Learning Northern East Cree

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Contents

1. Introduction

This book is intended as a guide for speech language pathologists working with first language speakers of Northern East Cree (henceforth NE Cree). The data presented here is based on data from a case study of a young girl who was video-recorded between the ages of 20 and 50 months as part of the Chisasibi Child Language Acquisition Study (CCLAS), a longitudinal study of first language acquisition in the Cree community of Chisasibi, Quebec. (Please visit http://www.mun.ca/cclas/ for more information about the project.) Our observations were made by comparing the Cree utterances spoken in two video-recorded sessions with this child, codenamed A1—one recorded when she was age 2;1.12 and another recorded at age 3;8.24. Examining these two sessions, which were recorded 19 months apart, allows us to chart some of A1's progress using Phon, a software program designed for the management, analysis, and sharing of large corpora of phonological data. A phoneme or syllable type is considered acquired when produced correctly in at least 80% of A1's utterances.

In this book, you will find a general description of NE Cree, followed by descriptions of how A1's syllable types and consonants are acquired. Vowels will not be addressed, though the vowel system of NE Cree is described in §2.1.

When discussing A1's development, we will refer to *target* and *actual* forms. *Target* utterances are what the Cree fieldworker, Darlene Bearskin, think A1 is trying to say while A1's *actual* productions are whatever the child actually says.

2. Cree

NE Cree is part of the Cree-Montagnais-Naskapi (CMN) dialect continuum, which is a member of the Central Algonquian language family. Within the CMN dialect complex, there are two groups—Western Cree and Eastern Cree. The varieties classified as Eastern Cree are also known as the *palatalized* dialects because they have /tʃ/ as their reflex for Proto-Algonquian **k* before front vowels; western dialects are also known as *non-palatalized* because velar stops in these varieties do not undergo this process.

East Cree, the variety relevant to this paper, is a palatalized dialect of Cree spoken by approximately 13,000 people in northern Quebec east of James Bay. This paper focuses on NE Cree, a subdialect spoken in three communities: Whapmagoostui, Chisasibi (formerly Fort George), and Wemindji. The child in this study, who has been codenamed A1, is from Chisasibi, a community home to approximately 3,800 Cree.

2.1 The phonemic inventory of NE Cree

The phonemic inventory of NE Cree is illustrated in (1) and (2). We are using roman orthography rather than the more common syllabic system to make the information accessible to a wider audience. This is possible because Cree orthography is generally phonemic.

A list of NE Cree consonants is shown in (1). Phonetic transcriptions are in square brackets. Note that obstruent voicing is non-contrastive in NE Cree, as in other Cree dialects, which means that the letter *p* can be articulated as either [p] or [b], *t* as either [t] or [d], etc.

(1) Consonants

Manner of articulation	Labial	Coronal	Dorsal	Laryngeal
Plosives	p	t	k, kw [k^w]	
Affricates		ch [tʃ]		
Fricatives		s, sh [ʃ]		h
Nasals	m	n		
Glides	w	y		

The vowels and diphthongs of NE Cree are shown in (2). Phonetic transcriptions are again in square brackets.

(2) Vowels and diphthongs

Vowels	Long		Short	
	î [iː]	û [uː]	i/a [ə]	u [ʊ]
	â [aː]			

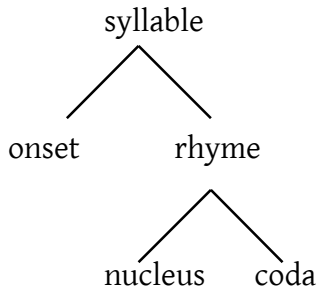
Diphthongs (long)		
	wâ	[(w)ɒː]
	wâw	[ɒw]
	âw	[aw]
	ay	[ay]
	iw	[iːw]
	uy	[uy]

Short vowels can be elided, resulting in what are sometimes called ‘secondary’ consonant clusters. These will be discussed later, in §2.3.

2.2 Syllable structure in NE Cree

Syllables consist of three basic parts: an obligatory nucleus that can be preceded by an optional consonantal onset and followed by an optional consonantal coda. The nucleus and coda have a tighter bond than the nucleus and onset; this relationship is reflected in an additional tier in the syllable structure known as the rhyme (or rime), which is made up of these two constituents. Basic syllable structure is shown in (3).

(3) Basic syllable structure



Although languages vary in the types of syllables they allow, there are universal typological tendencies. One such generalization is that CV is the only universal syllable type and is therefore unmarked. Some languages, such as Hua and Senufo, have only CV syllables while others, such as English, have many more. Another universal rule about syllables is that onsets are more desirable; some languages only have onsets but there are no languages with only codas.

Like other dialects of Cree, NE Cree has a (C)V(C) template. This means that NE Cree onsets are optional and can contain a single consonant (from those listed in (1)), while codas, also optional, are restricted to only the language's fricatives: *s, sh* or *h*. (Recall that, in NE Cree, *kw* is considered a single consonant.) Word-medial consonant clusters appear when two CVC syllables are side-by-side (or when a CVC syllable follows by a CV syllable): the first consonant in the cluster can be one of the 'coda' segments /s, ʃ, h/ and the second may be any consonant in the NEC inventory, as listed in (1).

NE Cree also permits an extra, word-final onset, resulting in word structures such as (...)CV.C or (...)CVC.C. Examples can be seen in (4). While these word-final onsets can initially appear to be coda consonants, as in (4a-c), they must be considered onsets because they are not fricatives. Note that the symbol (.) represents a break between syllables.

(4) Word-final onsets

a.	a.ti.**m**	'dog'
b.	chaa.ki.**t**	'long coat, jacket'
c.	uu.**t**	'canoe'
d.	ˈnis.**k**	'Canada goose'
e.	ˈa.misk.**kw**	'beaver'
f.	ˈwî.chish.**kw**	'muskrat'

NE Cree words with word-final consonants can thus end with a single onset consonant (4a-c) or a coda consonant followed by an onset consonant (4d-f).

Since a syllable cannot consist of only an onset, the nucleus of these word-final onsets must be empty, so we will call these syllables "empty-headed" throughout the book. Empty-headed syllables can also appear word-initially and word-medially in NE Cree, due to processes like syncope.

2.3 Accent and syncope

Quantity-sensitive languages, including members in the Algonquian family, have both light and heavy syllables. This binary distinction is useful for many reasons; most notably, heavy syllables attract stress. NE Cree is quantity-sensitive at the level of the nucleus, which means that coda consonants do not contribute to syllable weight in this language.

In NE Cree, short vowels are light and long vowels are heavy. Historically long vowels (*î* [iː], *û* [uː] and *â* [aː]) are tense, optionally long and not subject to syncope while historically short vowels (*i/a* [ə] and *u* [ʊ]) are lax and are subject to syncope (Dyck et al. 2006).

Stress assignment is also affected by syllable weight in NE Cree. Stress generally falls on the penultimate syllable if it is heavy, as in (5a-b); otherwise, the antepenultimate syllable receives stress (5c-d).

(5) Quantity-sensitivity[1]

a.	ˈî.ti.ni.m	‘hold like so’
b.	ˈwa.pu.shu.ch	‘rabbits’
c.	ni.ˈpâ.wi.n	‘bed’
d.	a.ˈwâ.shish	‘child’

Syncope optionally deletes short vowels (*i/a* [ə] and *u* [ʊ]) in metrically weak positions in NE Cree while metrically strong short vowels and long vowels (*î* [iː], *û* [uː] and *â* [aː]) are not unaffected (Dyck et al. 2006, 2008). The environment for syncope is illustrated in the following example sets. In (6), the first short vowel [ɪ] in the first syllable of both words (in the phonetic transcription) is not elided because it is in a stressed syllable. In contrast, in (7), the vowels in the underlined syllables (bolded in the transcriptions) can be deleted since they are unstressed.

(6) Metrically strong short vowels (no syncope)

a.	ni.maas	[ˈnɪ.mæs]	‘fish’
b.	nis.ku.t	[ˈnɪs.kʊ.t]	‘my nose’

(7) Metrically weak short vowels (syncope)

a.	nísh.tu.shaa.p	[ˈnɪʃ.**tʊ̥**.ʃæ.p^{h}]	‘thirty’
b.	áa.mih.kwaa.n	[ˈæ.**m^{h}**.gɔ.n]	‘spoon’
c.	saa.ki.híi.ki.n	[sæ.**k**.ˈhi.gɪ.n]	‘lake’

[1] Examples (4-6) have been syllabified slightly differently from the source material. Dyck et al. (2008) do not place the word-final consonants in their own syllables; in this paper, they have been syllabified as a word-final onset to be consistent with the arguments presented in §2.1. This change does not affect stress assignment since these syllables are extrametrical.

On a more technical note, the location at which syncope may apply can be predicted under a metrical analysis if NE Cree is analysed as iambic. Syncope can result in a devoiced vowel, as in (6a), a shortened devoiced element [^{h}], as in (6b), or the deletion of the vocalic element, as in (6c). When the vocalic element is deleted, the resulting surface structure contains a syllable that consists of a single consonant and an empty vowel. In sum, syncope affects unstressed short vowels. It occurs in a wide variety of contexts in NE Cree and can result in a devoiced element or complete vowel deletion.

2.4 Summary

NE Cree is a quantity-sensitive Algonquian language with a (C)V(C) syllable template. Pre-syncope, this results in word-medial consonant clusters of maximally two consonants, with restrictions on coda constituents. At this stage, word-medial and word-final clusters consist of two consonants. Post-syncope, there are fewer restrictions on surface forms, resulting in new combinations of consonant clusters in all word positions. Word-final consonants are classified as onsets since any consonant can appear in this position (recall that coda consonants are restricted to fricatives). Word-final onsets, like syncopated CV syllables, are classified as C syllables in this paper.

3. The acquisition of syllable types

In this section, we examine the four main syllable types in NE Cree: CV, CVC, V, and C. When examples are given in this section, and those that follow, they reflect the IPA transcription of the **target** form, as provided in Phon, unless otherwise noted. See Appendix A for more complete descriptions of A1's productions for all syllable types.

3.1 CV syllables

CV syllables are the most frequently occurring syllable type in most languages. They are also the most frequent syllable type in the two sessions we examined, accounting for the majority of the data (84.0% of Session 1 and 74.2% of Session 2).

Table 1. A1's production of CV syllables.

Session	Attempted (N)	% Target-like	% Deleted	% Substituted
1	288	87.5	4.9	7.6
2	544	88.2	6.1	5.7

As Table 1 shows, A1 has acquired this syllable type by age 2;1.12, producing it correctly 87.5% of the time. When she does not produce a target-like syllable, A1 deletes the entire syllable or substitutes a different kind of syllable with nearly the same frequency, particularly in Session 2. When substituting, she tends to insert a V syllable instead, perhaps because she has not mastered the necessary consonants. (This will be discussed in more depth in §4.)

3.2 CVC syllables

There are far fewer CVC syllables in the two sessions, accounting for a very small percentage (1.2%) of the data in Session 1 and 4.6% of Session 2. The results for A1's productions of this syllable type are shown in Table 2.

Table 2. A1's production of CVC syllables.

Session	Attempted (N)	% Target-like	% Deleted	% Substituted
1	4	75.0	0.0	25.0
2	34	85.3	0.0	14.7

Given that there are only four instances of CVC syllables in Session 1, it is not possible to draw any firm conclusions about A1's acquisition of this syllable type in this session, though it appears she is on her way to acquiring CVC syllables, producing 3 of the 4 instances correctly. In Session 2, A1 makes more attempts at CVC syllables and has acquired this syllable type by this point, producing target-like syllables in 85.3% of her attempts. In both sessions, A1 substitutes a less marked syllable type, the CV syllable when she does not produce a CVC syllable, which suggests that A1 may not have acquired syllabic subconstituents (such as the rhyme).

3.3 V syllables

Like CVC syllables, V syllables. i.e., syllables consisting of a single vowel or diphthong, are rare in the data we examined, occurring in 6.7% of the target forms in Session 1 and 3.7% of the Session 2 target forms. Unlike CVC syllables, however, A1 has not acquired V syllables in the time frame being examined, as Table 3 shows.

Table 3. A1's production of V syllables.

Session	Attempted (N)	% Target-like	% Deleted	% Substituted
1	23	43.5	0.0	56.5
2	27	40.7	22.2	37.0

In Session 1, A1 tends to substitute, producing (less marked) CV syllables; this appears to be her default syllable template, which makes sense since CV is the universally unmarked syllable type. In Session 2, A1 shows a similar percentage of target-like productions to Session 1 but she is now also deleting target V syllables instead of only substituting them. In both sessions, many of the substitutions occur word-initially, suggesting that word-initial V syllables may be more challenging to acquire. This could be due to word-segmentation issues; with so little data, we cannot say for with certainty.

3.4 C syllables

As

Table 4 shows, C syllables appear infrequently in Session 1 but are more common in Session 2. In fact, they are the second most frequent type of syllable in the data set in the later session.

Table 4. A1's production of C syllables.

Session	Attempted (N)	% Target-like	% Deleted	% Substituted
1	28	14.3	64.3	21.4
2	115	56.5	39.1	4.3

A1 shows great improvement between sessions but remains well below the acquisition benchmark. In Session 1, A1 overwhelmingly deletes (64.3% of occurrences) C syllables, though we cannot determine whether this is a problem for perception or production. In Session 2, A1 produces target-like syllables in just over half of her attempts, though she still favours deletion, though she uses this strategy less often when she is older. When she substitutes, she produces CV syllables, which suggests that she understands the underlying structure.

Syncope can also turn CVC syllables into CC syllables. These syllables appear later in A1's speech, as she attempts more complex words. In Session 2, most of A1's target CC syllables are found in four words: the CC sequence [kʃ] is present in the target forms of *pâyikushtâu* [baj**kʃ**ˈtaw, baj**kʃ**daw] 'nine'; the verb root *kusht-* [**kʃ**t] 'be scared', found four times in utterances such as *chikushtâu* [ʤʊ**kʃ**ˈtaw] 'you scared?' (3;8.24-71T); and *achihkush* [ɛˈʤu**kʃ**] 'star', found twice. There was also one instance of the sequence [ks] for the root *kischih-* [**ks**tsi] 'be capable/know how to' in *tâpâ nikischihun nîyi* [daˈba ˈnɪkstsʊni] 'I can't do it/I don't know how to do it' (3;8.24-117T).

A1 successfully produces a CC syllable for only six of the 13 target words (46.2%) in which this sequence is found. These six target-like productions occur in her six productions of the word *pâyikushtâu* 'nine'. This suggests lexical learning, as opposed to acquisition of this syllable type.

For the two instances of *achihkush* [ɛˈʤukʃ] 'star,' A1 produces the affricate [ʧ] instead of /kʃ/, pronouncing the target form as [ˈgʊʧ] (3;8.24-238) and [ɪˈgʊʧ] (3;8.24-239). This suggests that she may be interpreting the /kʃ/ sequence as an affricate, or that the /k/ is assimilating to the place of articulation of /ʃ/. It is possible that [t] and [ʃ] might be better regarded as separate phonemes rather than an affricate in these instances since, as §4.1.1 will show, A1 sometimes produces [t] for /k/ in onset position (though not for /k/ as an OEHS (cf. §4.2.1)).

In five examples, the CC syllable is found in the verb complex. (Note that Algonquian verbs are morphologically complex, carrying both derivational and inflectional morphology, meaning that grammatical functions like person and number are encoded in the verb, as well as things like tense.) In the verb complex in the examples in (8), A1 combines the first two syllables of the target form (the person prefix *ni-* and the first syllable of the verb stem, i.e. /ks/ or /kʃ/), into a CVC syllable, so that the underlined segments in a <u>CV</u>.C<u>C</u> sequence are realized as CVC syllables. In the examples in (8), the target forms are listed in the top tier (T) and A1's actual production is the bottom tier (A).

(8) <u>A1's productions of CV.CC sequences as CVC syllables in Session 2</u>

a. *tâpâ nikischihun* 'I can't do it/I don't know how to do it' (3;8.24-117)
T: [da.ˈba **ˈnɪ.ks.**tsʊ.ni]
A: [**nɪʃ.**ˈʤa.ni]

b. *chikushtâu* 'you scared?' (3;8.24-71)
T: [ʤʊ.**kʃ.**ˈtaw]
A: [**dɪʃ.**ˈdo]

c. *shâsh nimui nikushtâu pwâchikî* 'not anymore scared of the boogieman' (3;8.24-300)
T: [ˈʃɛʃ nəˈmʷi **ˈnʊ.kʃ.**taw ˈbʊ.ʤə.gi]
A: [ʤɛʃ ni.mi **dɪʃ.**da bʌˈʤə.gi]

d. *mâu nîyi mîn nikushtân û* 'this is mine I'm scared of it again'(3;8.24-352)
T: [ˈmaw ˈni ˈmi.**nʊ.kʃ.**tə.no]
A: [ma me.ɪ nə.mɛ.**ˈnɛʃ.**dɪ.nʊ]

e. *mâmî nikushtân û* 'I'm scared of it' (3;8.24-353)
T: [ˈma.mi **nʊ.kʃ.**ˈtə.no]
A: [ma.mi da.**ˈnɛs.**ta.n]

In all of the above examples, A1 deletes [k] to preserve [ʃ], a canonical or primary coda type in NE Cree. This suggests that she may, in fact, have some knowledge of phonotactics. Another possible explanations are that (coda) /ʃ/ is more perceptually salient (strident), or easier to produce, than (onset) /k/.

3.5 Other syllable data

In Session 2, A1 has some variation that seems systematic but does not fit into the above categories. This section will discuss this data.

One pattern observed in the data is the sequence C<u>V</u>.C<u>V</u> becoming a CV syllable, taking the consonant from the first syllable and vowel from the second syllable (underlined). Examples of this are listed in (9). The relevant syllables are bolded.

(9) <u>Examples of CV.CV CV</u>

a. *chiwâpihtân â nîyi akwâtisîu* 'see I am the best' (3;8.24-87)
T: [**ʤo.ˈha.**n ˈna ˈni əˈkʌ.ʦi.jow]
A: [**ˈʤa** ˈna ˈni ˈka.kʰ]

b. *pwâchikî* 'boogeyman' (3;8.24-310)
T: [ˈbʌ.**ʤə.gi**]
A: [wʊ.**ˈʤi**]

In total, there are 18 instances of this pattern. (Note that the target form of *chiwâpihtân* [ʤohan] is a reduced form.)

In addition to the <u>CV</u>.<u>C</u>C CVC syllables, there are also instances of A1 producing the sequence C<u>V</u>.C<u>VC</u> as a CVC syllable, created from the underlined constituents. These records are shown in (10).

(10) Examples of CV.CVC CVC

a. *chikushtâu* 'are you scared?' (3;8.24-69)
T: [ʤi.kəʃʰ.taw]
A: [lɛs.ˈdo]

b. *niyâyu nikutwâshch* 'five six' (3;8.24-173)
T: [ni.ˈjɑ̂j. gə.ˈdɑʃ.ʧ]
A: [ni.ˈgɑʃ]

c. *nikutwâshch* 'six' (3;8.24-224)
T: [nə.gə.ˈdɑʃ.ʧ]
A: [ni.ˈgɑʃ]

Since there are not many examples of this sequence, we cannot determine if this is a pattern; however, we see similar data in English, e.g., *banana* produced as [bænə].

A1 occasionally epenthesizes (adds) segments or syllables in her utterances in both sessions. (Content is considered epenthetic if there is no corresponding form to A1's productions in the Orthography or IPA Target fields.) She most commonly epenthesizes word-initially but meaningless syllables can also be found in other positions.

When A1 adds a V syllable, it is word- and utterance-initial in all but three instances; for Session 1, this occurs in 7 out of 10 instances and, for Session 2, in 13 out of 14 instances. Examples of epenthesized V syllables are given below.

(11) Examples of V syllable epenthesis

	Orthography	Target	Actual	Record
a.	*mommy*	[mɑ.mi]	[ɛ ma.ˈme]	2;1.12-17
b.	*nâu*	[ˈnaw]	[ə.ˈnaw]	3;8.24-171

This is different from the #V #CV repair mentioned in §3.3; in the #V #CV repair, A1 is replacing a syllable type she has yet to acquire with one she has already acquired whereas, in cases like those in (11), the extra syllable does not have corresponding form in the target word, nor does it carry any meaning.

CV syllables are sometimes added as well, as in (12). In Session 1, this occurs 15 times.

(12) Examples of CV syllable epenthesis

	Orthography	Target	Actual	Record
a.	*chipiha*	[tsə.ˈba]	[nɪ.dʌ.ˈbɑ]	2;1.12-95
b.	*mâutâh nîyi*	[maw.ˈda ˈni]	[ˈma.dʌ.ni.ja]	3;8.24-249

Six of these were word-and utterance-initial, five were word-medial and four were word- and utterance-final. Similarly, in Session 2, A1 added CV syllables three times before the target form, once word-medially and six times after the target form.

C syllables are epenthesized less frequently. In Session 1, A1 adds a C syllable word-finally twice and word-medially once. In Session 2, she adds this syllable type 12 times – twice at the start of the word (and utterance), five times word-medially and five times word- and utterance-finally. Examples of epenthesized C syllables are shown in (13).

(13) Examples of C syllable epenthesis

	ORTHOGRAPHY	TARGET	ACTUAL	RECORD
a.	*mommy*	[mɑ.mi]	['mɑ.mi.**n**]	2;1.12-194
b.	*mâutâh*	['maw.də]	['næ.**n**.da]	3;8.24-5

When found word-medially these syllables are typically found preceding a consonant with the same place of articulation, as in (31b).

3.6 Summary

Looking at these two sessions provides a snapshot of A1's acquisition of NE Cree. The data from these two sessions show that, by age 3;8.24, A1 has acquired first CV, then CVC syllables. She is still in the process of mastering the others (C and V syllables), with varying rates of success. CV syllables are unmarked and are consequently acquired first in many languages. Studies have also shown that that CV syllables are acquired before CVC syllables; A1's acquisition of syllable types appears to be following universal norms.

The results for C syllables are quite interesting because, although A1 shows a great deal of improvement between sessions, and although C syllables occur more frequently in the data than CVC syllables, A1 has not mastered this syllable type. If a purely frequency-based approach were being used, A1 should have acquired C syllables before CVC structures; however, this is not the case, suggesting that C syllables, which are the result of syncope and are highly phonologically marked, are more challenging to learn, despite their frequency. Finally, A1 produces target-like V syllables in approximately 40% of the data for both sessions.

In the next section, A1's acquisition of NE Cree consonants is discussed.

4. A1's acquisition of NE Cree consonants

The following discussion of NE consonants is divided according to syllable position since the literature shows that onsets are less marked and frequently acquired earlier than codas. Onsets and OEHSs are also discussed separately since A1 has not acquired C syllables by Session 2, as illustrated in the previous section; combining the two groups might skew the results. *kw* has been excluded from this analysis since it was not heard in either session.

See Appendix B for more complete descriptions of A1's productions for all NE Cree consonants, organized according to syllable position.

4.1 A1's acquisition of onsets

The results discussed in this section are only for consonants coded as onsets. Those coded as onsets of empty-headed syllables (OEHSs) will be discussed in the following section since they are found in syllables that A1 is in the process of acquiring (C syllables).

4.1.1. Plosives

Plosives are the second most frequently occurring natural class in the sessions examined, accounting for approximately one-third of the consonants found in target forms (32.7% of Session 1 and 32.5% of Session 2). Given that frequently occurring phones may develop early, A1 was expected to show higher percentages of target-like productions of /p, t, k/. Results for the NE Cree plosives, outlined in Table 5, illustrates that A1 shows different patterns of acquisition for each of the three NE Cree plosives.

Table 5. A1's production of NE Cree plosives in onset position.

Consonant	Session	Attempted (N)	% target-like	% deleted	% substituted
p	1	17	64.7	0.0	35.3
	2	40	82.5	10.0	7.5
t	1	51	78.4	3.9	17.6
	2	112	78.6	4.5	17.0
k	1	28	71.4	10.7	17.9
	2	49	69.4	12.2	18.4

For /p/, A1 produces target-like sounds at an above-chance rate in Session 1 (64.7%). When she does not produce a target-like consonant, A1 consistently substitutes, producing another plosive [t, k] (29.4% of her attempts) or another labial [w] (5.9%). These substitutions look like long-distance assimilation, e.g., A1 produces the target *tâpâ ihtâu* [dəbə ˈdaw] 'she's not there (nobody's there)' as [dəˈdʌ du] (2;1.12-117); however, long-distance assimilation is not common in the data set.

By Session 2, A1 has mastered onset /p/, successfully producing target-like sounds in 82.5% of her attempts, though she is now sometimes deleting instead of substituting. This occurs twice word-initially and twice word-medially; there does not appear to be a pattern for this strategy.

As Table 5 shows, for /t/, A1 demonstrates near-mastery in both sessions, showing little change between the two sessions. A1 rarely deletes, instead substituting a variety of consonants, including other coronals (8.0%) or other plosives (8.0%).

Similarly, A1 shows little variation between sessions and appears to be close to mastering onset /k/ in Session 1 but the results may be skewed due to one word—*kûhkûm* [**g**ʊ**k**um] 'grandmother'—occurring nine times. In Session 2, A1 uses a greater variety of words with /k/ in onset position, although the name *Cammie* accounts for five of her target-like productions. In Session 2, A1 uses a greater variety of words with /k/ in onset position, although the name *Cammie* accounts for five of her target-like productions. Her rates of target-like, deleted and substituted productions are quite similar in both sessions, as they were for /t/.

4.1.2. Affricates

As illustrated in (1), there is only one affricate in NE Cree: /ʧ/. A1's productions of this phoneme are displayed in Table 6.

Table 6. A1's production of /ʧ/ in onset position.

Session	Attempted (N)	% target-like	% deleted	% substituted
1	15	26.7	13.3	60.0
2	62	77.4	8.1	14.5

In Session 1, A1 has not mastered this segment. She primarily substitutes other coronals, particularly [t] (46.7%). This deaffrication (to [t]) suggests that, A1 has not yet acquired the [±anterior] (henceforth [±ant]) distinction. (This will also be discussed in the following section.) An example of deaffrication is shown in (14).

(14) Example of A1's substitutions for /ʧ/

Mommy chîyi û Mommy 'mommy this is you mommy' (2;1.12-51)
T: ['mɑmi ʤi'jo 'mɑmi]
A: [mɑmi **d**iə mɑmi]

In contrast, in Session 2, A1 has nearly acquired this segment, though she still shows some deaffrication, at a much lower rate (6.5% of her attempts), indicating that she may not fully grasp this distinction, which tends to appear later in the acquisition process. Another possibility here is that affricates may be harder to acquire since they are complex, i.e. two-part gestures; substituting plosives for affricates is a frequent pattern, followed by the substitution of fricatives for affricates.

4.1.3. Fricatives

The three NE Cree fricatives /s, ʃ, h/ do not occur that frequently in the data set; in Session 1, there are only two instances of fricatives in onset position and, in Session 2, there are 48. A1's productions of these segments are detailed in Table 7.

Table 7. A1's production of NE Cree fricatives in onset position.

Consonant	Session	Attempted (N)	% Target-like	% Deleted	% Substituted
s	1	0	n/a	n/a	n/a
	2	5	60.0	0.0	40.0
ʃ	1	1	0.0	100.0	0.0
	2	9	66.7	0.0	33.3
h	1	1	0.0	100.0	0.0
	2	34	32.3	58.8	8.8

As this table indicates, /s/ did not appear in the target forms in Session 1 and only five times in Session 2. In this session, A1 produces a target-like segment in three of these five attempts. There does not appear to be a systematic explanation for the two substitutions that occurred.

/ʃ/ is also infrequent in the data set, appearing as a target form once in Session 1 and nine times in Session 2. There is not enough data in Session 1 to determine A1's actual progress in at this age; in contrast, the data for Session 2 are likely a more realistic depiction of A1's abilities, suggesting she is close to acquiring this consonant. Her substitutions are all other coronals; she twice produces [s] for /ʃ/, reinforcing the idea that A1 has not acquired the [±ant] distinction, the only feature that distinguishes /s/ from /ʃ/, in keeping with the discussion on /ʧ/. (This distinction is learned later in the acquisition process.)

Like /ʃ/, /h/ appears only once in the target forms in Session 1 but is more frequent in Session 2, as illustrated in Table 7, though A1 continues to struggle with this consonant.[2] This lack of success may be due to one particular lexical item: the reduced form of the word *chiwâpihtân* [ʤaˈhɑn] 'you (sg.) see,' which occurs 20 times in Session 2. A1 consistently deletes /h/ in this word, accounting for all of the deleted attempts.[3] It is worth noting that all A1's target-like productions of [h] are restricted to one word, with variable target forms and orthography—*îhî / nîhî* [ə̃hə̃, nəˈhɛ] 'yes'—suggesting that her success might be restricted to a single, frequently occurring word.

4.1.4. Nasals

Nasals are the most frequently occurring natural class in onset position in the two sessions examined. The results for /m/ and /n/, found in Table 8, show that A1 is well on her way to acquiring nasals at age 2;1.12.

Table 8. A1's production of NE Cree nasals in onset position.

Consonant	Session	Attempted (N)	% target-like	% deleted	% substituted
m	1	131	67.9	16.8	15.3
	2	133	68.4	8.3	23.3
n	1	35	68.6	5.7	25.7
	2	124	80.6	9.7	9.7

A1 shows little change between sessions for A1's percentages of target-like productions of /m/. In Session 1, she uses deletion and substitution at near equal rates, with her deletions typically being word-initial (20/22) and found primarily in the first syllable of the word *mommy* (8/22); the other deleted segments happen across a variety of words. A1's substitutions do not appear to be systematic, although denasalization (/m/ → [p] or [t]) accounts for 11 of the 20 substitutions. In contrast, in Session 2, A1 deletes less and substitutes more. In these substitutions, she is producing segments that share features with /m/ more frequently than she previously did, at a rate of 80.6% (versus 60.0% for Session 1). This suggests that A1 is becoming better at producing this

[2] The laryngeal fricative /h/ was not expected to occur very often in onset position since it is found mainly in codas in the NE Cree lexicon (available at http://eastcree.org and on the *Cree Conversation CD and Manual*); its frequency in this study is likely a by-product of the low number of target forms containing /h/ in the data set.

[3] This word is subject to a significant amount of deletion. For this reason, we have analysed it as a reduced form of the word that appears in context.

consonant, especially since most of the substitutions have the same place (17/31) or manner (8/31) of articulation as /m/.

A1 shows more progress with onset /n/, acquiring this phoneme by Session 2. In Session 1, A1 deletes infrequently and substitutes a variety of segments for /n/. Her substitutions in Session 1 tend to share either place (4/9) or manner (3/9) of articulation with the target segment. Interestingly, in Session 2, she also deletes and substitutes at equal rates at this age.

4.1.5. Glides

In this study, glides coded as both 'onset' and 'ambiguously syllabified' in *Phon* have been counted as onsets. Intervocalic glides were coded as ambiguously syllabified only in the following contexts: word-medial VGV (vowel- glide-vowel) sequences, exemplified in (13a), and VG# #V sequences (a word-final glide followed by a vowel-initial word), in (13b). This example set is repeated on the following page.

(13) Examples of glides coded as ambiguously syllabified

a.	*kiyâh nîyi ituhtâu*	[ˈg**ija** ˈni ˈitʰdaw]	'yes, I will go'	(3;8.24-32T)
b.	*nîyi û*	[n**ij** **ˈo**]	'me (this is mine)'	(2;1.12-27T)

Including the ambiguously syllabified glides as onsets increases the number of attempts that A1 makes at glides in onset position but does not alter the list of substituted consonants; A1 uses the same set of substitutes whether the glides have been coded as onsets or as ambiguously syllabified.

Although glides, along with stops and nasals, are thought to develop earlier than fricatives and affricates, the results for /w/ and /j/, shown in Table 9, indicate that this is not precisely the case.

Table 9. A1's production of NE Cree glides in onset position.

Consonant	Session	Attempted (N)	% target-like	% deleted	% substituted
w	1	6	33.3	33.3	33.3
	2	17	58.8	29.4	11.8
j	1	9	44.4	22.2	33.3
	2	33	72.7	21.2	6.0

In Session 1, A1 makes only six attempts at /w/. Four of these six attempts were coded as ambiguously syllabified; A1 produced a target-like segment for only one of these four occurrences. There are too few instances of [w] in the target forms in this session to make strong generalizations but the data suggest that A1 has not yet mastered this segment.

In Session 2, A1 still has not acquired this segment in onset position but seems to be progressing in that direction. In this session, 11 of the 17 attempts were coded as ambiguously syllabified; A1 produced a target-like segment six of the 11 times. In both sessions, the substitutions occurred for segments that were coded as ambiguously syllabified. This suggests that A1 can differentiate between these and regular onsets.

For /j/, there is a similar pattern. There are few occurrences of the segment in the target forms in Session 1, eight of which have been coded as ambiguously syllabified. A1 is more successful at producing target-like segments in Session 2, nearing the benchmark for acquisition. There are similar rates of deletion in both sessions but less substitution in Session 2.

4.1.6. Summary

At age 3;8.24, A1 is still in the process of acquiring consonants in onset position, having acquired only two consonants—/p, n/. She is nearing mastery of four other onset consonants, producing target-like segments for /t, k, ʧ, j/ in over 70% of her attempts. When A1's acquisition of onset consonants according to manner of articulation, summarized in Table 10, we can see that, despite this progress, A1 has yet to produce target-like consonants in any natural class at a rate of over 80%. She is nearing this benchmark with plosives (77.1% target-like), affricates (77.4%) and nasals (74.3%), and is not far behind with glides (68.0%), but appears to still have difficulty with fricatives (41.7%). Fricatives are also the natural class that A1 tends to delete the most, in both sessions, which suggests that this is the most challenging natural class for her to acquire; fricatives are acquired later than other classes of sounds.

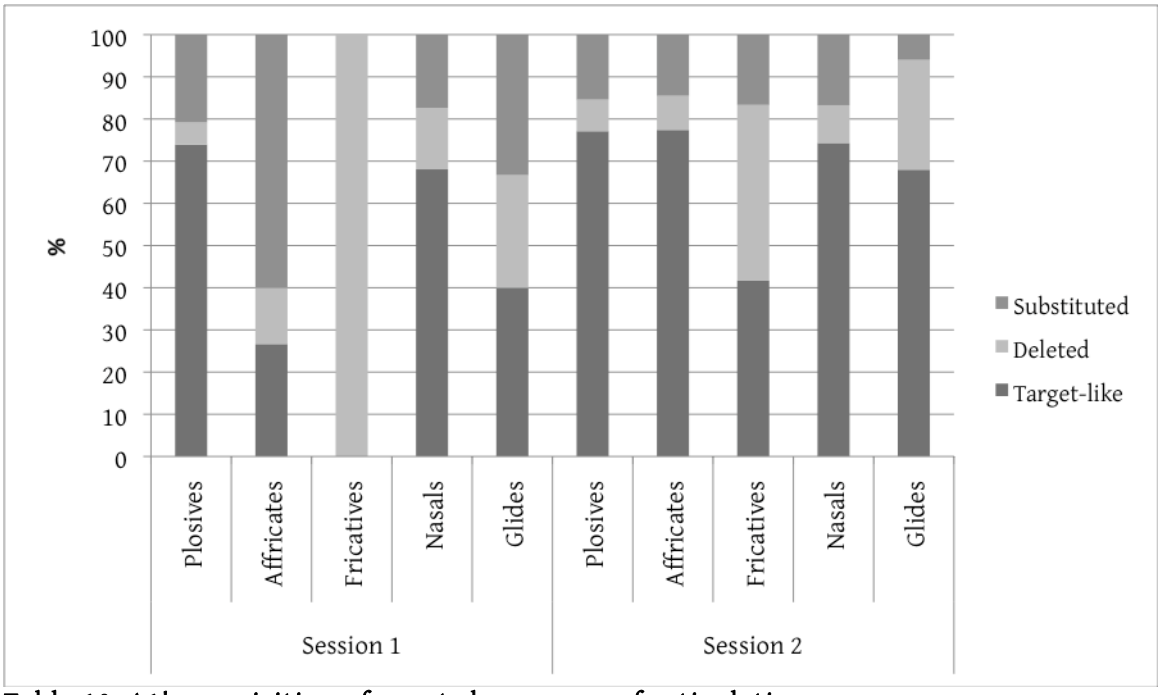


Table 10. A1's acquisition of onsets by manner of articulation.

Combining A1's target-like productions with her attempts where she substituted a segment with similar values, e.g., the same place or manner of articulation, provides a more positive assessment of A1's abilities for all of the natural classes, except for the affricates, suggesting she may be acquiring manner of articulation before specific consonants. This combination shows A1 producing plosives at a rate of 83.3%.

Grouping onsets consonants as obstruents and sonorants reinforces that A1 is producing more target-like segments in Session 2, with a small increase in percentages for both sonorants and obstruents. Once again, combining A1's target-like productions with substitutions of similar consonants provides a more positive description of A1's abilities, suggesting A1 has acquired the distinction between obstruents and sonorants by Session 2.

When the data are examined in terms of place of articulation, a similar picture emerges, shown in Table 11. Note that, in this chart, coronals are divided according to the [±ant] contrast since the target NE Cree consonants make this distinction. As Table 11 shows, A1 is nearing mastery of both groups of coronals (78.9% for those that are [+ant] and 71.4% for those that are [-ant]), as well as labials (70.5%). Finally, recall from the inventory presented in (1) that the dorsal and laryngeal categories are each represented by a single consonant (/k/ and /h/, respectively); A1 has yet to acquire either of these phonemes.

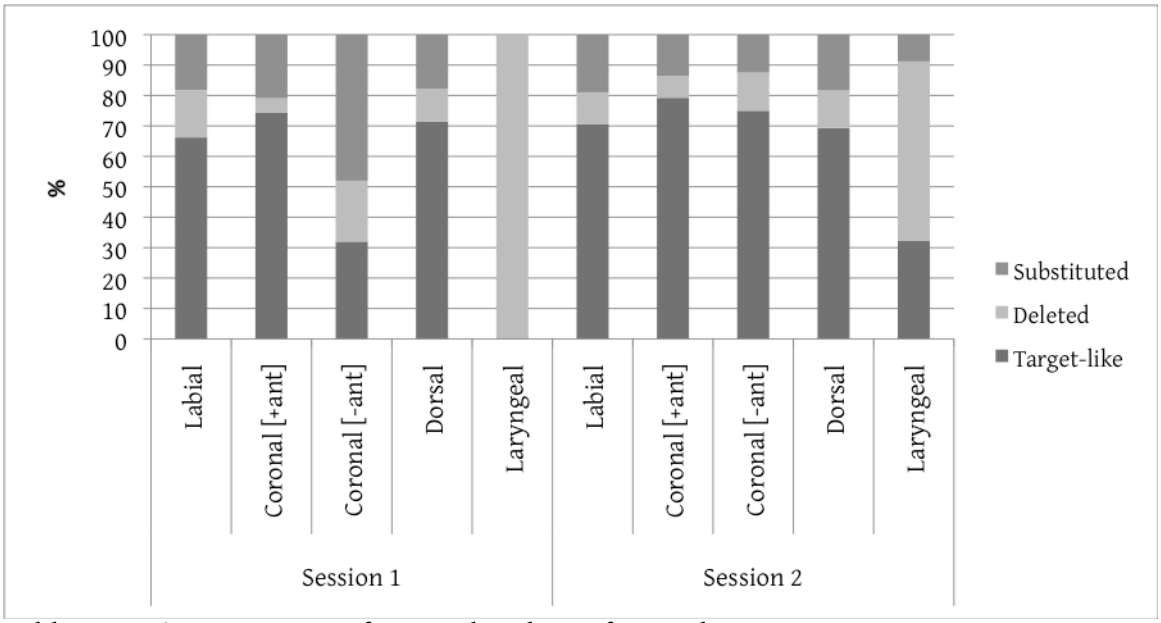


Table 11. A1's acquisition of onsets by place of articulation.

When A1's target-like productions are combined with the substituted segments that share the target's place of articulation, changes are only visible for labials and [±ant] coronals; the other three categories remain the same. As a result of these adjustments, it appears that A1 has acquired the place of articulation for NE Cree [+ant] coronals by Session 1 and labials by Session 2.

4.2 A1's acquisition of onsets of empty-headed syllables

Onsets of empty-headed syllables (OEHSs), or onsets of syllables with elided vowels (including onsets of C and CC syllables), occur much less frequently than the onsets of syllables with an overt nucleus. As such, the data will be discussed primarily in terms of raw numbers, rather than percentages, although percentages are available in all examples.

Only plosives, affricates, and nasals appear as OEHSs in the target forms of the sessions analysed; consequently, fricatives and glides are not discussed in this section.[4]

4.2.1. Plosives

Plosives occur infrequently as OEHSs in this data set, Table 12 shows. For /p/, for example, there are no target forms with this consonant as an OEHS in Session 1. In Session 2, there are only four instances. The single target-like production is found word-medially; the three substitutions are word-final. At first glance, it appears that A1 is consistently substituting a different plosive for [p] but these three instances all contain the same target form *apih* [ɪ**pʰ**] 'sit', which A1 produces as [ˈjɛt̚aw ɪ**t** ˈjɛjaw ɪ**t**] (3;8.24-333) and [ˈjɛgaw jɪ**t**] (3;8.24-334), so it is possible that this is a lexical effect.

Table 12. A1's production of NE Cree plosives in OEHS position.

Consonant	Session	Attempted (N)	% target-like	% deleted	% substituted
p	1	0	n/a	n/a	n/a
	2	4	25.0	0.0	75.0
t	1	3	33.3	66.7	0.0
	2	39	66.7	25.6	7.7
k	1	0	n/a	n/a	n/a
	2	24	62.5	29.2	8.3

The coronal plosive /t/ is the only one to occur with frequency in OEHS syllables. It is found three times as an OEHS in the target forms of Session 1 but is more common in Session 2, as illustrated in the above table. OEHS /t/ occurs primarily word-finally in the data set: A1's three attempts at OEHS /t/ in Session 1 are all word-final, as are all but four of the attempts in Session 2. Of the 35 word-final attempts at this segment, 65.7% were target-like, 25.7% were deleted and 8.6% were substituted. In Session 2, A1 also has four word-medial OEHSs, three resulting in target-like productions and the other in deletion.

Although it appears that A1 is fairly successful at producing [t] as an OEHS in Session 2, she is often repeating the same words. Specifically, A1 attempts *mitâhtu* [mɪdætʰ, midatʰ] 'ten' 14 times, *nishtu* [nɪʃt, nɪʃtʰ] 'three' 11 times and the (typically-reduced) verbal root *ihtut* [dʊt, dʊtʰ, dutʰ] 'do' seven times, accounting for 32 of the 39 occurrences of this segment as an OEHS. This suggests that the information in Table 12 may not accurately represent A1's abilities at this stage of development, or that she is learning to produce OEHS C-syllables on a word-by-word basis.

Like /p/, the final NE Cree plosive /k/ was not found in the target data for Session 1; however, as Table 12 shows, /k/ appears as an OEHS more frequently in Session 2, both word-medially and word-finally. 15 of the 24 instances of /k/ as an OEHS were found word-medially, 13 of these in the [kʃ] or [ks] syllables discussed in

[4] Fricatives do not appear as onsets of empty-headed syllables, presumably because there are few instances of sV, ʃV or hV sequences in the data. Glides are not found in this position, likely because they are part of a diphthong when followed by a consonant. The three natural classes that can occur in this position are all [-continuant] but this may be a by-product of the data, not the explanation.

§3.4. In these attempts, /k/ was deleted six times, substituted twice and produced in a target-like manner seven times. Of the nine word-final segments, eight of these attempts were target-like; the remaining attempt resulted in a deletion. This suggests that A1 is more successful with /k/ as a word-final OEHS.

It is worth noting that most of the deletions of /k/ occur word-medially in longer utterances. The two instances of OEHS [ʧ] in the actual forms appear in the same word—target *achihkush* [ɛ.ˈʤu.kʃ] 'star' produced as either [ˈgʊʧ] (3;8.24-238) or [ɪˈgʊʧ] (3;8.24-239)—suggesting that the presence of [ʧ] in the actual forms might be word-specific. Also, as with other plosives in OEHS position, [k] appears in the same words repeatedly in this session: *pâyikw* [bajk, bajkʰ] 'one' appears seven times, *pâyikushtâu* [bajkʃtaw, bajkʃdaw] 'nine' six times and the root *kusht-* [kʃt] 'be scared' four times (in utterances such as *chikushtâu* [ʤʊkʃ'taw] 'you scared?' (3;8.24-71T)).

Overall, it seems that A1 has become more aware of plosives as onsets of empty-headed syllables but it is not possible to determine whether she has acquired them in this position, or is producing them only in specific words, due to the small sample size. However, when word position is taken into account, it appears that A1 is closer to acquiring plosives that are word-final onsets of empty-headed syllables than those that are word-medial. She produces target-like utterances in 66.7% of her word-final attempts and 50.0% of her word-medial ones. It remains to be seen if A1 is acquiring final OEHS position or if this is lexical learning.

4.2.2. Affricates

Like /p/ and /k/, the affricate /ʧ/ does not appear as an OEHS in Session 1 although it is present in the target forms of Session 2. Results are shown in Table 13.

Table 13. A1's production of /ʧ/ in OEHS position.

Session	Attempted (N)	% target-like	% deleted	% substituted
1	0	0.0	0.0	0.0
2	13	0.0	92.3	7.7

In Session 2, all 13 attempts at this target form are found in word-final position and none is realized in a target-like manner. In 12 instances, /ʧ/ is preceded by /ʃ/ and A1 categorically deletes the affricate. For example, she produces the target word *nîshwâshch* [niˈʃaʃʧ] 'nine' as [niˈʃaʃ] (3;8.24-125) and the target form *kutwâshch* [gəˈdaʃʧ] 'six' as [ənˈgaʃ] (3;8.24-156). It is possible that deletion occurs because [ʃʧ] is an articulatorily complex sequence. For the single substitution, A1 produced [t]; deaffrication was also found with /ʧ/ in onset position (§4.1.2).

4.2.3. Nasals

Both NE Cree nasals appear as OEHSs in the data examined, as illustrated in

Table 14.

Table 14. A1's production of NE Cree nasals in onset position.

Consonant	Session	Attempted (N)	% target-like	% deleted	% substituted
m	1	9	0.0	100.0	0.0
	2	3	33.3	33.3	33.3
n	1	13	53.8	46.2	0.0
	2	48	47.9	41.7	10.4

In Session 1, A1 categorically deletes /m/ in this position; however, all of her attempts occur in a single word—*kûhkûm* [gʊkum] 'grandmother'—so it is impossible to say whether A1 has yet to acquire this segment in this syllable position, or this word. In Session 2, A1 still shows difficulty with /m/ as an OEHS: she begins to produce [m] as an OEHS but is only successful in one of her three attempts; all three instances of /m/ as on OEHS are both word- and utterance-final.

For /n/, the most frequent OEHS consonant, a different pattern emerges. In Session 1, A1 produces target-like segments or deletes equally. In this session, all of the deletions are found word-finally; the target-like productions are evenly divided between word-medial (3/7) and word-final (4/7) positions. The three target-like word-medial productions were all found in the same word – *mânitâh* [ˈmændə] 'like that', which produces as either [ɛnəˈdʌ] (2;1.12-82) or as [ɪnˈdʌ] (twice in 2;1.12-145) – so this may be a lexical effect. (Note that A1's production of this word as [ɛ**nə**ˈdʌ] shows no syncope in the syllable in question; syncope is optional in NE Cree.)

The results for Session 2 show a similar distribution of rates, although A1 occasionally substitutes other segments for /n/, typically those that share place or manner of articulation with the target consonant. All of these substitutions occurred for word-final onsets of empty-headed syllables. This suggests A1 is making progress with the acquisition of word-final OEHS since her percentage of target-like productions is nearly identical to Session 1. When A1's attempts are analysed according to position in the word, the data show that she was more successful at producing OEHS /n/ word-medially: she produces target-like segments in 53.8% of the word-final attempts and in 77.8% of the word-medial ones.

4.2.4. Summary

A1 has yet to acquire any particular consonant as an OEHS. Only six phonemes appear as onsets of empty-headed syllables in this data set: /p, t, k, ʧ, m, n/. Table 15 shows the data grouped according to place of articulation. Note that the results for plosives for Session 1 are only for /t/ since the other two were not found in OEHS position in Session 1.

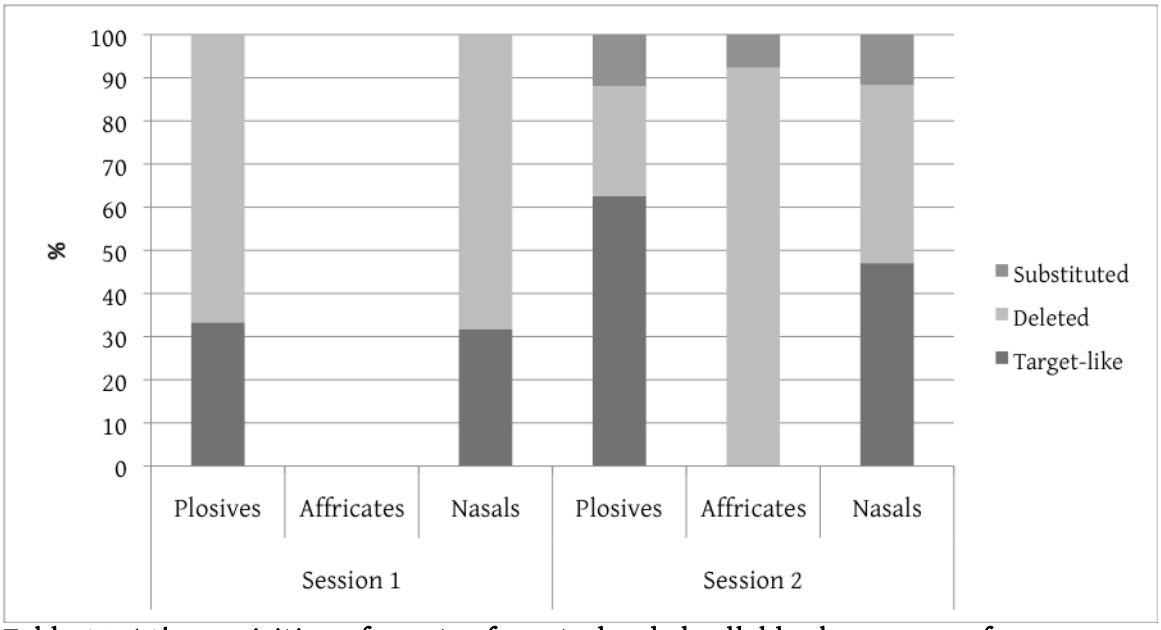


Table 15. A1's acquisition of onsets of empty-headed syllables by manner of articulation.

The chart illustrates that A1 has yet to master onsets of empty-headed syllables; it also suggests that she will acquire plosives in the position first since she produces target-like utterance 61.5% of the time at age 3;8.24. OEHS plosives are heavily aspirated (Power 2009), while OEHS nasals are not; this increased saliency may make it easier to acquire plosives in this environment.

When the data are grouped as obstruents and sonorants. A1 shows near identical progress in these two classes of sounds. Specifically, A1's rates of target-like productions increase by the same amount, and she also begins to substitute, with near equal percentages, at age 3;8.24.

In Table 16, these findings are grouped according to manner of articulation. Only the relevant categories are included.

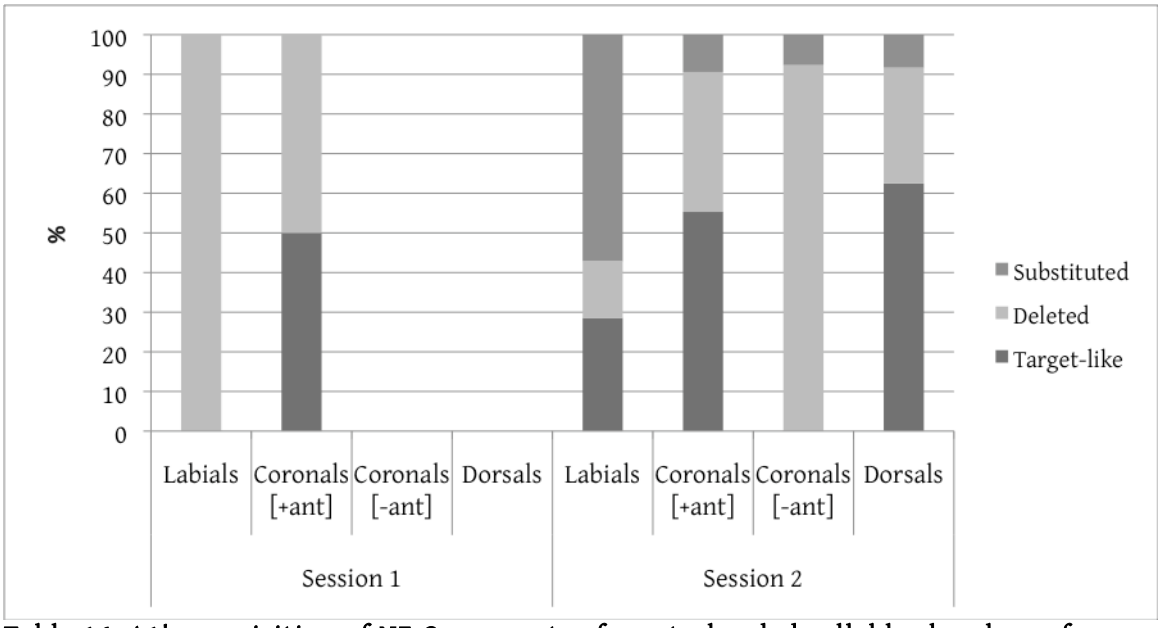


Table 16. A1's acquisition of NE Cree onsets of empty-headed syllables by place of articulation.

As this chart shows, A1 is most successful with dorsals (/k/) and least successful with labials (/p, m/); her ability to produce target-like coronals is the same at both ages.

When the OEHS data are examined in terms of word position, they show that A1 is making significant progress in her acquisition of these segments. The three instances of word-medial OEHS consonants in Session 1, all of which were target-like, occur in the same word—*mânitâh* [ˈmændə] 'like that' (cf. §4.2.3). This is likely a lexical effect and is probably not an accurate representation of A1's abilities at age 2;1.12.

When we consider A1's target-like productions in terms of both manner of articulation and word position, as in Table 17, it becomes clear that A1 is more successful with plosives word-finally and with nasals word-medially.

The results for the affricate /ʧ/ must be interpreted differently. A1 does not produce a target-like [ʧ] in either session. In the data set, /ʧ/ only appears in word-final position as an OEHS in Session 2 and is deleted in 12 of A1's 13 attempts. All instances of deletion occur when /ʧ/ is preceded by /ʃ/, in words like *nîshwâshch* [niˈʃaʃʧ] 'nine,' which A1 produces as [niˈʃaʃ] (3;8.24-125), and *kutwâshch* [gəˈdaʃʧ] 'six,' pronounced as [ənˈgaʃ] (3;8.24-156). This suggests that deletion occurs because of the articulatorily complex sequence [ʃʧ]. For the single substitution, A1 produced [t]; deaffrication was also found with /ʧ/ in onset position.

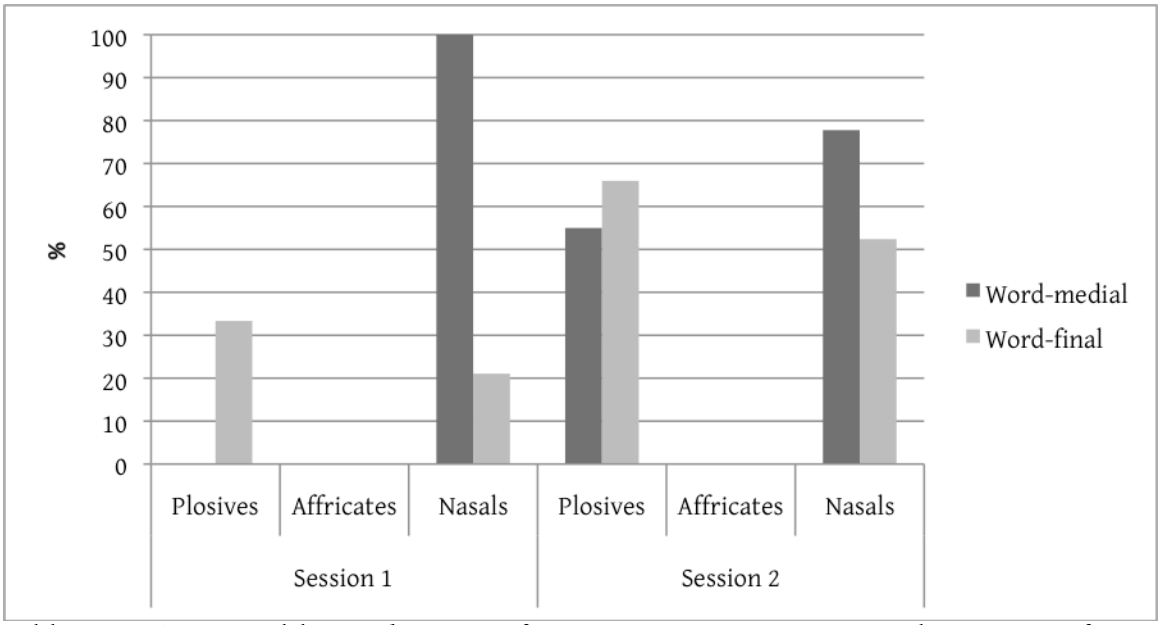


Table 17. A1's target-like productions of consonants in OEHS position by manner of articulation and word position.

In sum, A1 appears to be recognising segments as onsets of empty-headed syllables and is becoming increasingly more accurate with her productions of these consonants in this type of syllable. However, she has yet to acquire any segments in this syllable position by Session 2. When word position is considered, it becomes clear that A1 is slightly more successful at producing target-like onsets of empty-headed syllables word-medially; in Session 2, she produces target-like segments word-medially in 62.1% of her attempts, compared to 52.0% for her word-final attempts. The plosives go against this general trend; A1 is more successful with word-final segments in this natural class (66.0% target-like word-finally vs. 55.0% word-medially). It is also possible that A1's target-like productions are a result of lexical learning; more data are required to determine what strategy she is employing.

4.3 A1's acquisition of NE Cree codas

As discussed in §2.1, only fricatives can occur in canonical coda position in NE Cree. As such, this section is confined to the three fricatives found in the phonemic inventory of the language shown in the table below.

Table 18. A1's production of NE Cree fricatives in coda position.

Session	Consonant	Attempted (N)	% Target-like	% Deleted	% Substituted
1	/s/	0	-	-	-
	/ʃ/	4	75.0	0.0	25.0
	/h/	0	-	-	-
2	/s/	2	50.0	0.0	50.0
	/ʃ/	51	80.4	7.8	11.8
	/h/	3	0.0	100.0	0.0

A1 demonstrates the most success with coda /ʃ/. This consonant appears only four times in Session 1 and is correctly produced in three of A1's attempts; since all three productions occur in the diminutive suffix *-ish*, it is possible that A1 may have acquired this morpheme, rather than coda /ʃ/. By Session 2, however, A1 appears to have acquired this segment, producing in 80.4% of her attempts. However, coda /ʃ/ occurs quite frequently in NE Cree numbers; her attempts to produce /ʃ/ in *nîshu* [ˈniʃ] 'two,' *nishtu* [ˈnɪʃtʰ] 'three,' *nikutwâshch* [nəgəˈdɑʃʧ, gəˈdɑʃʧ] 'six,' *nîshwâshch* [niˈʃɑʃʧ, niˈʃɑʃ] 'seven,' and *pâyikushtâu* [ˈbajkʃtaw, bajkʃˈdaw] 'nine,' listed here in their target forms, account for 34 of the 51 attempts at this coda /ʃ/ (with 31 target-like productions). When word position is considered, it becomes clear that A1 is more successful with /ʃ/ when it is found as a word-medial coda, producing a target-like segment in 91.7% (33/36) of her attempts. Word-finally, A1 has a target-like production 64.3% of the time (9 out of 14 attempts).

In contrast, both /s/ and /h/ appear infrequently in the two sessions examined so it is not possible to draw firm conclusions about A1's acquisition of these coda consonants. A1's single target-like production of /s/ occurs in word-initial position; it is possible that being word-initial makes the coda [s] in this utterance more perceptually prominent to A1. (In addition, /s/ is prominent [strident] on its own.) A1's three attempts at /h/ were in Session 2, in word-final position; her consistent deletion may be attributed to NE Cree's tendency to delete coda [h], with compensatory lengthening of the vowel.

Since coda consonants are more marked than onset consonants, children tend to acquire these later. This, combined with the fact that coda consonants occur much less frequently than onset consonants in the data set, make it unsurprising that A1 has acquired only one of the three NE Cree coda consonants by age 3;8.24.

4.4 Summary: A1's acquisition of NE Cree consonants

Overall, A1 shows progress in her acquisition of NE Cree consonants over a 19-month span, from age 2;1.12 to age 3;8.24. The following tables show the percentages and total N for each consonant in each position. Table shows the results for Session 1.

Table 19. Summary of Session 2 consonants.

	Onset				OEHS				Coda			
	N	Tar.	Del.	Sub.	N	Tar.	Del.	Sub.	N	Tar.	Del.	Sub.
/p/	17	64.7	0.0	35.3	0	-	-	-				
/t/	51	78.4	3.9	17.6	3	3.33	66.7	0				
/k/	28	71.4	10.7	17.9	0	-	-	-				
/ʧ/	15	26.7	13.3	60.0	0	-	-	-				
/s/	0	-	-	-					0	-	-	-
/ʃ/	1	0.0	100.0	0.0					4	75.0	25.0	0.0
/h/	1	0.0	100.0	0.0					0	-	-	-
/m/	131	67.9	16.8	15.3	9	0	100.0	0.0				
/n/	35	68.6	5.7	25.7	11	45.5	54.5	0				
/w/	6	33.3	33.3	33.3								
/j/	9	44.4	22.2	33.3								

At this stage, A1 has not acquired any consonants, though she is approaching the acquisition benchmark (80.0%) with plosives and nasals in onset position, and coda /ʃ/. (Bolded numbers indicate that A1 has achieved or surpassed the benchmark of acquisition.)

Table 20 summarizes the results from Session 2. Bolded numbers indicate that A1 has achieved or surpassed the benchmark of acquisition.

Table 20. Summary of Session 2 consonants.

	Onset				OEHS				Coda			
	N	Tar.	Del.	Sub.	N	Tar.	Del.	Sub.	N	Tar.	Del.	Sub.
/p/	**40**	**82.5**	**10.0**	**7.5**	4	25.0	0	75.0				
/t/	112	78.6	4.5	17.0	39	61.5	25.6	7.7				
/k/	49	69.4	12.2	18.4	24	62.5	29.2	8.3				
/ʧ/	62	77.4	8.1	14.5	13	0.0	92.3	7.7				
/s/	5	60.0	0.0	40.0					2	50.0	0.0	50.0
/ʃ/	9	66.7	0.0	33.3					**51**	**80.4**	**7.8**	**11.8**
/h/	34	32.4	58.8	8.8					3	0.0	100.0	0.0
/m/	133	67.7	8.3	15.8	3	33.3	33.3	33.3				
/n/	**124**	**80.6**	**9.7**	**9.7**	47	4.7	42.6	10.6				
/w/	17	58.8	29.4	11.8								
/j/	33	72.7	24.2	3.0								

At this stage, A1 has acquired /p/ and /n/ in onset position, as well as /ʃ/ in codas. Interestingly, A1 has target-like productions of /ʃ/ more frequently in coda position than in onset (where she has target-like productions 66.7% of the time in this session). This may be attributed to the phonotactic distribution of /ʃ/.

5. Discussion

Looking at these two sessions reveals that A1 is making progress in her acquisition of NE Cree. The syllable data show that A1 has acquired CV syllables, the most common syllable type in the data by Session 1, producing target-like syllables in 87.5% of her attempts at the form. Since the CV syllable is unmarked and, consequently acquired first in many languages, this indicates that A1's acquisition of NE Cree follows universal norms. By Session 2, she has acquired CVC syllables but has yet to master the other two syllable types in NE Cree. The results for C syllables are quite interesting because A1 shows a great deal of improvement between sessions, with her rate of target-like productions going from 14.3% to 56.5%. Although C syllables occur more frequently in the data than CVC syllables, A1 has not mastered this syllable type, likely because they are phonologically marked. Finally, she produces target-like V syllables approximately 40% of the time in both sessions.

A1's acquisition of consonants also progresses between sessions. In Session 1, recorded when she was 2;1.12, A1 has not passed the benchmark of acquisition for any of the NE Cree consonants, in any of the syllable positions considered. By Session 2, recorded at age 3;8.24, A1 has acquired three segments: /p/ and /n/ in onset position, and coda /ʃ/. An examination of her acquisition of natural classes at this stage in her

development reveals that A1 has nearly acquired plosives (77.1% target-like), affricates (77.4% target-like) and nasals (74.3%) as onsets, and is approaching competence with glides (68.0%). She continues to have difficulty with fricatives (41.7% target-like) in this position, the natural class that A1 tends to delete the most in both sessions. Adopting a more liberal interpretation of her productions, in which similar substitutions are grouped with target-like productions, suggests that she may have acquired manner of articulation for onset plosives, as well as the distinction between obstruents and sonorants in this position.

The data on onsets of empty-headed syllables show that A1 has yet to acquire this position. She demonstrates differing levels of acquisition based on word position: A1 produces more target-like consonants word-medially than word-finally. When the data are grouped according to their natural classes, however, they show that this is true for nasals in Session 2; plosives show the opposite result.

A1 demonstrates some success with coda consonants, namely /ʃ/. This may be due to the fact that fricatives are acquired later than other natural classes, or to the fact that onsets are typically acquired earlier than codas. The other two NE Cree fricatives do not appear frequently in coda position in the data set.

Overall, A1 is acquiring the consonants and syllable types of NE Cree. From the two sessions examined, it is not possible to determine when she will acquire the full consonant inventory and all of the syllable types, but there is nothing in the data that indicates that this will not happen.

Appendix A: NE Cree syllable data

This section lists more specific breakdowns of A1's productions of the various NE Cree syllable types.

(1) Production of CV syllables in Session 1

Attempted:	288		
Target-like:	252	(87.5%)	
Deleted:	14	(4.9%)	
Other syllable type:	22	(7.6%)[5]	
C:	1	(0.3%)	
V:	21	(7.3%)	

Production of CV syllables in Session 2

Attempted:	544		
Target-like:	480	(88.2%)	
Deleted:	33	(6.1%)	
Other syllable type:	31	(5.7%)	
C:	7	(1.3%)	
V:	24	(4.4%)	

(2) Production of CVC syllables in Session 1

Attempted:	4		
Target-like:	3	(75.0%)	
Deleted:	0	(0.0%)	
Other syllable type:	1	(25.0%)	
V:	1	(25.0%)	

Production of CVC syllables in Session 2

Attempted:	34		
Target-like:	29	(85.3%)	
Deleted:	0	(0.0%)	
Other syllable type:	5	(14.7%)	
CV:	5	(14.7%)	

[5] The percentages listed in the breakdown of "Other syllable types" reflect their percentage of the number of attempts; in this case the single C syllable is 0.3% of the 288 attempted CV syllables. This is also true in the next section for the data on "Substituted" phones.

(3) Production of V syllables in Session 1

Attempted: 23

Target-like:	10	(43.5%)	
Deleted:	0	(0.0%)	
Other syllable type:	13	(56.5%)	
CV:		13	(56.5%)

Production of V syllables in Session 2

Attempted: 27

Target-like:	11	(40.7%)	
Deleted:	6	(22.2%)	
Other syllable type:	10	(37.0%)	
CV:		10	(37.0%)

(4) Production of C syllables in Session 1

Attempted: 28

Target-like:	4	(14.3%)	
Deleted:	18	(64.3%)	
Other syllable type:	6	(21.4%)	
CV:		6	(21.4%)

Production of C syllables in Session 2

Attempted: 115

Target-like:	65	(56.5%)	
Deleted:	45	(39.1%)	
Other syllable type:	5	(4.3%)	
CV:		5	(4.3%)

Appendix B: NE Cree consonants

This section lists the results for A1's productions of NE Cree consonants, grouped according to syllable position and manner of articulation. First, consonants in onset position are listed in (1)-(11).

Plosives:

(1) Production of /p/ in Session 1

Attempted:	17				
Target-like:	11	(64.7%)			
Deleted:	0	(0.0%)			
Substituted:	6	(35.3%)			
Other labials:			[w][6]	1	(5.9%)
Other plosives:			[t]	4	(23.5%)
			[k]	1	(5.9%)

Production of /p/ in Session 2

Attempted:	40				
Target-like:	33	(82.5%)			
Deleted:	4	(10.0%)			
Substituted:	3	(7.5%)			
Other labials:			[w]	3	(7.5%)

(2) Production of /t/ in Session 1

Attempted:	51				
Target-like:	40	(78.4%)			
Deleted:	2	(3.9%)			
Substituted:	9	(17.6%)[7]			
Other coronals:			[ʧ]	3	(5.9%)
			[s]	1	(2.0%)
			[j]	1	(2.0%)
Other plosives:			[p]	1	(2.0%)
Other obstruents:			[h]	2	(3.9%)
Other:			[w]	1	(2.0%)

[6] Recall that /w/ is being grouped with labials in this paper even though it has both labial and dorsal qualities but (§**Error! Reference source not found.**).

[7] Due to rounding, the percentage listed next to "Substituted" is not always the same as the sum of the percentages listed for the segments substituted.

Production of /t/ in Session 2

Attempted:	112			
Target-like:	88	(78.6%)		
Deleted:	5	(4.5%)		
Substituted:	19	(17.0%)		
Other coronals:		[ʧ]	2	(1.8%)
		[s]	1	(0.9%)
		[n]	2	(1.8%)
		[l]	1	(0.9%)
		[ɹ]	2	(1.8%)
		[j]	1	(0.9%)
Other plosives:		[p]	2	(1.8%)
		[k]	7	(6.3%)
Other:		[w]	1	(0.9%)

(3) Production of /k/ in Session 1

Attempted:	28			
Target-like:	20	(71.4%)		
Deleted:	3	(10.7%)		
Substituted:	5	(17.9%)		
Other plosives:		[t]	3	(10.7%)
Other:		[n]	1	(3.6%)
		[w]	1	(3.6%)

Production of /k/ in Session 2

Attempted:	49			
Target-like:	34	(69.4%)		
Deleted:	6	(12.2%)		
Substituted:	9	(18.4%)		
Other plosives:		[p]	2	(4.1%)
		[t]	3	(6.1%)
Other obstruents:		[s]	1	(2.0%)
Other:		[j]	3	(6.1%)

Affricates:

(4) Production of /ʧ/ in Session 1

Attempted:	15				
Target-like:	4	(26.7%)			
Deleted:	2	(13.3%)			
Substituted:	9	(60.0%)			
	Other coronals:		[t]	7	(46.7%)
			[l]	1	(0.7%)
	Other obstruents:		[p]	1	(0.7%)

Production of /ʧ/ in Session 2

Attempted:	62				
Target-like:	48	(77.4%)			
Deleted:	5	(8.1%)			
Substituted:	9	(14.5%)			
	Other coronals:		[t]	3	(4.8%)
			[s]	1	(1.6%)
			[l]	1	(1.6%)
			[n]	1	(1.6%)
	Other obstruents:		[k]	2	(3.2%)
			[h]	1	(1.6%)

Fricatives:

(5) Production of /s/ in Session 2

Attempted:	5				
Target-like:	3	(60.0%)			
Deleted:	0	(0.0%)			
Substituted:	2	(40.0%)			
	Other coronals:		[ʧ]	1	(20.0%)
	Other obstruents:		[f]	1	(20.0%)

(6) Production of /ʃ/ in Session 1

Attempted:	1	
Target-like:	0	(0.0%)
Deleted:	1	(100.0%)
Substituted:	0	(0.0%)

Production of /ʃ/ in Session 2

Attempted: 9

Target-like:	6	(66.7%)			
Deleted:	0	(0.0%)			
Substituted:	3	(33.3%)			
Other coronal fricatives:			[s]	2	(22.2%)
Other coronals:			[ʧ]	1	(11.1%)

(7) Production of /h/ in Session 1

Attempted: 1

Target-like:	0	(0.0%)
Deleted:	1	(100.0%)
Substituted:	0	(0.0%)

Production of /h/ in Session 2

Attempted: 34

Target-like:	11	(32.3%)			
Deleted:	20	(58.8%)			
Substituted:	3	(8.8%)			
Other laryngeals:			[ʔ]	1	(2.9%)
Other:			[w]	1	(2.9%)
			[n]	1	(2.9%)

Nasals:

(8) Production of /m/ in Session 1

Attempted: 131

Target-like:	89	(67.9%)			
Deleted:	22	(16.8%)			
Substituted:	20	(15.3%)			
Other labials:			[p]	6	(4.6%)
			[w]	2	(1.5%)
Other nasals:			[n]	4	(3.1%)
Other sonorants:			[j]	1	(0.8%)
			[ɹ]	1	(0.8%)
Other:			[t]	5	(3.8%)
			[h]	1	(0.8%)

Production of /m/ in Session 2

Attempted:	133			
Target-like:	91	(68.4%)		
Deleted:	11	(8.3%)		
Substituted:	31	(23.3%)		
Other labials:		[p]	8	(6.0%)
		[w]	8	(6.0%)
		[f]	1	(0.8%)
Other nasals:		[n]	7	(5.3%)
		[ɲ]	1	(0.8%)
Other sonorants:		[j]	1	(0.8%)
Other:		[t]	3	(2.3%)
		[h]	1	(0.8%)
		[ʔ]	1	(0.8%)

(9) Production of /n/ in Session 1

Attempted:	35			
Target-like:	24	(68.6%)		
Deleted:	2	(5.7%)		
Substituted:	9	(25.7%)		
Other coronals:		[t]	2	(5.7%)
		[ʧ]	1	(2.9%)
		[ɹ]	1	(2.9%)
Other nasals:		[m]	3	(8.6%)
Other sonorants:		[w]	1	(2.9%)
Other:		[p]	1	(2.9%)

Production of /n/ in Session 2

Attempted:	124			
Target-like:	100	(80.6%)		
Deleted:	12	(9.7%)		
Substituted:	12	(9.7%)		
Other coronals:		[t]	1	(0.8%)
		[ʃ]	1	(0.8%)
		[j]	1	(0.8%)
Other nasals:		[m]	4	(3.2%)
Other sonorants:		[w]	2	(1.5%)
Other:		[p]	1	(0.8%)
		[f]	1	(0.8%)
		[ʔ]	1	(0.8%)

Glides:

(10) Production of /w/ in Session 1

Attempted:	6				
Target-like:	2	(33.3%)			
Deleted:	2	(33.3%)			
Substituted:	2	(33.3%)			
Other labials:			[m]	1	(16.7%)
Other:			[ʔ]	1	(16.7%)

Production of /w/ in Session 2

Attempted:	17				
Target-like:	10	(58.8%)			
Deleted:	5	(29.4%)			
Substituted:	2	(11.8%)			
Other glides:			[j]	1	(5.9%)
Other:			[t]	1	(5.9%)

(11) Production of /j/ in Session 1

Attempted:	9				
Target-like:	4	(44.4%)			
Deleted:	2	(22.2%)			
Substituted:	3	(33.3%)			
Other coronals:			[t]	1	(11.1%)
			[l]	1	(11.1%)
Other:			[p]	1	(11.1%)

Production of /j/ in Session 2

Attempted:	33				
Target-like:	24	(72.7%)			
Deleted:	7	(21.2%)			
Substituted:	2	(6.0%)			
Other coronals:			[n]	1	(3.0%)
Other:			[k]	1	(3.0%)

Details of A1's productions of onsets of empty-headed syllables are listed in (15)-(20):

Plosives:

(15) Production of /p/ as OEHS in Session 2

Attempted: 4

Target-like:	1	(25.0%)		
Deleted:	0	(0.0%)		
Substituted:	3	(75.0%)		
Other plosives:		[t]	3	(75.0%)

(16) Production of /t/ as OEHS in Session 1

Attempted: 3

Target-like:	1	(33.3%)
Deleted:	2	(66.7%)
Substituted:	0	(0.0%)

Production of /t/ as OEHS in Session 2

Attempted: 39

Target-like:	26	(66.7 %)		
Deleted:	10	(25.6%)		
Substituted:	3	(7.7%)		
Other coronals:		[ʧ]	3	(7.7%)

(17) Production of /k/ as OEHS in Session 2

Attempted: 24

Target-like:	15	(62.5%)		
Deleted:	7	(29.2%)		
Substituted:	2	(8.3%)		
Other:		[ʧ]	2	(8.3%)

Affricates:

(18) Production of /ʧ/ as OEHS in Session 2

Attempted: 13

Target-like:	0	(0.0%)		
Deleted:	12	(92.3%)		
Substituted:	1			
Other coronals:		[t]	1	(7.7%)

Nasals:

(19) Production of /m/ as OEHS in Session 1

Attempted: 9

Target-like:	0	(0.0%)
Deleted:	9	(100.0%)
Substituted:	0	(0.0%)

Production of /m/ as OEHS in Session 2

Attempted: 3

Target-like:	1	(33.3%)		
Deleted:	1	(33.3%)		
Substituted:	1			
Other nasals:		[n]	1	(33.3%)

(20) Production of /n/ as OEHS in Session 1

Attempted: 13

Target-like:	7	(53.8%)
Deleted:	6	(46.2%)
Substituted:	0	(0.0%)

Production of /n/ as OEHS in Session 2

Attempted: 48

Target-like:	23	(47.9%)		
Deleted:	20	(41.7%)		
Substituted:	5	(10.4%)		
Other coronals:		[t]	3	(6.3%)
Other nasals:		[m]	1	(2.1%)
Other:		[p]	1	(2.1%)

Details about coda consonants in A1's productions are listed in (21)-(23):

(21) Production of /s/ as coda in Session 2

Attempted:	2			
Target-like:	1	(50.0%)		
Deleted:	0	(0.0%)		
Substituted:	1	(50.0%)		
Other:		[ʃ]	1	(50.0%)

(22) Production of /ʃ/ as coda in Session 1

Attempted:	4			
Target-like:	3	(75.0%)		
Deleted:	1	(25.0%)		
Substituted:	0	(0.0%)		

Production of /ʃ/ as coda in Session 2

Attempted:	51			
Target-like:	41	(80.4%)		
Deleted:	4	(7.8%)		
Substituted:	6	(11.8%)		
Other: coronal fricatives:		[s]	3	(5.9%)
		[h]	1	(2.0%)
Other coronals:		[t]	1	(2.0%)
		[ʧ]	1	(2.0%)

(23) Production of /h/ as coda in Session 2

Attempted:	3	
Target-like:	0	(0.0%)
Deleted:	3	(100.0%)
Substituted:	0	(0.0%)

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