the metrical parameter settings in the NE Cree system, A1 would have exhibited other patterns of errors, this time with target words that do not show extrametricality, effectively shifting final target stress to the non-final (presumably penultimate) position. This is not the case. As shown in (18) and (19) she often reverts to final stress, even during recording sessions where she is capable of producing at least some target penultimate and antepenultimate stress. I will now discuss the findings outlined in this section in light of the metrical acquisition of other languages, in the following section.

4. Linking NE Cree to Previous Literature on the Acquisition of Stress

In chapter 2, I provided a survey of the literature on the acquisition of stress in which I discussed both lexical (e.g. Klein 1984) and rule based (e.g. Hochberg 1988a; Allen and Hawkins 1980; Fikkert 1994, 1995; Kehoe 1998) approaches to the acquisition of stress.

The majority of the literature, including the current study, supports a rule based approach to language acquisition. Within this approach, two positions are currently entertained: one being that children initially have default parameter settings (Dresher and Kaye 1990; Fikkert 1994; Kehoe 1998), and the other being that children start their acquisition with a more neutral system (Hochberg 1988a,b; Rose and Champdoizeau 2007a,b).

Prior to the introduction of Metrical Stress Theory (Hayes 1989; 1995), and the proposal for metrical parameter defaults (Dresher and Kaye 1990), arguments for a trochaic bias emerged (Allen and Hawkins 1978, 1980; Allen 1983). Many authors have commented on whether or not a trochaic bias actually exists, some supporting it (e.g. Allen and Hawkins 1978, 1980; Allen 1983; LaBelle 2000) and others rejecting it (Hochberg 1988a; Archibald 1996; Rose and Champdoizeau 2007a,b). However, very few have commented on other possible parametric defaults. Fikkert (1994; 1995) and Kehoe (1998) however investigate the acquisition of stress in Dutch and English respectively, within the framework of Metrical Stress Theory. First I provide a review (from chapter 2) of the developmental stages proposed by these authors. I then outline their proposed metrical defaults. Finally, I discuss the NE Cree facts in light of this research.

4.1. The Proposed Stages in the Acquisition of Metrical Structure

As noted in chapter 2, Fikkert (1994) and Kehoe (1998) formulate similar stages in child metrical development. Fikkert (1994), who investigated Dutch prosodic acquisition, proposed the following developmental stages.

(20) Summary of the stages in the acquisition of stress (Fikkert 1994)

a. Stage 1: Everything is mapped onto a trochaic foot (iambic patterned words are reduced to one syllable)
b. Stage 2: All disyllables are produced as trochees
c. Stage 3: Level stress on syllables
d. Stage 4: Main stress acquired

Kehoe's proposed stages, given below, are intended to better suit her observations of English learning children.

(21) Kehoe's (1998) stages of stress acquisition

a. Stage 1: Trochaic Constraint Stage (Age 22 months): Everything mapped onto a trochaic foot
b. Stage 2: Experimental Stage (Age 28 months): Stress errors, some equal stress, shift to final syllable (indicating that extrametricality has not yet been acquired).
c. Stage 3: Consistent Stress Pattern Stage (Age 34 months): Target stress placement

These proposals are similar in their nature: Kehoe (1998) more or less combines stages 1 and 2 of Fikkert (1994). Each of the stages proposed by these authors is considered in light of the errors made by A1. (In the discussion below, Fikkert's (1994) stages 1 and 2 will be combined into a single stage.)

4.1.1. Stage 1: Trochaic Template

First of all, there is no evidence for a trochaic template affecting A1's productions, even in the earliest recording session. In fact, I have argued throughout this chapter that A1 has an overwhelming preference for final stress, especially during the first three recorded sessions at age 2;02.02, 2;08.28 and 3;04.09. This preference for final stress strongly suggests that A1 has early iambic footing. Note however that the preference for a trochaic foot is found at approximately age 22 months in Kehoe's study. Since the first recorded session of A1 took place at the child's age of approximately 26 months, the lack of evidence for a trochaic template in A1's speech could be a result of the lack of data recorded prior to that age. This is unfortunately an issue that can only be addressed empirically and thus cannot be addressed further on the basis of available data; see however recent works by Rose and Champdoizeau (2007a,b) on this issue.

4.1.2. Stage 2: Equal Stress, Frequent Stress Errors, Final Stress

At stage 2, Fikkert (1994) finds that when Dutch-speaking children produce words consisting of more than one foot, they produce equal stress on the strong syllable of each foot. Kehoe finds little evidence for equal stress in her study, and attributes Fikkert's (1994) findings to 'methodological factors in stress transcription' (Kehoe 1998:19). Alternatively, Kehoe (1998) finds that English speaking children do produce many stress errors at this stage, but these errors generally involve moving stress to the final syllable. She attributes the difficulty at this stage to a default setting against extrametricality.

Firstly, to address Fikkert's (1994) findings, A1 appears to have mastered the End Rule by 2;02.02. A1 almost consistently makes the rightmost foot in her utterance more prominent (acoustic evidence for this is outlined in chapter 5). The difference between Fikkert's (1994) findings and those presented in the current study may be attributed to the fact that Dutch speaking children have evidence for secondary stress in their language, while in NE Cree there is little evidence for secondary stress in the target.

Secondly, Kehoe (1998) finds that children make many stress errors at this stage, by often moving stress to the final syllables. For example, (HL)<H> shaped nouns in the target are often produced with word final stress. Kehoe (1998) attributes this to the observation that the children have not yet properly set the extrametricality parameter. This is similar to observations made in this study; A1 often shifting stress to the final syllable at 26 months, with significant improvement at 49 months.

4.1.3. Stage 3: Target Stress Placement

At stage 3, the stress system of the language is properly acquired. Kehoe (1998) notes that in English speaking children the system is properly acquired at approximately age 34 months. As the data discussed in this chapter shows, A1 fully acquires stress much later. By age 49 months, A1 has almost 90% accuracy with her stress productions. As argued throughout this chapter, A1's difficulty comes from the apparent arbitrariness of extrametricality in NE Cree. In English, final extrametricality affects only nouns, which is perhaps why children as young as 34 months are able to perfect the stress system in English. In NE Cree, however, extrametricality occurs on a larger subset of forms,[13] and is not limited to a single word class. The relatively opaque evidence from the ambient language results in greater difficulty learning the lexical items with syllable extrametricality and those with foot extrametricality. As a result extrametricality on some of the words is acquired relatively late by A1.

4.2. Default Metrical Parameters

Dresher and Kaye (1990) proposed several default metrical parameter settings which, they argue, are provided by UG. The proposed defaults are given based on typological markedness, for example, with quantity insensitivity being less marked than quantity sensitivity, quantity insensitivity is given as a default parameter setting. If evidence for

13 This subset of forms includes words with syllable extrametricality and a smaller subset of words with foot extrametricality (see chapter 3, section 4.3).

quantity sensitivity is available to the child, he or she can change the parameter setting based on positive evidence. Dresher and Kaye (1990), however, who are tackling the problem of acquisition from a learnability perspective, do not support their claim with empirical evidence. Fikkert (1995) tests Dresher and Kaye's (1990) proposal based on evidence she found in Dutch speaking children. Some of the metrical defaults proposed by Fikkert (1995) and, later, by Kehoe (1998), from English speaking children, are outlined in (22).

(22) Default parameter settings based on evidence fromDutch (Fikkert 1995) and English (Kehoe 1998)

a. **Quantity sensitivity**: No (Fikkert 1995) / Yes (Kehoe 1998)
b. **Headedness**: Left-headed
c. **Direction of Footing**: Right-to-left
d. **End Rule**: Right
e. **Extrametricality**: No

Although the findings from the current study are consistent with a neutral start hypothesis (Hochberg 1988a,b), they also support some of the metrical defaults proposed by Fikkert (1995) and Kehoe (1998). Each of the metrical defaults proposed by Fikkert (1995) and Kehoe (1998) are considered in light of NE Cree data in the following subsections.

4.2.1. Quantity Sensitivity

Fikkert (1995) proposes that quantity insensitivity is provided as a UG default. She argues that quantity insensitivity requires less information for the learner. For a child learning a quantity insensitive language, only the number of syllables is important for stress assignment. For a child learning a quantity sensitive language, on the other hand, both the weight of the rhymes and the number of syllables involved within the stress domain are important for stress assignment. Further evidence for Fikkert's (1995) claim comes from the fact that at stage 2 Dutch speaking children make many stress errors related to quantity sensitivity. It appears, however, that A1 is aware of syllable weight even in the earliest session; she almost consistently retains heavy syllables and reduces light syllables in metrically weak positions. HLH shaped words in the earliest sessions provide evidence for quantity sensitivity. A1 never puts stress on the penultimate syllable of HLH shaped words. She stresses the initial syllable (when she has acquired extrametricality on the form) or she stresses the final syllable (when she has not acquired extrametricality on the form). This pattern has already emerged by 2;02.02.

(23) Evidence for Quantity Sensitivity: Antepenultimate and Final Stress on HLH words

Orthography	Translation	Target IPA	IPA Actual	Target Structure	Actual Structure	Age
âkutâh	*right here*	'agoda	'ɛdʌ	(H)L<H>	(H)L<H>	2;02.2
âkutâh	*right here*	'agoda	ɛ'de	(H)L<H>	(H)(LH)	2;02.2
pwâchikî	*boogieman*	'bʌdʒəgi	dib'di	(H)L<H>	(H)(LH)	2;02.2
pwâchikî	*boogieman*	'bʌdʒəgi	dib'di	(H)L<H>	(H)(LH)	2;02.2
mânitâh	*like that*	'mændə / mænəta	ən'dʌ	(H)L<H>	(H)(LH)	2;02.2
îtuhtâu	*going*	'ɪdɛno	'gidʌ	(H)L<H>	(H)L<H>	2;08.28
pîtihwâu	*put it in pocket*	'bit^{h}o	'do	(H)L<H>	(H)(LH)	2;08.28

In the examples above, A1 places stress on either the antepenultimate or final syllable of HLH shaped words. She never erroneously stresses the penultimate syllable, even with positive evidence for a vowel in that position (i.e. it is not deleted in the target form). This strongly suggests that A1 was aware of syllable weight and therefore was aware of quantity sensitivity in her language early on. Kehoe (1998) notes that English speaking children also appear to be aware of syllable weight very early on, and proposes that if any default is present, her study supports quantity sensitivity. A combination of all of the evidence covered here, however, calls for a neutral start with regard to this parameter.

4.2.2. Headedness

Fikkert (1995) proposes that left-headed feet are the default. Motivation for this default is related to quantity insensitivity. Since a syllabic trochee is the only quantity insensitive foot, she proposes this foot as a default. Furthermore, in the Dutch data, children have an overall preference for trochaic feet in the beginning stages of acquisition. At stage 1, the only disyllabic productions are SW shaped words, and when faced with a WS shaped word children only produce the stressed syllable. Kehoe (1998) also finds a similar pattern in English. This preference towards trochaic feet is also unmatched in the current investigation. Since a preference for trochaic feet would result in a SW pattern, A1 should show a preference for initial or penultimate stress.[14] As documented throughout this chapter, A1 has a definite preference for final stress which strongly suggests an analysis of the metrical system of her language based on iambic footing.

Kehoe (1998) also finds that English speaking children prefer to map all of their productions onto a trochaic foot at approximately 22 months. As previously discussed, since A1 was already 26 months in the first session of this study, it is possible that she had default trochaic footing at an earlier stage (prior to the period covered by the CCLAS study). In light of recent research by Rose and Champdoizeau (2007a,b), however, the combined evidence from all languages strongly suggests a neutral start. Learners of trochaic languages, such as English and Dutch, generally show an early preference for trochaic feet, while learners of iambic languages such as NE Cree and French select an

14 A1 would show a preference for initial stress if she were analysing her language as trochaic with left-to-right footing. However, if she were analysing her language as trochaic with right-to-left footing, she would show a preference for penultimate stress.

iambic foot form early on.

4.2.3. Direction of Footing

Both Fikkert (1995) and Kehoe (1998) find that their data support an initial right-to-left direction of foot parsing. This finding is supported in the NE Cree data with examples from the corpus given below.

(24) Evidence for right-to-left foot parsing

Orthography	Translation	Target IPA	IPA Actual	With L-to-R footing	Target and Actual Structure
chipiha	*close it*	t^{h}ə'ba	nədʌ'ba	(LL)L*	L(LL)
pichihtin	*fall down*	bits'tɪn	dʒʊn	(LL)L*	L(LL)

Right-to-left parsing predicts the correct stress on these two forms, which do not have an extrametrical syllable in the target. It should be noted, however, that right-to-left parsing is the correct direction for the adult form, and as such this pattern does not provide evidence for a default. It is also the correct direction of parsing for Dutch (Fikkert 1994) and English, thus Dutch, English and NE Cree do not provide conclusive support for a universal default.

4.2.4. End Rule

Fikkert (1995) claims that End Rule Right is the default parameter, but that the End Rule is acquired late in development because the child must also have knowledge of the foot type and iterativity in the language. The late acquisition of an End Rule is manifested in the Dutch children's language once they are capable of producing words with two feet. When they are capable of producing such words they stress each strong syllable, instead of just stressing the rightmost foot. As discussed in 4.1.2, there is no evidence for equal stress in A1's speech. Furthermore, there is little evidence for secondary stress in NE Cree, which prevents the NE Cree speaking child from accessing any clear evidence that the rightmost foot is stressed. As a result, it appears that A1 has acquired the End Rule early in development. This is consistent with Kehoe's (1998) findings which also support an initially correct End Rule Right. Again, since End Rule Right is the correct stress rule for Dutch, English and NE Cree, the evidence from each of these language prevents any independent support for a universal default.

4.2.5. Extrametricality

Kehoe's (1998) study provides evidence for a default setting against extrametricality[15]. As discussed in 4.1.2, when English speaking children are faced with final syllable extrametricality, they often shift stress to the final syllable. A similar pattern is observed in the current study, suggesting a default negative setting for the extrametricality parameter. This default setting is conceptually consistent with the fact that extrametricality involves a relative degree of abstraction and, as such, should be disfavoured. In light of extrametricality as a relatively abstract parameter and the fact that in both English and NE Cree it appears to only occur on a subset of the lexicon, I argue that only an investigation of the acquisition of a language that displays systematic evidence for extrametricality would provide better ground to address this question. It is indeed possible that English speaking children and NE Cree speaking children initially opt for an analysis with the extrametricality parameter set to 'no' because of relatively defective positive evidence for extrametricality in these languages.

15 Fikkert (1995) takes a different theoretical approach to extrametricality in her investigation into Dutch metrical acquisition. This approach will not be addressed in this thesis.

Minimally, the stages in metrical development and the parametric defaults proposed by Fikkert (1995) and Kehoe (1998) all correlate with the general properties of the languages they are addressing. Indeed since both Dutch and English have trochaic footing, for example, it is not surprising that a Dutch or English speaking child should prefer this type of foot form in their early productions. In contrast to these two languages, NE Cree has a very different metrical system. In this respect, since A1's metrical system develops quite differently from those of English and Dutch speaking children, it appears that default parameters do not play a role in the acquisition of stress. Based on the findings presented in this chapter, it appears that A1 correctly set the less abstract parameters required for her target language early on. A1 is also aware of the most abstract parts of the system, such as extrametricality, from an early age. As early as 2;02.02 A1 produces some words with extrametricality correctly, although she does not acquire this parameter setting for all words until later. This contradicts previous attempts at describing universal stages in the acquisition of metrical structure. As a result, a neutral start hypothesis (Hochberg 1988a) appears to offer a more promising approach.

5. Concluding Remarks

The evidence presented in this chapter addresses a number of issues brought forth by the body of literature on the acquisition of stress. As Rose and Champdoizeau (2007a,b) point out, there has been very little literature testing the possible metrical parameter defaults available to children, and the literature which has been produced is biased towards a small subset of grammatically similar languages. Through looking a NE Cree, a language which is typologically different from Indo-European languages such as Dutch or English, I find the proposed default metrical parameter settings to be largely unsupported. In fact, the current study suggests that children do not have a preference for specific parameter settings, rather they are sensitive to the parameter settings of the ambient language from an early age. It is only when the input is unsystematic (e.g. optional extrametricality) that the child may have difficulty with a specific parameter. It is important, however, to bear in mind that the current research is merely a case study of one individual speaker starting at 26 months; further investigation into earlier NE Cree metrical development, and the development of other typologically different languages would be required to further substantiate this claim.

Chapter 5 – The Acquisition of the Phonetic Cues for Stress: A Case Study

1. Introduction

To this point the case has been put forward that fully acquiring the metrical system of NE Cree is a difficult task for the child, and that this system appears to be entirely acquired rather late in development when compared to the acquisition of stress systems in other languages. However, acquiring the metrical system of the language is not the only stress-related task for a child learning NE Cree (or any other language); the child must also learn the appropriate phonetic cues for stress in the target language. This chapter is devoted to a preliminary investigation of this issue in the data from A1. Before discussing the findings for A1, I present a summary of the relevant literature (section 2).[16] In section 3, I outline the methodology used in the current investigation, describe the acoustic cues for stress in NE Cree, and discuss A1's use of these stress cues over the developmental period studied. I continue in section 4 by situating A1's development within the body of research describing the acquisition of English stress. Concluding remarks of offered in section 5.

2. Summary of Background Studies

As it is the case in most of the literature on acquisition, the majority of published research on the acquisition of the phonetic cues for stress is based on English speaking children. A summary of the most relevant findings is given in (1) below.

16 This literature was described in more detail in chapter 2.

(1) Summary of findings from the acquisition of the phonetic cues for stress in English

a. Children have target acoustic cues for stress from an early age (Kehoe et al. 1995)
b. The difference in intensity between stressed and unstressed syllables increases with age (Kehoe et al. 1995)
c. Children only use duration to mark stress at age 2 (Pollock et al. 1993)
d. Positional effects on stress (Allen and Hawkins 1980; Schwartz et al. 1996)
    i. Final stress is marked by duration (Allen and Hawkins 1980; Schwartz et al. 1996)
    ii. Non-final stress marked by pitch (Allen and Hawkins 1980)
e. Children do not reduce unstressed syllables and the duration of unstressed syllables decreases with age (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996)

This research suggests that stress cues are acquired relatively early, and the ability to reduce unstressed syllables seems to develop slowly over time. Furthermore, Allen and Hawkins (1980) and Schwartz et al. (1996) argue that stress cues may be dependent on the position of the syllable within the word. Nevertheless, the stress cues relevant for English differ from those relevant for NE Cree (see section 3.1, chapter 3) thus NE Cree learners should acquire the phonetics of their stress system in a different way. In chapter 4, I observed that A1's metrical acquisition is largely dependent on the stress rules of her language, and not related to metrical defaults proposed in the literature. A similar pattern is observed in her acquisition of stress cues. A1 uses pitch, intensity and duration in a target-like manner from an early age, yet her use of these cues becomes even closer to adult NE Cree cues over time. The methodology and supportive data are discussed in the following section.

3. The Acquisition of the Phonetic Cues for Stress in NE Cree

In this section I provide the methodology implemented to determine whether A1, like English speaking children, has different stress cues depending on syllable position and whether she has difficulty with vowel reduction. I then outline the target cues for stress in NE Cree, in both final and non-final stressed syllables, and describe the A1 data in light of these target stress cues. Finally, I discuss vowel reduction in A1's speech from a longitudinal perspective.

3.1. Methodology

As mentioned above, previous research suggests that English speaking children may display different cues for stress depending on the position of the syllable within the word (Allen and Hawkins 1980; Schwartz et al. 1996). Additionally, the ability to reduce unstressed syllables, thereby making stressed syllables more prominent is a process which English speaking children acquire later in development (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996). In order to understand how specific cues are manifested in the realization of A1's stress, and how vowel reduction develops, several methodological issues must be considered.

Firstly, since vowel syncope (deletion) occurs frequently in NE Cree, it is important to select forms where at least one unstressed syllable and one stressed syllable are phonetically realized by the child. Such forms provide a measure for the prominence in duration, intensity and pitch on stressed syllables, relative to unstressed syllables. Secondly, it is important to keep syllable weight constant in target forms. NE Cree has long and historically short vowels; the former makes a syllable metrically heavy while the latter makes a syllable metrically light. As such, for the purpose of this investigation, I only selected forms that consist of either two short vowels or two long vowels. Doing so avoids the introduction of a lexically-based duration bias in the measurements, and ensures that an observed difference in vowel duration is due to either syllable position or stress, and not independently due to a difference in syllable weight. Thirdly, since several studies have revealed that stress cues may differ based on syllable position (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996), it is also important to look at final and non-final stress independent of one another. Finally, in order to determine whether or not A1's stress cues are becoming more target like, I also compare the stress cues of final and non-final environments to those in the target system.

In light of these issues, I now detail the adult stress cues in both non-final and final stress positions. I first discuss the mean difference in duration, maximum intensity and maximum pitch of stressed compared to unstressed syllables. These measurements indicate the prominence of the stressed syllable relative to the unstressed syllable, for each speaker. Following the description of target values, I discuss corresponding measurements for A1 at ages 2;02.02, 2;08.28, 3;04.09, 3;06.23, and 4;01.30.

3.2. The Target Phonetic Cues for Stress in NE Cree

I have argued that stress in NE Cree is marked by an increase in pitch, which is often accompanied by an increase in intensity (chapter 3, section 3.1). This pattern is consistent in the speech samples of both adult participants: DB and LBS. I now look at the stress cues for non-final stress followed by the cues for final stress in both DB and LBS in order to observe potential differences in cues based on stress position. For this investigation, I examined only phonetically disyllabic words and considered each word individually, calculating the difference in the maximum pitch, the maximum intensity and the duration of the stressed vowel compared to the unstressed vowel in each phonetically disyllabic word.

The difference in pitch was calculated by subtracting the pitch peak, in Hertz (Hz), of unstressed vowel from the stressed vowel. Research on L1 English listeners indicates that a syllable is perceived as stressed when there is an increase of 45.03 Hz to 58.03 Hz, with accuracy improving the close to the latter value (Pollock et al. 1993).

Similarly, the difference in intensity was measured by subtracting the peak intensity, in Decibels (dB), of the unstressed syllable from the intensity peak of the stressed syllable. In Pollock et al.'s (1993) study, they found that L1 English listeners perceived a syllable as stressed when there was an increase of 3.09dB to 4.84dB, with accuracy improving the when the increase was closer to 4.84 dB.

The difference in duration was measured by subtracting the vowel length, in milliseconds (ms), of the unstressed vowel from the stressed vowels.

Once I extracted these values, I calculated the mean difference in each dimension of stress: pitch intensity and duration. Because of issues that relate to data normalisation, it is important to look at the difference between stressed and unstressed syllables within each word, as the level of a stress cue can be affected by external factors; for example intensity and pitch can be affected by factors such as recording level and distance from the microphone, while duration can be affected by speech rate.

3.2.1. Target Non-Final Stress[17]

First, I consider phonetically disyllabic words with non-final stress. The mean difference for each cue is given below for DB and LBS.

(2) The mean difference in duration, intensity and pitch on non-final stressed syllables

Speaker	Mean difference in duration (ms)	Mean difference in intensity (dB)	Mean difference in pitch (Hz)
DB	-70.2	2.7	24.6
LBS	-6.3	2	30.6

The values above illustrate that both DB and LBS use a marked increase in pitch and a slight increase in intensity to mark non-final stress. There is a decrease in duration on non-final stressed syllables indicating that final unstressed syllables are, on average, longer than non-final stressed syllables. This is not surprising since universally final syllables are longer than non-final syllables, regardless of whether or not the final syllable is stressed (Hayes 1995).

17 Final syllables have special properties in NE Cree. They are typically (C)VV or (C)VC(C) shaped syllables and they generally do not undergo deletion (Dyck p.c.). This detail implies that the syllable-by-syllable comparison presented in the following subsections is inherently limited. However, in the context of the current acquisition study, such comparisons are warranted on the grounds that they offer an additional outlook on the child's prosodic development.

3.2.2. Target Final Stress

I now consider the mean difference in duration, maximum intensity and maximum pitch on final stressed syllables for DB and LBS.

(3) The mean difference in duration, intensity and pitch on word-final stressed syllables

Speaker	Mean difference in duration (ms)	Mean difference in intensity (dB)	Mean difference in pitch (Hz)
DB	35	1.7	42.2
LBS	19.1	5	37.25

On word-final stressed syllables DB and LBS use an increase in pitch (and a slight accompanying increase in intensity) to mark stress, however, there is an increase in duration on word-final stressed syllables as well. As illustrated in (2), an increase in duration also occurs on unstressed final syllables, thus supporting Hayes' (1995) claim that final syllables are longer than non-final syllables and suggesting that an increase in duration is not related to stress in NE Cree. In light of these data, I now turn to A1's acquisition of stress cues, and her ability to reduce syllables over time.

3.3. A1's Acquisition of the Phonetic Cues for Stress

In summary, I have demonstrated that NE Cree speaking adults use an increase in pitch, and a slight increase in intensity to mark stress. I have also found that final syllables, regardless of whether they are stressed, are marked with an increase in duration. Following the same approach, I now discuss A1's overall use of stress cues.

I examined each phonetically disyllabic word in the child corpus and determined which phonetic cues were relevant for making the stressed syllable prominent.[18]

(4) A1's use of duration, intensity and pitch in marking stress over time

Age	# of forms	Devoiced/ deleted	Increased duration	Increased intensity	Increased pitch
2;02.02	51	8/51	42.2% (19/43)	67.4% (29/43)	100% (43/43)
2;08.28	98	43/98	56.3% (31/55)	74.5%(41/55)	96.4% (53/55)
3;04.09	195	121/195	59.4% (44/74)	66.6% (50/74)	98.6% (73/74)
3;06.23	86	31/86	34.7% (17/49)	49% (24/49)	100% (49/49)
4;01.30	117	50/117	56.7% (38/67)	68.7% (46/67)	97% (65/67)

The percentages given above show that pitch is acquired as the primary cue for stress from the earliest recording and is used almost consistently in each of the following sessions. It thus seems as though the child has mastered the correct phonetic cues as early as the first recording, which suggests that pitch is mastered early in the acquisition of NE Cree. However, A1 often uses intensity and duration along with pitch. In order to elaborate on this, I now consider the relationship between pitch and the other stress cues more closely.

3.4. A1's Acquisition of Phonetic Cues for Stress: A Closer Look

In order to understand how specific cues are manifested in A1's production of stress, I examine the stress cues for non-final and final stress independently, and continue with a description of her ability to reduce unstressed vowels in 3.4.3.

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18 Several words from the corpus were omitted because of vowel weakening which, in NE Cree involves either vowel devoicing or deletion. This implies that several words are produced with only one voiced vowel. Such words were discarded from the calculations as they do not provide a reliable comparison as to which cue is used primarily to mark stress. The third column in (4) provides the number of forms which were omitted per session.

3.4.1. Non-Final Stress

NE Cree adults mark non-final stress with an increase in pitch and a slight increase in intensity. I now consider the relative prominence of non-final stressed syllables in A1's speech. In the following table, I present the mean difference in duration, maximum intensity and maximum pitch on non-final stressed syllables for each session.

(5) Mean difference in duration, intensity and pitch on non-final stressed syllables

Age	Mean difference in duration (ms)	Mean difference in intensity (dB)	Mean difference in pitch (Hz)
2;02.02	-184.6	0	37.8
2;08.28	-122.9	0.8	50.2
3;04.09	-49	1	16.5
3;06.23	80.1	0.1	83.7
4;01.30	-0.2	5.7	58

The values given above demonstrate that like DB and LBS, A1 does not use duration to mark non-final stress. Furthermore, the mean difference in pitch between stressed and unstressed vowels strongly suggests that pitch is the most relevant cue for marking non-final stress. A1's use of intensity to mark non-final stress, however, is not quite as strong. In the first four sessions, A1 does not appear to use intensity to mark stress, however, in the last session, the mean increase in intensity on non-final stressed syllables is relatively high. The data given in (5) illustrate that A1 has acquired pitch as the main cue for stress early on, while she acquires the secondary cue (intensity increase) later. A1's later use of intensity to mark stress shows that her productions of non-final stress are becoming more target-like. In the next subsection I consider her development of final stress.

3.4.2. Final Stress

In the following table I have calculated A1's mean difference in duration, maximum intensity and maximum pitch on final stressed syllables for each session.

(6) The mean difference in duration, intensity and pitch on final stressed syllables

Age	Mean difference in duration (ms)	Mean difference in intensity (dB)	Mean difference in pitch (Hz)
2;02.02	49.2	1.8	120.8
2;08.28	65.9	5.7	102.9
3;04.09	46.3	3.8	43.7
3;06.23	51.9	2.5	55.3
4;01.30	22.7	3.7	79.6

The first notable difference between non-final stress and final stress is A1's use of duration. While there is no increase in duration on non-final stressed syllables, there is a consistent increase on word-final stressed syllables. Furthermore, there is a much more significant increase in intensity on stressed syllables, especially starting at age 2;08.28. In the first session A1's intensity increase is relatively low, which is consistent with a low increase in intensity on non-final stressed vowels discussed in the previous section. Finally, although A1 has acquired pitch as the primary cue for stress from an early age, A1's relative level of pitch on final stressed syllables also becomes more target-like. In the two first sessions at age 2;02.02 and 2;08.28, A1's pitch increase is extremely high, at approximately 120Hz. However, by 3;04.09 the increase in pitch on final stressed syllables has reached a more target-like level which is 32.2Hz for DB and 37.25Hz for LBS. A1 has acquired a more target-like pitch increase by the third session, however there is notable increase in pitch from age 3;04.09 to age 4;01.30 as well. The increase from 43.7Hz to 79.6 Hz, however, is rather insignificant considering that the child has much larger fluctuations in pitch than the adult. Variable phonetic behaviour such as this, which may related to the child's immature motor control, which manifests itself by a relatively ballistic use of speech articulators, have been documented in other aspects of phonological acquisition (e.g. Rose, in press).

3.4.3. Unstressed Syllables

In addition to learning how to produce target-like stress, NE Cree children also need to learn how to reduce unstressed syllables. Previous literature on English speaking children reveals that children often begin by not reducing unstressed syllables, and that the duration of unstressed syllables decreases over time (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996). I now address the issue of unstressed syllables in A1's speech over time. Firstly, I shall consider the rate of unstressed syllable deletion, since NE Cree speakers most often use vowel deletion, as opposed to weakening, to reduce unstressed syllables.

(7) Rate of unstressed syllable deletion over time

Age	Number of unstressed syllables	Number of deleted unstressed syllables	Percentage of deleted unstressed syllables
2;02.02	65	23	35.3%
2;08.28	125	68	54.4%
3;04.09	271	176	64.9%
3;06.23	158	90	56.9%
4;01.30	183	125	68.3 %

The table above illustrates that A1's rate of unstressed syllable deletion gradually increases over time. In the first session, at age 2;02.02 she deletes 35.3% of unstressed syllables, a rate which is almost double by age 4;01.30.

In addition to vowel deletion, vowel reduction is also an important process that children must acquire. The research available on English speaking children (e.g. Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996) suggests that initially children do not reduce unstressed syllables; consequently the duration of unstressed syllables decreases over time. In order to determine if the same pattern is attested in the development of NE Cree, I look at the mean duration of the unstressed syllable of each word. Based on these mean values at ages 2;02.02, 2;08.28, 3;04;09, 3;06.23, and 4;01.30, I can determine to a certain degree whether or not A1's ability to reduce unstressed syllables improves over time. It should be noted, however, that these mean values could also be influenced to some extent by speech rate.

3.4.3.1. Non-Final Unstressed Syllables

In the following table A1's mean duration of non-final unstressed syllables is provided for each session.

(8) Mean duration, non-final unstressed syllables

Age	Mean Duration (ms)
2;02.02	113
2;08.28	117.8
3;04.09	103.4
3;06.23	169.4
4;01.30	98.3

The values above show that overall A1 shows some decrease in the duration of her non-final unstressed syllables between age 2;02.02 and 4;01.30. However, the data are highly variable and as such provide little evidence of a gradual reduction of unstressed, non-final syllables. This pattern may instead be due to the fact that final stressed syllables typically display much greater duration than non-final syllables and, as a result, make non-final unstressed syllables look reduced in comparison. I now turn to A1's reduction of final unstressed syllables.

3.4.3.2. Final Unstressed Syllables

A1's mean duration of final unstressed syllables is provided in (9) for each session under investigation.

(9) Mean duration final unstressed syllables

Age	Mean Duration (ms)
2;02.02	373.1
2;08.28	293.6
3;04.09	279
3;06.23	221.6
4;01.30	135.8

Final unstressed syllables pattern differently than non-final unstressed syllables with regard to vowel reduction. In (9) there is a consistent decrease in duration, while in (8), the relative duration of non-final unstressed syllables showed much variability over time. Based on the adult NE Cree data, final syllables appear to be longer regardless of whether or not they are stressed. Furthermore, Hayes (1995:100) claims that final syllables are universally longer and as such hold a certain amount of phonetic prominence. As a result, it is possible that A1 is sensitive to the duration of final syllables early on but gradually reduces the duration of final unstressed syllables in order to make non-final stressed syllables more prominent.

3.5. Interim Summary

Thus far I have shown that A1 has correctly acquired pitch as the primary acoustic cue for stress from the very first session and that her use of relative intensity increases over time. Indeed, as discussed earlier, Ladefoged (2005) claims that when an increase in pitch is produced as a result of a speaker using larger puffs of air, an increase in intensity will also occur. In light of this, two possible explanations for A1's gradual increase in intensity can be entertained. Firstly, A1 is developing physically and as a result, her lung capacity and strength is increasing, which in turn means that she is capable of producing larger puffs of air. This is perhaps why an increase in intensity is more strongly associated with stress in later sessions. Secondly, it may simply be that A1 has achieved more adult like stress, and the increase in intensity is not attributable to physiological growth.

I have also observed that on the surface non-final and final stress have different acoustic correlates in A1's speech. A1 produces non-final stress with an increase in pitch and a slight increase in intensity, while she produces final stress with an increase in pitch, intensity and duration. I argue, however, that the increase in duration on final stressed syllables, which is consistent with the target language, may in fact be a result of inherent duration associated with final syllables, as proposed by Hayes (1995).

Finally, I have noted that A1's rate of unstressed syllable deletion increases significantly from age 2;02.02 to 4;01.30, and consistent with these findings, her ability to reduce unstressed syllables also improves.

I elaborate on this discussion in the following section where I compare A1's stress development with the results of previous research into the acquisition of stress in English speaking children.

4. Comparison with Previous Research

I observed several commonalities and difference between the patterns discovered in A1's speech and those found in English speaking children. Since acquisition research aims to isolate aspects of language that are universal from those that are language specific, commonalities in how children acquire these languages could point to universal patterns in stress development and thus provide a foundation for future research on basic human language faculty.

4.1. Similarities in NE Cree and English Stress Cue Development

Several patterns found in the development of stress cues in English speaking children are supported, or partially supported, in the current case study. The research findings which are consistent with A1's development, are summarized in (10):

(10) Findings from previous research on the acquisition of the phonetic cues for stress in English speaking children that also describe the A1 data

☑	a.	Children have target acoustic cues for stress from an early age (Kehoe et al. 1995)
☑	b.	The difference in intensity between stressed and unstressed syllables increases with age (Kehoe et al. 1995)
	c.	Children only use duration to mark stress at age 2 (Pollock et al. 1993)
☑	d.	Positional effects on stress (Allen and Hawkins 1980; Schwartz et al. 1996)
	i.	Final stress is marked by duration (Allen and Hawkins 1980; Schwartz et al. 1996)
☑	ii.	Non-final stress marked by pitch (Allen and Hawkins 1980)
☑	e.	Children do not reduce unstressed syllables and the duration of unstressed syllables decreases with age (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996)

Kehoe et al. (1995) found that like adult speakers, English speaking children use a combination of pitch, amplitude (intensity) and duration to mark stress from a very early age. However, they also found that children's use of intensity to mark stress increases over time. These findings are supported by the current study. The primary cue for stress produced by adult speakers of NE Cree is pitch, and from the very first session, at age 2;02.02, A1 uses pitch as her primary stress cue. A1's use of intensity also increases and becomes more target-like over time. In the non-final stress position, the mean increase in intensity is 0 dB at age 2;02.02, which increases to 5.7 dB by age 4;01.30. This pattern also emerges in words with final stress in which the mean increase in intensity is 1.8dB at age 2;02.02 and 3.7dB by the final session. As discussed previously in this chapter, it is possible that the increase in intensity over time is attributable to physical development. Since pitch can be produced without a sharp increase in intensity, by increasing tension in the vocal folds, it is possible that A1 is initially producing pitch in this way. However, as

A1 continues growing, her lung capacity and strength increases, and so she can produce an increase in pitch by creating larger puffs of air on stressed syllables. This growth, in turn, gives her the ability to produce a stressed syllable that is both higher in pitch and intensity. Additional support for this claim comes from the argument that both DB and LBS produce stressed syllables in this physiological way (see chapter 3, section 3.1).

Allen and Hawkins (1980) and Schwartz et al. (1996) found that English speaking children use different stress cues depending on the position of the stressed syllable within a word. Both of these studies demonstrate that English speaking children mainly use pitch to mark non-final stress and duration to mark final stress. I have described a similar pattern above: A1 primarily uses an increase in pitch on non-final stressed words, with a slight increase in intensity, while in the final position, she uses an increase in duration, as well as an increase in intensity and pitch. However, since an increase in duration is found on all final syllables in NE Cree, irrespective of stress, and is attested in many other languages, I attribute this increase in duration to the inherent final syllable length proposed by Hayes (1995), and not to developmental stage in the acquisition of phonetic stress cues.

In addition to creating prominence on stressed syllables, children learning languages such as English and NE Cree need to reduce unstressed syllables in order to make stressed syllables even more prominent. Allen and Hawkins (1980), Pollock et al. (1993) and Schwartz et al. (1996) find that initially children do not reduce unstressed syllables such that the duration of unstressed syllables decreases over time. Since vowel reduction generally involves vowel deletion in NE Cree, I looked at the rate of A1's unstressed syllable deletion over time, and found that her rate of deletion increased by

33% from age 2;02.02 to 4;01.30. This indicates that her ability to reduce syllables improves over time. Furthermore, A1 decreases the duration of unstressed syllables significantly from age 2;02.02 to 4;01.30, which is especially true of final unstressed syllables. The research on English learning children indicates that initially children do not reduce unstressed syllables; however, in the current study there is evidence that A1 can reduce syllables from the very first session, but that this ability improves over time. This asymmetry between English and NE Cree speaking children may be a result of a linguistic difference in vowel reduction. While vowel deletion is very common in NE Cree, it is a much less prominent process in English, which can only occur in a limited number of contexts; vowel weakening to schwa is indeed the main reduction process observed in English.

In conclusion, A1's development of NE Cree shares developmental similarities with English speaking children. Both A1 and English speaking children gradually develop target-like intensity on stressed vowels and learn to reduce unstressed vowels in a target-like manner over time. It is possible that these patterns are universal, however considerably more research on the acquisition of other languages would be required to fully substantiate this claim.

4.2. Differences in NE Cree and English Stress Cue Development

Some of the research on the acquisition of stress cues in English speaking children does not describe NE Cree speaking children and thus cannot represent universal stages in the acquisition of stress.

(11) Findings from previous research on the acquisition of the phonetic cues for stress in English speaking children that do not describe the A1 data

a. Children have target acoustic cues for stress from an early age (Kehoe et al. 1995)

b. The difference in intensity between stressed and unstressed syllables increases with age (Kehoe et al. 1995)

c. Children only use duration to mark stress at age 2 (Pollock et al. 1993)

d. Positional effects on stress (Allen and Hawkins 1980; Schwartz et al. 1996)

   i. Final stress is marked by duration (Allen and Hawkins 1980; Schwartz et al. 1996)

   ii. Non-final stress marked by pitch (Allen and Hawkins 1980)

e. Children do not reduce unstressed syllables and the duration of unstressed syllables decreases with age (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996)

Firstly, Pollock et al. (1993) found that English speaking children use duration only to mark stress at age 2. This is an area where NE Cree differs from English. From an early age A1 has acquired pitch as the most important cue for stress from the earliest session at age 2;02.02.

Secondly, as discussed in the previous sub-section, Allen and Hawkins (1980) and Schwartz et al. (1996) found that English speaking children use only duration to mark stress in the word-final position. Although I do find that final syllables are longer than non-final syllables in A1's speech, she does not exclusively use duration to mark final stressed syllables. She also consistently uses an increase in pitch and intensity on these forms. Furthermore, I argue that the increase in duration on final stressed syllables in NE Cree is a result of inherent vowel length, because A1 also has an increase in duration on final syllables that are unstressed.

5. Concluding Remarks

In the previous chapter, I found little support for the default metrical parameters found in the analysis of A1's stress system over time. I concluded that A1 is in fact very sensitive to the stress system of her language from an early age. Likewise, it appears that she is also very sensitive to the acoustic cues for stress in her language. The fact that patterns observed in a NE Cree speaking child differ from those observed in English speaking children provides evidence that the stages in stress acquisition are largely dependent on the evidence provided by the target language. For example, the process of vowel deletion which is productive in NE Cree, is used early in A1's development, while English speaking children acquire this process considerably later, an observation that also matches the relatively rare occurrence of vowel deletion in English. Furthermore, research indicates that duration plays a different role in the stress systems of NE Cree and English. In NE Cree, durational contrasts are more closely related to syllable position, while in English such contrasts are more closely related to stress. As a result, duration plays a more significant role in the acquisition of English stress, such that it has been found to be the only cue marking stress at age 2 (Pollock et al. 1993).

A1 differs from English speaking children in how she acquires stress, perhaps because of differences in the relevant phonetic cues for stress in each language; however, she also displays some similarities. Firstly, both A1 and English speaking children display target-like cues from an early age, a similarity that suggests children are universally very sensitive to the ambient language stress cues. Furthermore, in both English speaking children and the A1 data, an increase in intensity on stressed vowels develops over time. This may be an indication that children are physiologically incapable of producing the same intensity contrasts as adults, or it may simply be that children universally acquire this cue later in development. Additionally, although A1 reduces unstressed vowels earlier than what is observed in English speaking children, in both A1's speech and that of English speaking children, vowel reduction develops gradually such that the duration of unstressed vowels decreases over time.

The similarities and differences in the acquisition of stress cues in NE Cree, and those observed in English, suggest that their development is predictable. The primary and background research combined in this chapter suggests that universally, if intensity is a relevant cue, it will develop later in acquisition, while duration and pitch should develop early on. Finally, the acquisition of processes such as vowel reduction and deletion depends on their relative frequency in the target language. These conclusions are, however, based on the parallels between English and the current case study. Further investigation into the acquisition of languages with different stress cues and rate of vowel reduction would be required before firm conclusions can be drawn.

Chapter 6 — Discussion

1. Introduction

The main goals of this thesis were, first, to discuss the phonetic and metrical properties of stress in NE Cree, a relatively under-documented language and, second, to offer a preliminary investigation of the acquisition of NE Cree stress based on a longitudinal case study. This work was undertaken with the aim of contributing to research in the fields of aboriginal linguistics and language acquisition. As mentioned in previous chapters, there is currently relatively little research describing the acquisition of stress, and the research available largely describes Indo-European languages such as English, Dutch and French. A consequence of this is that any literature aimed at describing universal patterns of stress development is biased towards a group of typologically similar languages. The current study offers a breakaway from this tendency by describing the acquisition of stress in NE Cree, a language which has little in common with the stress systems of Indo-European languages. In the next sections, I present a summary of my main findings, and discuss some outstanding issues which have emerged from my work, providing potential areas for future investigations.

2. Summary of Findings

2.1. Extrametricality in NE Cree

The adult data introduced in chapter 3 and chapter 4 provided evidence for a lexically determined extrametrical syllable in NE Cree, and in some exceptional cases an extrametrical foot. In chapter 3 of this thesis I addressed two recent proposals aimed at formalizing the phonological underpinnings of stress in NE Cree: Dyck et al. (2006) and Wood (2006), showing how neither study fully describes the data under investigation. The discrepancies between these studies and my own led to my proposal of a modified analysis, with the aim of attaining strong empirical adequacy. Both Dyck et al. (2006) and Wood (2006) describe NE Cree as a right headed, quantity sensitive language which disallows degenerate feet and has final syllable extrametricality. It is in their treatment of exceptional data that their analyses differ. In order to account for the fact that some exceptional words display stress on the antepenultimate, rather than the (expected) penultimate syllable, Wood (2006) posits an extrametrical foot, instead of the regular extrametrical syllable, while Dyck et al. (2006) observe an exceptional trochaic foot located to the left of the extrametrical syllable. Based on the data examined in chapter 3, I argued that extrametrical footing better describes the exceptional data.

Additionally in chapter 4, many lexical items with final stress were identified in target productions. Although many final stresses in the target could be attributed to obviative morphology and a constraint on degenerate feet, a list of words with unexplainable final stresses remained, such as *âpiha* 'open it', *tâpâ* 'no', *wiyipâu* 'it is black' and *chiwâpihtân* 'you see'. Based on these data, I determined that final syllable extrametricality did not fully describe the NE Cree stress placement, and as such, I argued that extrametricality is in fact a lexically determined attribute in this language.

2.2. Evidence for a Neutral Start Hypothesis

In chapter 4, I discussed A1's metrical development in light of previous research on the acquisition of metrical structure, and found virtually no evidence for previously proposed default parameters. Instead, I found that A1's development supported a neutral start in stress learning (Hochberg 1988a,b) whereby the child is initially neutral to all metrical parameters and constructs a system from the available data in the ambient language. The child data provided in chapter 4 demonstrate that A1 properly set the metrical parameters of her language from an early age. She did, however, have difficulty with the extrametricality parameter, which improved significantly from the first session at age 2;02.02 to the final session at age 4;01.30. A1's difficulty with extrametricality manifests itself as a preference for final stress in the initial stages of her development. In her early productions, A1 preferred final stress. In target words with non-final stress, she most often shifted penultimate and antepenultimate stress to the final syllable. I argue that A1's difficulties stem from the unsystematic input available from the adult language. This analysis provides support for the proposal that extrametricality is a lexically determined parameter in NE Cree. Aside from this issue, I observed that all other metrical parameters are acquired very early, and the parameter settings acquired do not match the default parameters described in the literature. This observation calls into question the previous claims that children's metrical parameters are initially set at a default. Contrary to literature supporting metrical defaults, the current study is instead consistent with an unbiased grammar at the onset of acquisition.

2.3. Early Sensitivity to the Phonetics for Stress

In chapter 5, I looked at the acoustic cues for stress in A1's speech over time and determined that she is very sensitive to NE Cree stress cues from an early age. At the first recording session A1 had already acquired the primary cue for stress: pitch. The data do show, however, that she gained better cue control throughout the acquisition period of 2;02.02 to 4;01.30. This is illustrated by the fact that her use of intensity on stressed vowels increased over time, a pattern also found in English speaking children. Although intensity is a secondary cue in NE Cree, it is the primary cue for stress in English. Since this stress cue behaves similarly in both languages, I argue that this pattern of phonological development may arise through a relationship between prosodic and physiological development. Because intensity tends to be produced by creating a larger puff of air in the lungs, it is possible that younger children are less capable of producing significant intensity increases on stressed vowels.

Furthermore, A1's ability to reduce unstressed syllables develops gradually, which is illustrated through her increasing rate of vowel deletion and through her decrease in duration of unstressed vowels over time. Although this pattern is also observed in English (Allen and Hawkins 1980; Pollock et al. 1993; Schwartz et al. 1996), A1 begins to reduce unstressed syllables earlier than English speaking children do. I suggest that this is a result of the extent of vowel reduction in NE Cree compared to English; while vowel reduction in NE Cree most often involves vowel deletion, in English vowel reduction usually involves a decrease in vowel length and quality.

3. Outstanding Issues

The current study offers additional insight into analytical aspects of the NE Cree stress system and its acquisition. However, further research would help address some of the issues which lie beyond the scope of this thesis.

Firstly, an investigation into more adult speakers of NE Cree would provide additional support for the analysis I presented in chapter 3. During my research, I encountered challenges stemming from the dialectal differences within the community of Chisasibi. Two dialects of NE Cree are spoken within this community: the coastal dialect and the inland dialect. Since A1 is a speaker of inland dialect, the interview from adult coastal speaker LBS was discarded from the investigation into the metrical system of NE Cree. As a result, the metrical analysis outlined in chapter 3 is derived from only one female speaker.

Secondly, investigating the acquisition of stress in more NE Cree learning children would provide further support for the developmental patterns observed in A1. This thesis is a case study discussing the stress development of one NE Cree speaking child. Given the amount of variation typically observed across first language learners (e.g. Bernhardt and Stemberger 1998), and despite the great regularity in the patterns observed in my case study, there is no way to demonstrate whether A1 is representative of the majority of NE Cree learning children. This implies that this study would clearly benefit from a look at the developmental patterns of stress in other NE Cree learning children.

Thirdly, research into the early acquisition of stress in NE Cree speaking children would provide further insight into how stress is acquired. At the beginning of this study A1 is 2;02.02, however, previous research indicates that stress is acquired relatively early in development. This suggests that studying the stress patterns of earlier productions than those available in the corpus under investigation may provide further detail into the acquisition of the target language's phonetic and metrical properties.

Finally, the current thesis has highlighted the importance of studying languages which are typologically different from widely researched languages such as English, Dutch and French. In fact, studying the development of stress in languages with a variety of parametric rules and phonetic cue combinations is the only way linguists will achieve a universal understanding of how children acquire stress. A question arising from this thesis specifically calls for the study of an iambic language which systematically has an extrametrical syllable. If a child learning such a language initially shifts stress to the final syllable, there may be evidence for a default against extrametricality. However, if a child learning such a language does not have an initial stress shift to the final syllable, then there would be further evidence for a neutral start hypothesis, which I have argued for in this thesis.

Notwithstanding, this thesis offers a significant contribution to the field of aboriginal linguistics and language acquisition both in terms of the case study it documents and as a foundation for further research.

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