POSITIONAL EFFECTS IN PHONOLOGICAL DEVELOPMENT: A CASE STUDY

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Positional Effects in Phonological Development: A Case Study

by

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Abstract

This thesis investigates positional effects in the acquisition of English, based on a longitudinal case study. Analyses of the acquisition of voicing contrasts and cluster development in onsets are conducted. In addition, an acoustic analysis of Voice Onset Time (VOT) is performed on obstruent stops in singleton onsets in order to test the reliability of the multiple-blind transcriptions used in the corpus.

While the results were inconclusive with regards to positional effects, significant observations were made. First, the acoustic investigation reveals that manually transcribed data are a reliable means of analysis, especially when following a multiple-blind protocol. Second, the analysis of the acquisition of voicing in onsets reveals that voicing contrasts were acquired extremely early. This finding is further supported by a recent study by Kager et al. (in press). Finally, the investigation of the acquisition of onset clusters reveals that branching onsets and s+C clusters are acquired following independent paths.

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Chapter 1 - Introduction

Several studies to date have found positional effects in adult phonological systems across languages (e.g. Lombardi 1999, de Lacey 1998, Zoll 1998, Beckman 1997). These effects refer to the observation that certain prosodic positions such as stressed versus unstressed syllables enhance or hinder the realization of segments and segmental sequences. For example, in adult English, vocalic contrasts are neutralized in non-prominent positions (e.g. unstressed syllables). Thus, the first vowels in the related words "Plato" and "platonic" have different realizations; the vowel is fully realized as [eɪ] in the stressed syllable of *Plato* ['pleɪɪo], while that same vowel is reduced to a schwa [ə] in the unstressed syllable of *platonic* [plə'tʰɑnɪk]. The implication from these studies is that we should expect positional effects to also manifest themselves in the development of child language. There has been some research providing evidence of such effects (e.g. Kehoe and Hilaire-Debove 2004, Inkelas and Rose 2003, Rose 2000). These studies raise the question as to whether these positional effects are generalized across children and target languages, or limited to specific children.

To address this question, I investigate the acquisition of voicing contrasts and the acquisition of onset clusters based on a longitudinal case study of the acquisition of English as a first language. The results of this investigation have implications from methodological, empirical and theoretical perspectives. First, the results of this investigation do not yield any clear indication that positional effects manifest themselves

across developing phonologies. Indeed, no such effects could be found in my case study.

Despite the lack of conclusive results with regard to positional effects, this thesis does produce a number of important results. The first of these relates to methods of investigation of child language phonology. More specifically, in chapter 4, I propose a discussion in which impressionistic versus acoustic methods of investigation are confronted. I first address the issue of 'covert contrasts', which some researchers argue discredits child language acquisition studies that are based on impressionistic transcription. Researchers such as Scobbie (1998) claim that a truly accurate account of child language development must include acoustic measurements to possibly account for the occurrence of covert contrasts. I demonstrate that despite the commonly held assumption that acoustic investigations are inherently more sound methodologically, these methods also present challenges, particularly in terms of data interpretation. This claim is based on the investigation of onset stop consonants only, and in no way is construed to mean that acoustic measurements are not absolutely required for the acquisition of other segment types (e.g. vowels). In order to test this, I first carry out an investigation of the accuracy of transcribed data following a triple-blind protocol. This study provides supporting evidence that impressionistic transcriptions offer valid data, at least when they are conducted in an appropriate way such as the one discussed in this thesis. Second, an acoustic analysis of Voice Onset Time (VOT) is conducted. As we will see, while the measurements themselves provide firm data, their interpretation, which requires a certain degree of arbitrariness in categorizing the results, pose a significant methodological challenge. This situation directly affects the results, because it can lead to

inconclusive or potentially unreliable interpretations of the data. Finally, a comparison of the relationship between inter-transcriber reliability and VOT is conducted.

Aside from these methodological considerations, I also conduct a study on the acquisition of voicing contrasts in singleton onset plosives. As we will see, such contrasts appear to be acquired very early in English. Indeed, the voicing errors found in the corpus are seldom. These errors primarily come from inaccurate voicing of a target voiceless consonant, and not vice versa. These results are compared with those of a recent study by Kager, van der Feest, Fikkert, Kerkhoff and Zamuner (in press) who report that the contrast is acquired early in English and German, but later in Dutch.

In addition, this thesis offers some significant findings in the area of prosodic development, specifically concerning the development of onset clusters. The results here indicate that the relative sonority of the segments involved in a cluster play a role in the development of s+C clusters (e.g. spear vs. sweat; skip vs. slip), but not in the development of branching onsets. In sum, the results of this investigation show that while branching onsets are all acquired at the same time, the level of sonority distance between the [s] and following consonant of the s+C cluster determines the order of acquisition. This suggests first that the two cluster types (s+C versus branching onset) must be analyzed independently, and, second, that the development of these clusters may be affected differently by constraints such as those regulating the sonority profile of the consonants forming the cluster.

Finally, it must be noted that despite common beliefs, this thesis offers one of the rare *longitudinal* studies on the development of phonology in English (cf. Smith 1973,

Pater 1996). While some of the patterns documented in the next chapter have already been documented in other studies, I provide a quantitative and qualitative look at the developmental facts from a longitudinal perspective. This method enables interpretation of the patterns in light of overall phonological development. This thesis thus adds a significant contribution to the existing body of evidence available in the scientific literature on phonological development.

The thesis is organized as follows. In chapter 2, I provide a review of the current literature on positional effects. Chapter 3 outlines the methodology adopted in the study. In chapter 4, I investigate the production of voicing contrasts based on both manually transcribed and acoustically measured data. In chapter 5, I examine the acquisition of branching onsets and s+C onsets. Finally, in chapter 6, I provide a summary of the main findings unveiled by this study, and offer concluding remarks as well as suggestions for further research in the area of phonological development.

Chapter 2 - Background Literature

2.1 Relevant Findings in Current Literature

As mentioned in the introduction, the primary goal of the current investigation is to document positional effects in child language. There are several sources in the current literature that discuss positional effects. While the majority of studies available focus on positional effects in adult languages, there are a number of works available that discuss the phenomena in child language. In section 2.2, I outline some of the main findings that relate to positional effects in the current literature on adult languages. In section 2.3, I review the findings from the literature on child language. In section 2.4, I provide a summary in which I compare the findings from adult and child languages.

2.2 Positional Effects in Adult Languages

2.2.1 Positional Faithfulness

The central generalization about positional effects in adult languages, is that phonological contrasts tend to be maintained more accurately in prosodically strong positions such as word-initial or stressed positions, while they tend to be partially or completely neutralized in prosodically weaker positions. This observation is described in the literature on theoretical phonology as a positional faithfulness effect (e.g. Beckman 1997). As Beckman (1997) points out, marked contrasts are confined to positions in which they can be more easily discerned, such as in word-initial position, stressed syllables, long vowels, syllable onsets and syllable nuclei.

Providing additional evidence , Lombardi (1999) discusses positional faithfulness effects as the force behind such phenomena as laryngeal neutralization and voicing assimilation in obstruent clusters. For example, in German, devoicing of obstruents occurs in syllable-final position, while voicing contrasts among obstruents are fully maintained in onset position. This correlates with the fact that, across languages, onsets are typically better licensors of contrasts than other consonantal positions within the syllable (e.g. Itô 1986, cf. Steriade 2001).

Within Optimality Theory (OT; Prince and Smolensky 1993), Universal Grammar (UG) has provided each specific grammar with a set of constraints. Differences across languages are accounted for by the different ranking of these constraints according to each particular grammar. In the literature on OT, tableaux are used to determine which output form is acceptable according to the particular rankings of that language. Within the tableaux, the candidate productions that violate the constraints are marked by an asterisk (*), while those violations that eliminate the possible production from surface realization are marked with an exclamation (!). The constraint ranking which allows for the coda-onset asymmetry in German is illustrated in tableau (2.1) below. As we can see, the onset consonant must obey the highly-ranked faithfulness constraint IDOns, which states that onsets must be faithful to underlying voicing, even at the cost of violating the lower-ranked markedness constraint *Lar, which militates against the preservation of voicing contrasts. In contrast, the coda consonant in (2.1a), which falls outside of the scope of the IDOns constraint, undergoes the markedness effects of *Lar, this constraint

being itself ranked over the faithfulness constraint IDLar, which states that segments must be faithful to input voicing.

(2.1) Syllable Final Neutralization in German (Lombardi 1999)

	IDOns	*Lar	IDLar
a. /rad/			
[rad]		*!	
☞ [rat]			*
b. /gut/			
☞ [gut]		*	
[kut]	*!		*

Another positional effect can be found in assimilatory processes. Voicing assimilation occurs in languages such as Yiddish, as a result of the high ranking of the constraint AGREE, which states that obstruent clusters must agree in voicing, ranked over the constraints IDOns and IDLar. The tableau in (2.2) below demonstrates how this ranking can affect output forms.

(2.2) Direction of Voicing Assimilation in Yiddish (Lombardi 1999)

	Agree	IDOns	IDLar
/bakbeyn/			
a. [bak.beyn]	*!		
☞ b. [bag.beyn]			*
c. [bak.peyn]		*!	*

As we can see, obstruent clusters must obey the highly-ranked constraint AGREE, which states that obstruents in a cluster must agree in voicing. The cost of ranking the constraints in this order is that (2.2b) remains as the output form, as choices (2.2a) and

(2.2c) violate higher ranked constraints. Lombardi (1999) argues that these effects are present in several adult languages such as Polish, Dutch, Catalan, and Sanskrit.

2.2.2 Positional Markedness

Another positional effect attested in adult languages relates to the observation that complex segments and segmental sequences tend to occur more freely in prosodically strong positions than in prosodically weak positions. This tendency is referred to in the literature on theoretical phonology as positional markedness (e.g. de Lacy 1998, Zoll 1998). Theories of positional markedness predict that marked (i.e. complex or rarely-occurring) segments and segmental sequences must preferentially appear in prosodically strong positions. De Lacy (1998), for example, argues for the necessity of markedness constraints to regulate relative segmental sonority in prominent positions. De Lacy gives the example of sonority constraints on onsets in Campidanian Sardinian (CS). In this language, rhotics and glides are not allowed to occur word-initially, but may occur elsewhere. De Lacy provides the word for "rose", which originates from the Latin form "rosa", as "aroza" in CS. He claims that the markedness constraint *σ_1/MAR/rhotic, which states that rhotics cannot occur word-initially, is ranked above some relative faithfulness constraint.

Adopting a similar approach, Zoll (1998) argues, based on evidence from Hamer, a language in which metathesis and assimilation processes cannot be accounted for solely with positional faithfulness constraints, that positional markedness constraints are indispensable and a necessary component of grammar. In the same vein Smith (2000)

proposes that augmentation effects, (i.e. processes whereby prominent positions are enhanced by attracting prosodic complexity), are driven by markedness constraints making reference to prosodically strong positions. Similarly, Alber (2001) argues for positional constraints that favor the realization of output segments in word initial syllables. Finally, Recasens (2004) discusses the effect of syllable position on consonant cluster reduction in Catalan. He finds that cluster reduction occurs word-finally, while strengthening occurs word-initially.

2.2.3 Summary

From this brief survey, we can see that positional effects are pervasive in adult languages, in which they can take many different forms. In the next section, I introduce similar evidence, from the perspective of child language.

2.3 Positional Effects in Child Language

2.3.1 Positional Faithfulness

Effects similar to those observed in adult languages are attested in child language. A number of studies document positionally-determined effects in child phonologies, both within the word and within the syllable. For example, Rose (2000) provides evidence for positional effects in the productions of Québec French-learning children. He notes that at the stage when branching onsets first emerge, they are realized only in stressed syllables while being reduced to singleton onsets in unstressed positions. This asymmetry is exemplified in (2.3).

(2.3) Examples of Branching Onset Production in Stressed vs. Unstressed Positions

Stressed Position	(a) *glisse* '(s/he) slides' /**gl**ɪs/ → [**kl**ɪs]
	(b) *citrouille* 'pumpkin' /si**t**χʊj/ → [θə'**t**χu:j]
Unstressed Position	(c) *glissade* '(a) slide' /**gl**isad/ → [**k**a'sæd]
	(d) *trouvé* 'found' /**t**χuve/ → [tʊ've]

As we can see in the examples above, the [gl] cluster is maintained in the stressed position in example (2.3a) of *glisse* '(s/he) slides', but reduced to [k] in example (2.3c) of *glissade* '(a) slide'. The same is true of the [tχ] cluster. In the stressed position, the cluster is fully realized in example (2.3b), *citrouille* 'pumpkin', but it is reduced to [t] in example (2.3d), *trouvé* 'found'.

Building on the Rose (2000) study, Kehoe and Hilaire-Debove (2004) attempt to determine whether consonant-glide-vowel (CGV) sequences are acquired differently than consonant-liquid-vowel (CLV) sequences by French learners. They address the question of how these two types of sequences are acquired from different perspectives, including that of positional faithfulness effects. They find that the French-learning children were more accurate in their productions of CGV sequences in stressed syllables than in unstressed syllables. In contrast, they did not find the same effect in the production of CLV sequences, failing to support Rose's (2000) initial findings. However, Kehoe and Hilaire-Debove's study is based on cross-sectional data, in contrast to Rose's longitudinal approach, a situation which may have led to discrepancies in the results, thereby explaining the differences between the two studies.

2.3.2 Truncation

Another manifestation of positional effects in child language comes from patterns of syllable truncation. Truncation is a common process in early word production whereby children reduce the size of multi-syllabic words down to a smaller number of syllables. For example, many children go through a stage during which they produce 'banana' as ['næna]. In this example, the three-syllable word has been truncated to a two-syllable word. Children who display syllable truncation typically maintain prominent syllables such as the stressed and word-final syllables, while deleting syllables located in other, less prominent positions within the word (Pater 1997). For example, the word 'hippopotamus' [hɪpə'pɑɾəmʊs] is often pronounced as ['pɑmʊs] by English-learning children. Truncation occurs in adult language as well. As we observe in English, unstressed (prosodically weak) syllables containing [ə] are often omitted from speech, for example in the word *about* [ə'baʊt], which is often realized as ['baʊt].

2.3.3 Positional Neutralization

In addition to preservation or deletion effects, positional effects can also manifest themselves in some of the emerging processes observed in child language. One clear example of this comes from Inkelas and Rose (2003) who discuss velar fronting (VF) as an effect of positional neutralization. This study is based on a diary corpus of a single English-learning child which reveals that at the stage when VF occurred, it was attested only in prosodically strong positions, such as word-initial onsets, and onsets of primary

and secondary stressed syllables. The table in (2.4a) provides examples of the VF process by position, while table (2.4b) provides examples of velar production in prosodically weak positions.

(2.4) Positionally-Determined Velar Fronting (Inkelas and Rose 2003)

a) Velar Fronting in Prosodically Strong Position

Position	**Production**	**Target Form**
Word-initial primary-stressed syllable onset	[ˈtʰʌp]	'cup'
Word-initial unstressed syllable onset	[**d**ʊˈdʊ]	'Gügü'
Word-medial primary-stressed syllable onset	[əˈ**d**ɪn]	'again'
Word-medial secondary-stressed syllable onset	[ˈhɛw,tɔptɛə]	'helicopter'

b) Velar Production in Prosodically Weak Position

Position	**Production**	**Target Form**
Word-medial unstressed syllable onset	[ˈbʌ**k**ɪt]	'bucket'
Word-internal coda	[ˈæ**k**ʧwi]	'actually'
Word-final consonant	[ˈbɪ**g**]	'big'

Inkelas and Rose argue that physiological constraints imposed by the shape of the child's immature vocal tract must be considered to explain VF. This process is, in fact, problematic from a theoretical point of view for two reasons. First, there are no attestations of VF in adult languages, an observation that already puts the phenomenon at odds with the literature on theoretical phonology. In addition, based on the findings such as the ones listed above from the literature on positional faithfulness and positional markedness, one would expect velar neutralization to a coronal in weak positions, but not in prosodically strong positions. By referring to physiological constraints such as the

relative largeness of the child's tongue especially with regard to the proportionally short palate, Inkelas and Rose propose that VF in strong positions is a result of the articulatory enhancement of velars in strong onset positions, which yields extended contact of the tongue body on the anterior portion of the palate into the coronal region. This articulatory enhancement is also evident in adult language (Fougeron and Keating 1996). However, because of the mature shape of the adult vocal tract, it does not result in neutralization patterns such as those observed in (2.4).

2.4 Summary and Comparison

It thus appears, from the brief review of positional effects in child language provided above, that there exist similarities between developing (child) and end-state (adult) systems. Both adults' and children's grammars appear to be sensitive to prosodic factors relating to various positions within the syllable and the word, which directly affects their phonologies. However, as alluded to above, the evidence from child language is often limited to cross-sectional studies, which prevent a truly developmental look into the phenomena observed, and to a handful of longitudinal case studies, which provide only a subset of the longitudinal evidence required for a full understanding of the positionally determined phenomena. To better understand the interaction between prosodic factors and phonological development, additional longitudinal studies of the acquisition of segmental sequences and contrasts across different prosodic positions are required. This thesis offers one step in this direction.

Chapter 3 - Methodology

3.1 Introduction

This chapter introduces the methodology adopted in this research. In section 3.2, I first discuss the data recording and transcription. I then discuss, in section 3.3, the method adopted for performing acoustic measurements of VOT in singleton onsets. In section 3.4, I describe the procedure for extraction and compilation of the data on the acquisition of onset clusters, as well as the method of phonological analysis of branching onsets.

3.2 Data Recording

The data analyzed in this study come from a corpus gathered with a North American, English-learning child named Sonya. Recordings of the child were conducted approximately every second week, between the child's ages of 1;04.18 and 2;06.02. The recording sessions were conducted in the child's everyday environment to capture spontaneous speech in a naturalistic setting.[1] A total of 3866 speech samples, most of which contain several words, were recorded. Thus, this corpus provides a sound basis to capture the most central aspects of the child's developing phonological system throughout the period covered by the study.

Sonya was recorded on TDK SA90 tapes while playing with toys or looking at picture books, using an analogue recording machine Marantz PMD221 with a multidirectional tabletop microphone Sound Grabber P2M-12-SG. The microphone was

[1] The recording and segmentation of the data were funded under an FCAR grant to Heather Goad at McGill University.

placed between the interviewer and Sonya on a foam cushion on the floor to reduce interfering noise from toys and movement. The recording sessions generally lasted between 20 and 45 minutes, occasionally for longer periods of time, depending on Sonya's mood and attention span on that particular day. However, in the case of a shorter session, the next recording session was held within less than two weeks whenever possible, to insure that the corpus was maximally representative of each important step in the child's phonological development. During the recording sessions, the interviewer focused mainly on allowing the child to produce spontaneous speech. At times, the interviewer also repeated the child's attempted words in order to facilitate the later identification of the words for data extraction and transcription.

Once the recording sessions were complete, the tapes were digitized using SoundEdit 16v2 in 16-bit sample size at a sample rate of 22.05 kHz. The digitized tokens were then labeled and imported into the database program *ChildPhon* (Rose 2003), which enables transcription, coding, and compilation of the tokens.

3.2.1 Transcription

As mentioned above, the corpus contains 3866 utterances, all of which have been transcribed as narrowly as possible using the standards of the International Phonetic Alphabet (IPA). The transcriptions were performed following a triple-blind protocol using Sony Dynamic Stereo headphones MDR-V600. Three native English transcribers performed full transcription on the corpus, without access to each other's transcriptions. This resulted in three sets of fully transcribed data. All transcriptions were then compared

and validated by two of the three transcribers, in order to attain the most accurate results possible. This validation process involved the two transcribers simultaneously listening to the utterances and reviewing all three corresponding phonetic transcriptions. Both transcribers had to agree upon one transcription for it to be validated. When the transcribers could not mutually agree on a suitable transcription, the transcription was modified until an agreement was reached.

3.3 Acoustic Analysis of Plosives in Singleton Onsets

An analysis of plosives in singleton onsets was carried out to capture the development of voicing contrasts in Sonya's speech. Consonant voicing was analyzed acoustically by measuring the VOT values of obstruent stops from spectrograms using *Praat* (http://www.fon.hum.uva.nl/praat/), a software program specialized for acoustic measurements of speech sounds. The acoustic analysis was performed manually on good quality speech samples from the first two-third portion of the corpus. Child speech is often difficult to analyze acoustically due to unusual phonetic properties such as formant structure, or to the high frequency pitch of child speech (Buder and Stoel-Gammon 1993). However, this problem was compensated for by acoustic measurement of a large number of speech samples. In addition, the limitations inherent to child speech analysis mentioned above do not affect VOT measurement as much as they affect the measurement of vocalic properties such as vowel formant structure. Since VOT is the focus of the measurements performed in the current research, the technical difficulties

mentioned in Buder et al. (1996) do not significantly affect the results presented in chapter 4.

3.4 Data Compilation

Once the acoustic analyses were completed, the data were transferred to *Phon* (Rose, MacWhinney, Byrne, Hedlund, Maddocks, O'Brien and Wareham 2006) a new software program designed specifically for the study of child language. Using the query functions of *Phon*, production patterns of segment and segmental sequences were extracted according to each prosodic position that may be potentially relevant. Building on Inkelas and Rose (2003), I list, in (3.1), the six positions that were coded for. (Recall that the scope of my research does not include word-final consonants or consonant clusters.)

(3.1) Prosodic Positions that are Relevant for the Study of Positional Effects in Onsets

a. Word-initial primary-stressed syllable

b. Word-initial secondary-stressed syllable

c. Word-initial unstressed syllable

d. Word-medial primary-stressed syllable

e. Word-medial secondary-stressed syllable

f. Word-medial unstressed syllable

Note that there is no a priori reason to believe that all of these positions should necessarily influence the acquisition process. However, the exhaustive listing for onsets in (3.1) has the merit of enabling a systematic compilation of phonological behaviors of all relevant prosodic positions, several of which proved relevant in Inkelas and Rose's (2003) study of positional velar fronting (especially, the distinction between prosodically weak versus strong positions).

A systematic comparison of target utterances and actual renditions of these utterances allow for the accurate detection of the phonological processes found throughout the corpus. The consonantal sequences are analyzed based on the phonetic transcriptions. Consonant clusters are considered reduced when one or both of their consonants undergo deletion in the form produced by the child. When two consonants are produced, the classification is based on the phonetic make up of the consonants realized. For example, /tr/ → [t] is classified as 'second consonant deletion', /tr/ → [tw] is labeled as 'second consonant modification', where the target /r/ is substituted by [w], and /tr/ → [tr] is considered as 'target-like'. This aspect of my study is primarily concerned with the acquisition of prosodic constituents, irrespective of the actual phonetic make up of the consonants produced. However, this latter issue will be discussed whenever necessary.

The results are analyzed in light of the general hypothesis discussed in chapter 2, that prosodically strong positions are more likely to license, therefore to facilitate the acquisition of, segmental contrasts and segmental sequences. Conversely, prosodically weak positions are predicted to hinder the acquisition process.

In the next chapter, I demonstrate that despite general criticisms in the field of linguistics about the validity of the transcriptions used in child language acquisition studies, carefully transcribed data are useful and reliable. I also document the acquisition path of voicing contrasts in singleton onset plosives.

Chapter 4 - The Acquisition of Voicing Contrasts

4.1 Introduction

In recent years in the field of first language acquisition, there has been a lively debate on methodological considerations concerning the validity of transcription of child language production data as a reliable basis for research. Some linguists such as Scobbie (1998) argue that due to the phenomena of 'covert contrasts', i.e. linguistically-significant differences in speech sounds that are very difficult or impossible to perceive by the adult ear of even the most experienced transcribers, language acquisition data based solely on impressionistic transcriptions cannot be considered truly accurate. Such contrasts, however, can be acoustically measured in order to improve the quality of the transcriptions and, consequently, of the analyses that are based on these transcriptions. This line of argument suggests that a truly accurate account of child language development must include acoustic analyses, in order to detect the occurrence of potential covert contrasts.

In this chapter, I will challenge this argument and demonstrate that data transcribed carefully using a multiple-blind protocol are indeed useful and reveal a sufficient degree of detail to enable the analysis of production data. I will also discuss issues inherent to research based on acoustic analysis, especially with regard to the interpretation of acoustic data of onset stop consonants. While this chapter cannot be taken as a conclusive proof that transcription-based studies are always reliable, it will support the view that transcription data should not systematically be discarded as irrelevant for the study of language development. The general argument supporting my

claim is based on a study of voicing contrasts in singleton onset plosives [p, b, t, d, k, g]. In section 4.2, I discuss inter-transcriber reliability. Section 4.3 provides the results of my acoustic analysis of VOT of singleton onset plosives. In section 4.4, I discuss the relationship between the transcription based and acoustically measured data. Finally, in section 4.5, I investigate Sonya's acquisition of voicing contrasts in singleton onsets. This analysis is discussed in light of the recent work by Kager, van der Feest, Fikkert, Kerkhoff and Zamuner (in press).

4.2 Inter-transcriber Reliability

As mentioned above, the corpus used throughout this research consists of 3866 utterances, many of which contain two or more words. The transcription of these utterances followed a triple blind protocol, performed by three independent native English-speaking transcribers. Once the independent transcriptions were complete, they were validated by a team of two of the transcribers, who simultaneously assessed the competing transcriptions in order to attain the most accurate results possible. The transcription that was judged the most accurate was selected as the validated one. This transcription could be further modified whenever needed to ensure maximal accuracy as judged by the validation team. After completion of the validation process, the corpus was imported into a Microsoft Excel spreadsheet, which was used to perform a systematic comparison of the transcriptions, namely the individual transcriptions of each of the three transcribers involved, as well as the final, validated transcription that was attained by the validation team.

724 utterances containing stops in singleton onsets, both word-initially (WI; n=428) and word-medially (WM; n=296), were separated according to position, and then ranked based on inter-transcriber agreement. This ranking process involved a four-way comparison of each utterance including each of the three separate (blind) transcriptions as well as the final validated transcription. When all three blind transcriptions of a given plosive had the same voicing as the corresponding plosive in the validated form, it was given a maximal rank of 3. If only two transcribers agreed with the voicing of the validated transcription, this token was given a rank of 2. Similarly, if only one transcriber agreed with the validated transcription on voicing, it was given a rank of 1. Finally, in only one case there was no agreement between the voicing of the validated form and any of the blindly-performed transcriptions. This exceptional token received a score of 0.

An example of this comparison is presented below, in (4.1), for which only two of the transcribers agreed on the voicing of [g] in "go". In this example, and in further tables, the transcriptions of the three transcribers are labeled "Tr 1", "Tr 2" and "Tr 3", while the validated transcription is labeled "Validated". The orthography and target transcriptions are also provided.

(4.1) Agreement Rank of 2 for Consonant Voicing

Orthography	**Target**	**Tr 1**	**Tr 2**	**Tr 3**	**Validated**
go	[gow]	[gow]	[gow]	[kɔ̰]	['gɔ]

As we can see in the above example, transcribers 1 and 2 agreed on the voicing of [g] with the validated form.[2]

This classification provides strong evidence of inter-transcriber reliability, for both word-initial and word-medial singleton onset plosives, with overall agreement rates between 94% and 99%. The table in (4.2) provides a breakdown of the results.

(4.2) Inter-transcriber Reliability

Rank	**WI**	**WM**	**Total**
3	404	277	681
2	21	16	37
1	3	2	5
0	0	1	1
Total	428	296	724
Transcriber Reliability			
3/3	94.39%	93.58%	94.06%
2/3	99.30%	98.99%	99.17%

Out of the 724 singleton onset plosives sampled, all three transcribers agreed on the voicing of the transcribed plosive 94.06% of the time. Also, in 99.17% of the cases, at least 2 of the 3 transcribers agree on the voicing of the validated plosive. These values indicate that perceived voicing of plosives in onset positions, whether word-initial or word-medial, is highly reliable across transcribers. In only 6 instances, the inter-transcriber agreement is less than 2/3. These cases are listed in table (4.3) below. Five such examples received a score of 1, while only one case received a score of 0. This situation occurred during the validation process when the two transcribers listened

[2] The complete ranking for each token can be found in Appendix A.

simultaneously to the production. Both transcribers agreed that the voicing was incorrect in all three of the competing transcriptions, and both agreed to change the voicing in the newly validated transcription.

(4.3) Tokens for Which the Transcriber Agreement is Less Than 2/3

Ortho.	Target	Tr 1	Tr 2	Tr 3	Validated	Rank
dada	[ˈ**d**ædæ]	[ˈ**d**ɛdæʔ]	[ˈ**d**ædæʔ]	[ˈ**d**ɛtɛʔ]	[ˈ**d**ɛdæʔ]	1
blanket	[ˈ**bl**ænŋkət]	[ˈ**b**ægij]	[ˈ**p**ædij]	[ˈa^{j}nʧˈ**p**æ͡ʤi]	[ʌjwãˈ**b**ædij]	1
blanket	[ˈ**bl**ænŋkət]	[ˈ**b**ædijː]	[ʌˈ**p**^{h}ædij]	[up^{ˀ}ˈ**p**æd^{j}iː]	[ɐ̃ʔˈ**b**ædiːj]	1
monkey	[ˈmʌŋ**k**ij]	[ˈmɪ**g**ij]	[ˈma**j**k^{h}ij]	[ˈmɪkˀˈk^{h}i^{j}]	[ˈme**j**k.**g**ij]	1
apple	[ˈæpəɬ]	[ˈæt^{h}æbɑ]	[ˈæt^{h}ætæt^{ˀ}]	[ˈætæpæʔ]	[ˈʔæt^{h}æbæʔ]	1
cheapy	[əˈt͡ʃijpij]	[əˈt͡ʃijp^{h}ij]	[ʌˈt͡ʃijpij]	[ʔæˈʧipiː]	[ʔəˈt͡ʃijbij]	0

There are several issues that may have contributed to the exceptionally low agreement rates for each example above. The sound clip of the first example, "dada", is very short, and the target sound [d] occurs almost immediately at the beginning of the clip, making it difficult to perceive. For both examples of "blanket", background noise and static may have contributed to the low agreement amongst the transcribers. The example of "monkey" has a low agreement rate possibly because Sonya pauses briefly between syllables, as indicated by the period in the validated transcription, which made it difficult to perceive the correct voicing. The example of "apple" was uttered very quickly, making it difficult to perceive accurately. Finally, the example of "cheapy" also had background noise, which may have affected its perception.

In order to attain a more refined picture of which factors may have reduced inter-transcriber reliability, I also classified the rates of agreement based on segment and prosodic position. The results of these classifications are provided in (4.4).

(4.4) Total Inter-transcriber Agreement (3/3) per Segment and Prosodic Position

	WI-1	WI-2	WI-U	WM-1	WM-2	WM-U
[p]	99.18%	100%	100%	100%	94.44%	100%
[t]	100%	100%	100%	100%	100%	92.31%
[k]	99.24%	100%	100%	100%	100%	98.21%
[b]	93.44%	92.86%	95.83%	100%	91.67%	81.08%
[d]	96.76%	100%	95.45%	83.33%	75%	93.02%
[g]	92.68%	100%	71.43%	100%	100%	90.48%

(WI = word-initial; WM = word-medial; 1 = Primary Stress; 2 = Secondary Stress; U = unstressed)

The shaded areas in this chart indicate the few environments where the inter-transcriber agreement of 3/3 is less than 90%. As we can see, such situations occur only with voiced consonants. For the segment [d] in word-medial primary and secondary stressed positions, both lower agreement rates shaded in the chart come from only one score lower than 3/3. However, the agreement rate for both cases was still high at 2/3. Similar situations occur for [g] and [b] in unstressed positions. For the word-initial unstressed [g], the agreement is less than 3/3 in two of the seven tokens found, and, in those cases, the agreement is 2/3. Also, for the word-medial unstressed [b], there are 7 cases out of 37 where the inter-transcriber agreement is less than 3/3. For these cases, 5 have an agreement rate of 2/3, one utterance has an agreement of 1/3 and one example, discussed above, has 0/3 agreement. While the inter-transcriber agreement rates were very high overall, some segments such as [d], or positions such as word-initial unstressed, appear to negatively affect perception of voicing contrasts, if only in a marginal way.

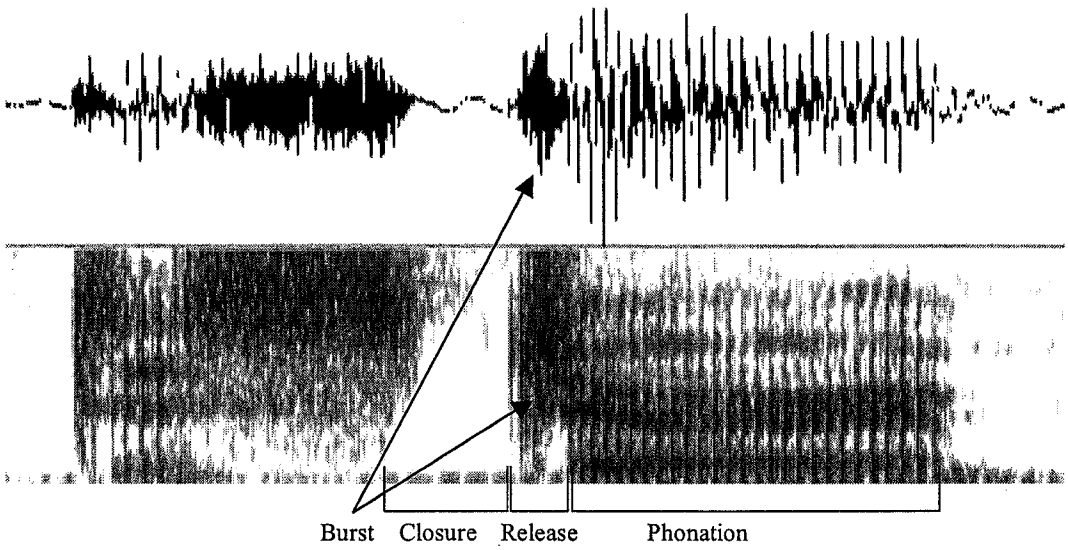
In order to further assess transcription reliability, I performed an acoustic analysis of the transcribed segments [p, b, t, d, k, g] in singleton onset position. This study is presented in the next section.

4.3 Acoustic Analysis of Transcribed Voicing

The second study conducted to investigate the issue of transcription reliability is based on acoustic measurements of those validated transcriptions that were used in the ranking for inter-transcriber reliability in section 4.2.

The acoustic cue that distinguishes voiced from voiceless stops is typically referred to as Voice Onset Time (VOT; e.g. Lisker and Abramson 1969). Taking a stop consonant+vowel sequence as an example, VOT is a value that represents the time period between the release of the stop consonant and the activation of the vocal folds required to produce voicing on the vowel. The diagram in (4.5) illustrates the visual cues associated with VOT. The closure phase is indicated by very drastic or total absence of spectral energy. The release phase is characterized by a burst in energy of relatively high frequency. Finally, the activation of the vocal folds in vowel production is indicated by semi-periodic vibrations whose various areas of intensity are observed through spectrographic formant structure.

(4.5) Measuring VOT on a Spectrogram



Each token was classified according to segment type ([p, b, t, d, k, g]), its position within the word (word-initial or word-medial), and stress (primary, secondary, unstressed). Segment type was based on the actual realization, not the target one, a method compatible with the goal of this portion of the study, which is to evaluate transcription accuracy using acoustic measurements of VOT.

Once the forms were collected and incorporated into separate Excel worksheets according to segment type, each token was measured for VOT using *Praat* (http://www.fon.hum.uva.nl/praat/), and the value, calculated in milliseconds, was entered in the corresponding worksheet, which can be found in Appendix B. After all of the measurements were complete, transcription accuracy was assessed quantitatively. The first step in this assessment consisted of extracting the mean and standard deviation of

VOT values per segment and prosodic position. The following table (4.6) illustrates the values according to each segment and prosodic position.

(4.6) Mean and Standard Deviation According to Segment and Position

	WI-1	WI-2	WI-U	WM-1	WM-2	WM-U
[p]	n = 122	n = 11	n = 4	n = 10	n = 18	n = 36
	m = 63	m = 51	m = 23	m = 51	m = 52	m = 49
	sd = 28	sd = 16	sd = 6	sd = 26	sd = 20	sd = 23
[t]	n = 135	n = 22	n = 9	n = 12	n = 6	n = 13
	m = 68	m = 65	m = 41	m = 71	m = 38	m = 51
	sd = 42	sd = 35	sd = 19	sd = 24	sd = 15	sd = 32
[k]	n = 131	n = 26	n = 13	n = 13	n = 13	n = 56
	m = 75	m = 57	m = 57	m = 72	m = 84	m = 60
	sd = 30	sd = 33	sd = 23	sd = 23	sd = 30	sd = 30
[b]	n = 122	n = 14	n = 24	n = 5	n = 12	n = 37
	m = 7	m = 5	m = 4	m = 6	m = 10	m = 6
	sd = 4	sd = 3	sd = 1	sd = 2	sd = 10	sd = 5
[d]	n = 185	n = 32	n = 44	n = 6	n = 8	n = 43
	m = 7	m = 7	m = 6	m = 6	m = 5	m = 6
	sd = 5	sd = 7	sd = 6	sd = 2	sd = 3	sd = 7
[g]	n = 41	n = 7	n = 15	n = 4	n = 1	n = 21
	m = 11	m = 5	m = 4	m = 6	m = 41	m = 7
	sd = 5	sd = 2	sd = 3	sd = 1	sd = n/a	sd = 3

(n = number of tokens; m = mean value; sd = standard deviation)

As we can see, the mean VOT for voiceless plosives is much higher than for voiced plosives. This is expected given that the range of VOT for a voiced plosive is close-ended; only a small degree of aspiration can be attained before a voiced stop begins to be perceived as voiceless. As opposed to this, the VOT for a voiceless plosive is virtually open-ended; both aspirated and strongly aspirated stops fall within the same, voiceless category. For the same reason, the standard deviation values for VOT of the voiceless

segments are much higher and more variable than those of the voiced segments. Finally, the shaded areas of the chart illustrate cases where the mean VOT stands apart from the mean VOT of the same segment for different positions. For example, the mean VOT for [p] in word-initial, unstressed position is 23 ms., which is much lower than the other mean values for [p] that are between 49 ms. and 63 ms. This value may have been obtained for a few of reasons. First of all, aspiration is typically lower in unstressed positions. Also, there are only 4 examples of [p] measured in this position, one of which falls in the "borderline" voicing category (see below), which may have affected the calculation of the mean. The next shaded example is of the plosive [g] in word-medial, secondary stressed position. Here, the mean VOT value is like that of a voiceless plosive. However, this is due to the fact that there was only one example of a transcribed word-medial, secondary stressed [g] in the sampled utterances, which had a VOT that was fairly high at 41 ms. This one occurrence represents a case of incorrect transcription (See discussion in section 4.4.3). Also, since there is only one example of a transcribed word-medial, secondary stressed [g], there is no standard deviation available. Other than these two problematic cases, the VOT measurements obtained look fairly consistent.

Now that the inter-transcriber agreement has been assessed, and the acoustic analysis of VOT is performed, the final step in determining transcription reliability is to document the relationship between transcription data and VOT values.

4.4 Relationship Between Transcription and VOT Values

To investigate the relationship between transcribed voicing and acoustically measured VOT values, the first step was to assign a standardized threshold to categorize the VOT values as being part of the voiceless or the voiced category. In order to determine what the arbitrary values should be, I first searched for normative data on VOT in English in the scientific literature. However, even though VOT is discussed at length in several books and articles, there is very little informative data on normative values for VOT in English. In addition, the few cases found yielded a situation that can be characterized as inconclusive at the very best. Ladefoged (2001: 127) states normative VOT for a stressed initial /p/ in English to be between 50-60 ms., while an initial /b/ should have a VOT of about 10 ms. This suggests that plosives whose VOT falls between 10 and 50 ms. have an undetermined status. In contrast to this, Shriberg and Kent (2003: 79) quote the normative English VOT values as less than 20 ms. for voiced stops, and between 30-80 ms. for voiceless stops, leaving the 20-30 ms. area unclear. Finally, Borden et al. (2003: 115) claim that English VOT values above 50 ms. represent voiceless stops, something similar to Ladefoged (2001), implicitly suggesting that values below 50 ms. will yield voiced plosives.

Given this rather unclear situation, and considering the fact that that VOT values are relative ones that are directly affected by factors such as stress, position, speech rate, emphasis, etc., I set arbitrary values that offer a compromise between the different standards proposed. These standards are discussed in section 4.4.1 below, followed by a

slightly revised set of standards in section 4.4.2. Finally, in section 4.4.3, I provide a comparison of transcription reliability and the acoustically measured data.

4.4.1 Initial VOT standards

The VOT standard values I first considered are as follows: VOT values equal or greater than 25 ms. are categorized as "voiceless"; values equal to or greater than 15 ms. and but lower than 25 ms. are categorized as "borderline"; VOT values below 15 ms. are categorized as "voiced". It is indeed understood that VOT is not a categorical value, but a gradient one. The "borderline" category is thus included to allow for a flexible approach to VOT data interpretation, which enables a more careful interpretation of the data. Table (4.7) below illustrates how the criteria for voicing categorization were implemented where "x" represents the acoustically measured VOT value.

(4.7) Criteria for Voicing Categorization

	Voicing Category		
	"Voiced"	**"Borderline"**	**"Voiceless"**
x = VOT value (ms.)	$x < 15$ ms.	15 ms. $\leq x < 25$ ms.	$x \geq 25$ ms.
e.g. [b] = 26 ms.			✓
e.g. [b] = 19 ms.		✓	
e.g. [b] = 10 ms.	✓		

The arbitrary values were then applied to every segment, in every prosodic position, in an effort to judge the accuracy of transcription. This was performed relative to transcription such that a transcribed [b] with a VOT value of 26 ms. was considered

"voiceless" and, therefore, transcribed incorrectly.[3] The table in (4.8) summarizes the results. The integers correspond to the number of tokens that fall in each category.

(4.8) Transcription Accuracy According to VOT Standards

	Voicing	**WI-1**	**WI-2**	**WI-U**	**WM-1**	**WM-2**	**WM-U**
[p]	Voiceless	111	10	1	10	17	33
	Borderline	7	1	3	0	1	3
	Voiced	4	0	0	0	0	0
[t]	Voiceless	130	22	6	12	5	10
	Borderline	5	0	3	0	1	2
	Voiced	0	0	0	0	0	1
[k]	Voiceless	127	25	13	13	13	49
	Borderline	3	1	0	0	0	3
	Voiced	1	0	0	0	0	4
[b]	Voiced	121	13	24	5	10	36
	Borderline	0	0	0	0	1	0
	Voiceless	1	1	0	0	1	1
[d]	Voiced	183	31	42	6	8	42
	Borderline	1	0	1	0	0	0
	Voiceless	1	1	1	0	0	1
[g]	Voiced	28	7	15	4	0	20
	Borderline	13	0	0	0	0	1
	Voiceless	0	0	0	1	0	0

These values can also be represented in terms of mean accuracy. In the following table (4.9), the accuracy is illustrated by percentage values. This includes the percentage of the transcriptions that were correctly transcribed according to the arbitrary values assigned,

[3] The complete set of corresponding data can be found in Appendix B.

as well as the percentage of transcriptions that were categorized as either correct or borderline.

(4.9) Transcription Accuracy Percentages

	Accuracy	**WI-1**	**WI-2**	**WI-U**	**WM-1**	**WM-2**	**WM-U**
[p]	Voiceless	90.98%	90.91%	25.00%	100%	94.44%	91.67%
	Voiceless + Borderline	96.72%	100%	100%	100%	100%	100.00
[t]	Voiceless	96.30%	100%	66.67%	100%	83.33%	76.92%
	Voiceless + Borderline	100%	100%	100%	100%	100%	92.31%
[k]	Voiceless	97.71%	96.15%	100%	100%	100%	87.50%
	Voiceless + Borderline	100%	100%	100%	100%	100%	92.86%
[b]	Voiced	99.18%	92.86%	100%	100%	83.33%	97.30%
	Voiced + Borderline	99.18%	92.86%	100%	100%	91.67%	97.30%
[d]	Voiced	98.92%	96.88%	95.45%	100%	100%	97.67%
	Voiced + Borderline	99.46%	96.88%	97.73%	100%	100%	97.67%
[g]	Voiced	68.29%	100%	100%	100%	0%	95.24%
	Voiced + Borderline	100%	100%	100%	100%	0%	100%

From the above data, it appears that transcription is least accurate in unstressed positions, both word-initially and word-medially. However, it must be noted that these results are based on the wrong premise that VOT perception is fixed irrespective of prosodic position. Indeed, it is often the case that VOT is lower in unstressed than in stressed positions (e.g. Fougeron and Keating 1997). It follows from this that the arbitrary VOT standards assigned should account for this observation. An example of this comes from an interview of Arthur Garfunkel during which he mentions the name of his band

Simon & Garfunkel. (*The Breakup*, Paul Simon *1964/1993* compilation box set.) In the production of the word 'Garfunkel', the word-initial, primary stressed and voiced [g] has a VOT of 33 ms., which is larger than the word-medial, unstressed [k] at 24 ms. The consonants are however accurately perceived as [g] and [k], respectively. This clearly illustrates the fact that the acoustic cue is not based solely on a fixed VOT value, rather that it interacts with prosodic position as well. This discussion continues in the following section.

4.4.2 Revised VOT standards

Building on the observations made in the previous section, I lowered all target VOT values for unstressed positions by 5 ms., in an attempt to take into account positional effects on VOT in my acoustic assessment. The revised target VOT values for categorizing plosives in unstressed position are thus as follows: a VOT value equal or greater than 20 ms. is categorized as "voiceless"; a value equal or greater than 10 ms., and less than 20 ms. is classified as "borderline"; those values less than 10 ms. are classified as "voiced". The classifications based on these new criteria are illustrated in table (4.10) below.

(4.10) Revised Criteria for Voicing Categorization

	Voicing Category		
	"Voiced"	**"Borderline"**	**"Voiceless"**
x = VOT value (ms.)	x < 10 ms.	10 ms. ≤ x < 20 ms.	x ≥ 20 ms.
e.g. [b] = 26 ms.			✓
e.g. [b] = 19 ms.		✓	
e.g. [b] = 9 ms.	✓		

By assigning these new value standards, the accuracy rate changed significantly. Table (4.11) below provides a comparison of the percentage of accuracy in unstressed position, according to both sets of VOT standards.

(4.11) Comparison of VOT Standards in Unstressed Positions

		Initial Targets		**Revised Targets**	
	Accuracy	**WI**	**WM**	**WI**	**WM**
[p]	Voiceless	25.00%	91.67%	75.00%	94.44%
	Voiceless + Borderline	100%	100.00	100%	100%
[t]	Voiceless	66.67%	76.92%	77.78%	84.62%
	Voiceless + Borderline	100%	92.31%	100%	100%
[k]	Voiceless	100%	87.50%	100%	89.29%
	Voiceless + Borderline	100%	92.86%	100%	96.43%
[b]	Voiced	100%	97.30%	100%	94.59%
	Voiced + Borderline	100%	97.30%	100%	97.30%
[d]	Voiced	95.45%	97.67%	95.45%	90.70%
	Voiced + Borderline	97.73%	97.67%	97.73%	97.67%
[g]	Voiced	100%	95.24%	86.67%	80.95%
	Voiced + Borderline	100%	100%	100%	100%

As can be seen in this table, the average accuracy shifts, at times quite drastically, with the new VOT target values. In fact, the revised values have both positive and negative impacts on the assessment scores, depending on the segments analyzed. For the voiceless segments, the new values have the positive effect of increasing accuracy as can certainly be seen word-initially for [p]. According to the initial target values, the accuracy of transcribing [p] correctly as "voiceless" was very low at 25%, however, with the new values, the accuracy increased to 75%. The new target values have the opposite effect on the voiced segments however. As with the transcribed [g] as "voiced" in word-initial position, there was a transcription accuracy rate of 100% with the initial VOT targets. However, with the new targets, that accuracy has dropped to 86.67%. As we can see from this portion of the investigation, even the task of verifying transcription accuracy using acoustic measurements, a method which on the face of it appears to be methodologically reliable, yields a series of uncertainties in the interpretation of the results.

Two conclusions can be drawn from this. First, because of the issues raised in the above discussion, one cannot claim that impressionistic transcriptions should be considered methodologically inferior to that of using acoustic criteria, the latter requiring some degree of arbitrariness when analyzing VOT, which directly affects the results. In contrast to this, given the high rates of inter-transcriber reliability demonstrated in section 4.1, it appears that the judgments obtained by transcribers do provide a sound basis for research, even if it does have its limitations. Second, because of the difficulties related to the provision of a clear criterion to assess voicing acoustically, this method also has problems which should not be neglected. VOT, like most acoustic parameters, can only

be interpreted dynamically while considering a series of interacting factors. Studies based on only one acoustic parameter are thus inherently limited, which poses problems for data interpretation that to a large extent, are comparable to those raised with impressionistic transcriptions.

4.4.3 Comparison of Transcription Reliability and VOT

Given the caveats discussed above, one of the most obvious solutions to the general methodological question discussed throughout this chapter is to combine transcription and acoustically-measured data. Such a combination would at least help in determining whether the contexts where difficulties are found (given either method) display some correlation. Following this line of thinking, I performed a comparison of inter-transcription agreement with VOT values. The logical assumption here is that the cases labeled as "borderline" in section 4.2 should be the cases where the most inter-transcriber disagreement occurs. However, this is not the case. As mentioned above, there are only six cases where the agreement is 1 or 0. In each of these cases, there are no "borderline" VOT values according to both the initial and revised sets of arbitrary VOT values discussed above. Table (4.12) below provides the results.

(4.12) Voicing Label and Inter-transcriber Agreement

Ortho.	Adult IPA	Child IPA	Rank	VOT(ms)	Label
dada	'dædæ	'dɛdæʔ	1	1.00	Voiced
apple	'æpəɬ	'ʔæt^{h}æbæʔ	1	8.00	Voiced
blanket	'blæŋkət	'bædiːj	1	7.00	Voiced
blanket	'blæŋkət	'bædij	1	8.00	Voiced
monkey	'mʌŋkij	'mejk.gij	1	41.00	Voiceless
cheapy	'ʧijpij	'ʧijbij	0	5.00	Voiced

The shaded examples in the above table represent unusual cases in the analysis. The example of "monkey" is shaded as the transcription was clearly incorrect. The incorrect perception, however, may have come from the fact that the child produced a geminate consonant broken into two halves by a short pause, something which is typically not allowed in the phonology of English and, as such, may have misled the transcribers. The second shaded example, the word "cheapy" received a rank of 0, as discussed in section 4.1 above. While the [b] in this word did receive a rank of 0, the validated process resulted in a transcription that corresponds to the VOT measurement in (4.12). In fact, apart from the example of "monkey", all of the validated forms have accurate voicing transcriptions according to the VOT values. While the inter-transcriber agreement was low for the voicing specification of the other plosives, the VOT values indicate accurate validation of the transcriptions.

Apart from the cases listed in (4.12), the vast majority of which support the claim that carefully performed impressionistic transcriptions are reliable, there are 32 cases word-initially, and 19 cases word-medially, where the VOT value falls in the "borderline" category, according to the new VOT standards listed in (4.10). Word-initially, the inter-transcriber reliability is 3/3 for 26 of 32 examples, for an average of

81%. The other 6 cases have an inter-transcriber agreement rate of 2/3. In word-medial position, 16 of the 19 examples (84%), have an inter-transcriber agreement rate of 3/3. The remaining 3 examples have an agreement rate of 2/3.

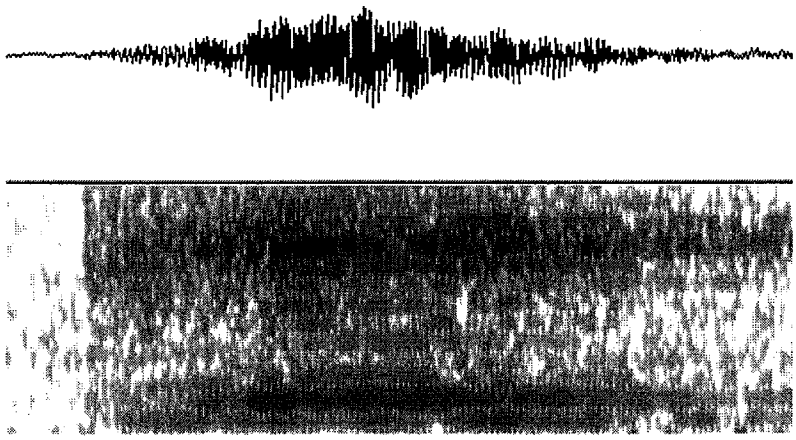
As can be concluded from the observations above, there are very few examples where the transcribed segment is incorrect (i.e., labeled voiceless but transcribed as voiced, and vice versa) according to the VOT targets. Word-initially, in primary stressed position, there are two such cases. The inter-transcriber agreements for these examples are 3/3 and 2/3, respectively. The following table (4.13) illustrates the cases of incorrect transcribed voicing word-initially, according to the voicing standards.

(4.13) Word-initial, Primary Stressed Examples of "Incorrect" Transcribed Voicing

	Age	**Ortho.**	**Adult IPA**	**Validated IPA**	**VOT (ms.)**	**Label**	**Rank**
[p]	1;10.10	peacock	ˈpʰiˌkʰɑkˈ	ˈpʰijˌkʰɑkʰ	13	Vcd	3
[d]	1;09.11	that's a man	ðætsəmæn	dætʰaṃˈmæ̃n	41	Vclss	2

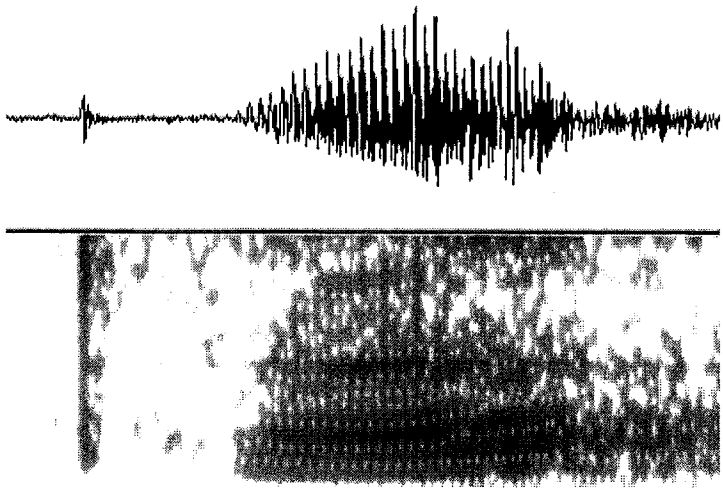
The first example, "peacock" was very difficult to measure. While the value decided on is 13 ms, additional attempts at measuring this example yielded other values. This is most likely due to noise that we can associate with a large quantity of saliva in Sonya's mouth during production, making for a pretty messy spectrogram, as can be seen with a screen shot illustrating the acoustic trace of the first syllable of this word below.

(4.14) Spectrogram of the First Syllable of 'peacock' (1;10.10)



As can be seen from this illustration, there is no clear visual cue that enables an unambiguous determination of the degree of aspiration in this example. In an attempt to further characterize this problematic case, two additional transcribers were asked to verify the voicing of the segment. Each of them concurred with the validated transcription, that the segment was indeed a voiceless [p]. I tentatively conclude from this that the apparent problem with this example actually emerges from the VOT measurement. For the second example, closer analysis of the spectrogram revealed that while the VOT of the segment is quite large at 41 ms, this time value is due to an apparent pause between the release of the stop and the initiation of phonation. What is particular about this relatively long pause is that there is no actual aspiration evident on the spectrogram. This virtually noise-free pause is represented in the spectrogram below.

(4.15) Spectrogram of the First Syllable of 'that's a man' (1;09.11)



It is possible that this has misled the transcribers, who perceived a voiced [d] instead of [t].

Word-medially, there are three cases in which a segment is transcribed incorrectly according to the VOT standards. Of these examples, two have an inter-transcriber agreement rate of 2/3, and the final example has an agreement rate of 1/3. These examples are presented in (4.16).

(4.16) Word-medial Examples of "Incorrect" Transcribed Voicing

	Age	**Ortho.**	**Adult IPA**	**Validated IPA**	**VOT (ms.)**	**Label**	**Rank**
[b]	1;04.18	Peter	'pʰijtəˑ	'bʌˌbʊ.ɛʔ	38	Vclss	2
[b]	1;11.08	purple	'pʰəˑpɫ	'pʰʊbʌ	33	Vclss	2
[g]	1;08.11	monkey	'mʌŋki	'mejk.gij	41	Vclss	1

While no clear explanation can be provided for the first example, I hypothesize that it may originate from the fact that North American English speakers typically expect a flap for target [t] in this position, something which may have misled the transcription. While the second example is also incorrect, the transcription of the voiced [b] may be due to the high speed at which the word was uttered. which may have mislead the transcribers in perceiving a [b]. Finally, as discussed previously in section 4.4.3 above, the production of an unusual geminate consonant in "monkey" may have led the transcribers in perceiving a [g].

As we can see from the above tables (4.13) and (4.16), for the purposes of analyzing the acquisition of voicing based on transcription data, the occurrence of an incorrect transcription is pretty rare. Despite the one case where the inter-transcriber agreement was 3, the other instances of incorrect transcription have an agreement rate of 2 or 1. Given this observation, it makes sense to claim that transcription-based studies should make use of acoustic analysis as a tool to test the accuracy of transcription of the segments with low inter-transcriber agreement rates, as long as the problematic forms are recorded with sufficient clarity to prevent the generation of unreadable spectrograms.

The next section of this chapter focuses on Sonya's acquisition of voicing contrasts for plosives in singleton onsets. For the purposes of this next section, each of the examples of incorrect transcription in tables (4.13) and (4.16), as well as those in table (4.12), for which the inter-transcriber agreement is less than 2, are excluded from the analysis.

4.5 The acquisition of voicing contrasts for plosives in singleton onsets

One of the most substantial investigations of the acquisition of voicing contrasts to date comes from Kager, van der Feest, Fikkert, Kerkhoff and Zamuner (in press), who study the acquisition of voicing contrasts in three Germanic languages: Dutch, German and English. They conducted a cross-sectional study to investigate the issue in Dutch, using data from 11 monolingual Dutch children between the age ranges of 1;0 and 2;11. The findings from this portion of the study reveal that, overall, Dutch children acquire voicing contrasts at a late age, which the authors claim to be after 2;6, an age which corresponds to the end of their study but at which no clear evidence of voicing acquisition was found. Kager et al. also found that the children make more errors in producing voiceless segments in place of voiced segments word-initially. Note here that Dutch is a pre-voicing language, i.e. a language whose voiced consonants have negative VOT values, meaning that activation of the vocal folds occurs before the release of voiced plosives. Addressing this issue as a potential factor for the late acquisition of voicing contrasts, Kager et al. investigated the acquisition of contrasts in German, an aspiration language which, similar to English, displays positive VOT values for both voiced and voiceless consonants. To perform this portion of their investigation, they selected a longitudinal database from CHILDES (MacWhinney 1999) of a child named Kerstin (aged 1;3-3;4). They found that voicing errors come primarily from voiceless (aspirated) stops being realized as unaspirated (voiced) plosives. Despite this, the voicing contrast was acquired in initial position by the age of 2;0, i.e. much earlier than what could be observed from the Dutch corpus. Finally, Kager et al. studied the acquisition of

the voicing contrasts effects in English, a language similar to German by virtue of being an aspiration language, but which differs from German in that it does not have syllable-final voicing neutralization. The findings for English were in fact more complex than those for German. The authors found a high proportion of both voicing and devoicing errors in initial position. However, pushing further into their investigation of this observation, they found that the initial devoicing errors were conditioned by a voiceless obstruent occurring later in the word, and that no such motivation occurred for the voicing errors.

Building on this study, I discuss, in the next section, Sonya's acquisition of voicing contrasts in singleton onset plosives. In section 4.4.1, I discuss the method used for this investigation. In section 4.4.2, I provide the results of this study. In section 4.4.3, I discuss these results and compare them to the ones from the Kager et al.'s (in press) study.

4.5.1 Method

The first step in investigating Sonya's acquisition of voicing contrasts of plosives in singleton onset position was to gather all utterances of target [p, b, t, d, k, g] contained in the corpus. This process was carried out by exporting all utterances into a Microsoft Excel worksheet, where they were sorted according to the position of the singleton onset. During the second step, I labeled each utterance according to how the singleton onset plosive was realized in relation to the target form in terms of voicing. Each production had the option of being labeled in three different categories, "Target-like" (TL),

"Incorrect voicing" (Incorrect), and "Other". Table (4.17) below provides illustrations of how these criteria were applied.

(4.17) Acquisition of Voicing Labels

Age	Ortho.	Target	Realization	TL	Incorrect	Other
1;04.18	cup	kʌp	ˈgʌʔ		✓	
1;04.18	Keesha	ˈkʰijʃə	ˈkʰijjɪ	✓		
1;04.18	Babar	ˈbæbaɪ	ˈwɑwɑ			✓

In the above table, the target voiceless [k] is realized as voiced [g], which is incorrect. In the second example, the voiceless [k] is realized as target-like. The final example illustrates the "other" category, in which the production of "Babar" as [wɑwɑ] does not resemble the target form's singleton onset plosives in terms of voicing or manner of articulation in general.

Once the labeling of the singleton onset plosives was completed, quantitative analyses were conducted on the data in an attempt to document the acquisition path for Sonya. These results of the quantitative analysis are presented in the following section.

4.5.2 Results

Overall, Sonya appears to have acquired the voicing contrast at a very early age, even before the beginning of the recordings, at 1;04.18. This implies that Sonya acquired voicing contrasts in a much more precocious fashion than the Dutch, German and English children discussed by Kager et al. (in press). The general breakdowns for both word-initial and word-medial environments are presented in table (4.18) below.

(4.18) Mean Values for Voicing Contrasts

a) Word-initial

i) Attempted forms:	2156	
ii) Target-like:	2009	(93%)
iii) Incorrect:	33	(2%)
iv) Other:	114	(5%)

b) Word-medial

i) Attempted forms:	638	
ii) Target-like:	511	(80%)
iii) Incorrect:	35	(6%)
iv) Other:	92	(14%)

While her accuracy rate is very high for both positions from the initial recordings, her production varies slightly in word-initial, primary stressed, and word-medial, unstressed environments. In section 4.5.2.1 I will provide the results for all but these two positions. I will discuss these two positions in sections 4.5.2.2 and 4.5.2.3 respectively.

4.5.2.1 General observations

Excluding the word-initial, primary stressed and word-medial, unstressed positions, the remaining positions studied here display the same patterns. The rate of target-like production is very high, and the rate of incorrect voicing is very low. I first provide a new chart, in (4.19), that illustrates the breakdown of production values.

(4.19) Mean Values for Voicing contrasts, Excluding WI-1 and WM-U

a) Attempted forms:	109	
b) Target-like:	86	(79%)
c) Incorrect:	1	(1%)
d) Truncated forms	18	(17%)
e) Other:	4	(3%)

While it may appear that the accuracy rate is lower for these positions with target-like productions at 79%, this value is a result of the high occurrence of "Truncated forms" at 17%. These truncated forms are all very systematic in that they all come from the deletion of word-initial, unstressed syllables (see Fikkert 1994 and Pater 1997 for additional discussion of truncation in child language). It is important to note that the rate of "incorrect" realization is very low, with only one occurrence accounting for 1% of the data. I provide relative examples of target-like production in table (4.20) below.

(4.20) Representative Examples of Target-like Production of Voicing Contrasts

Age	Orthography	Target	Realization	Position
1;05.00	gorilla	**g**ə'ɪɪlə	ow**g**ə'wɛ.ə	WI-U
1;06.10	again	ə'**g**ɛn	æ'**g**ɛʔ	WM-1
1;08.22	guitar	gɪ'taɪ	'**t**^{h}a:	WM-1
1;09.11	cucumber	'k^{h}jukʌm,**b**ə˞	'k^{h}ɤ̃ma**b**ɑ:	WM-2
1;10.10	guitar	**g**ə't^{h}aɪ	**g**ə't^{h}ɑ:	WI-U
2;00.04	reindeers	'ɹe^{j}n,**d**iɹz	'ɹejn,**d**ijʌdz	WM-2
2;05.12	Daniella	,**d**æn'jɛɬæ	,**d**ɐ̃n'jɛlɑ	WI-2

As we can see from each of the above examples, Sonya produces each form with the correct voicing specification. Table (4.21) below provides representative examples of truncated forms.

(4.21) Truncation in Word-initial Unstressed Position

Age	Orthography	Target	Realization	Position
1;05.29	banana	bəˈnænə	ˈnæ̃n̩	WI-U
1;08.22	guitar	gɪˈtaɹ	ˈtʰaː	WI-U
1;10.10	potato	pəˈtʰeɪdow	ˈtʰejdow	WI-U

While positional effects are evident in word-initial position, with regard to truncation, this has no effect on voicing contrasts.

The remaining four forms that occur in the "other" category appear to be unsystematic mispronunciations. Table (4.22) below illustrates examples from the "other" category.

(4.22) Utterances in the "Other" Category for Voicing Contrasts

Age	Orthography	Target	Realization	Position
2;05.12	Daniella	ˌdænˈjɛlæ	nɛ̃nənɛʔˈjɛlɑ	WI-2
1;06.23	hippopotamus	ˌhɪpəˈpʰɑɾəmʌs	ˈwɛbʊtʰ	WM-1
2;03.17	about	əˈbawt	əˌwaw	WM-1
2;05.12	strawberries	ˈstɹɑˌbəɹiz	ˌtwɑwɛwij	WM-2

The example of "Daniella" appears to be a case where Sonya stutters while attempting to produce this word. This is the first time Sonya attempts this word in the corpus, and she appears to have some trouble with it. (Note however, that in the corpus she immediately attempts the word again, and produces it accurately on her second attempt.) It appears that the example of "hippopotamus" may be a result of incorrect assignment of the orthographic form, since the realization resembles "rabbit" more than "hippopotamus". In any event, the actual form is so remote from the target one that no analysis can be based

on it. In the examples of "about" and "strawberry", the [b] is replaced by the sonorant [w], something that resembles another unsystematic pronunciation.

Finally, there is only one occurrence of an incorrect voicing realization. This occurs in the word-medial, primary stressed [t] of "guitar", at age 1;10.10. Example (4.23) illustrates the production.

(4.23) Incorrect Voicing in Word-medial Primary Stressed Position

Age	Orthography	Target	Realization
1;10.10	guitar	gəˈtʰaɹ	gɛˈdɑ

Since this is the only example in 109 attempts, of a production with the incorrect voicing, it should be considered an unsystematic mispronunciation. While there were a few mispronunciations of consonants illustrated above, the evidence clearly suggests that Sonya had already acquired voicing contrasts at the time when the first recordings of her speech took place.

The next section illustrates the findings for word-initial, primary stressed position. The data illustrates that the number of errors is relatively higher in this context, but the errors do show some degree of systematicity.

4.5.2.2 Word-initial primary stressed position

As stated in (4.24) below, the overall pattern of production for singleton onsets in word-initial, primary stressed position yields target-like voicing at a rate of 94%. We can see as well from these data that Sonya produced 33 voicing errors in this position. These errors

do not indicate that the voicing contrast has not been acquired, however. These errors are in fact scattered around the entire corpus, thus not indicating a unique acquisition period. This fact suggest that Sonya has acquired the contrast in this position, despite some unsystematic productions, which only account for 2% of the overall data.

(4.24) Mean Values for Voicing Contrast in Word-initial Primary Stressed Position

a) Attempted forms:	2123	
b) Target-like:	1994	(94%)
c) Incorrect:	33	(2%)
d) Other:	96	(4%)

Of the 33 productions with incorrect voicing, 25 (76%) are voiceless targets realized as voiced, while the remaining eight display the opposite pattern. The table in (4.25) provides examples of such cases.

(4.25) Voiceless Targets Realized as Voiced in Word-initial, Primary Stressed Position

Age	Orthography	Target	Realization
1;04.18	cup	ˈkʌp	ˈgʌʔ
1;06.10	pig	ˈpʰɪg	ˈbij
1;09.26	tail	ˈtʰeɪɬ	ˈdejəɬ
1;11.27	cozy	ˈkʰowzi	ˈgɔd͡ʒij
2;03.03	turtle	ˈtʰɚɬ	ˈdɔdɑ

Each of the target voiceless, word-initial plosives [p, t, k] are realized as their voiced counterparts [b, d, g]. This matches the observation made about voicing errors by Kager et al. (in press). Concerning the remaining eight examples, while Kager et al. found that the errors of devoicing a target voiced consonant were the result of a voicing harmony

pattern, no such conditioning was evident in devoicing errors from Sonya's corpus. Table (4.26) lists all of the occurrences of devoicing errors.

(4.26) Voiced Targets Realized as Voiceless in Word-initial Primary Stressed Position

Age	Orthography	Target	Realization
1;06.10	go	'gow	'kʰoːw
1;07.27	bicycle	'bajsɪ̩kɬ	'pʰowˌtʰʌ
1;09.11	diaper	'dajpə˞	'tʰɛpɛʔ
1;11.27	daddy	'dædi	'tʰæ̃nij
1;11.27	guys	'gajz	'kaj
1;11.27	guy	'gaj	'kʰʌs
2;02.03	barn	'baɹn	'pʰɑ̃ːn
2;06.02	do	'duw	'tʰuw

As we can see, except for the examples of "bicycle" and "diaper" above, there are no indications that voicing harmony is involved.

There is an additional situation occurring word-initially with the labeled "other". As we can see from the above numbers in (4.24), there are a total of 94 productions in this category. These productions are in this category for various reasons. In several productions, the target consonant is omitted, while, in others, it is substituted by a sonorant consonant. The following chart (4.27) provides representative examples of such productions.

(4.27) Representative Examples of Productions in the "Other" Category

Age	Orthography	Target	Realization
1;06.10	bean	bijn	ʔɪj
1;08.06	cow	kʰaw	ˈhɑw
1;09.11	boat	bowt˺	ˈwowtʰ
1;10.10	give to mom	gɪvtəmɑm	ˈgɪvəˌmɑ̃mij
1;10.24	cat	kʰæt˺	ˈætʰ
2;03.17	don't wanna	downʔwɑnə	ʔõwʔˈwɑ̃nə

Note as well that function words such as "to", "do", and "don't" ended up in this category quite often. I attribute this observation to the immature syntax of the child at the time of recording, which also correlates with the fact that these positions are often reduced in adult speech.

In the next section, I discuss the patterns found in word-medial, unstressed position.

4.5.2.3 Word-medial unstressed position

There are a total of 565 productions in word-medial unstressed onsets, 441 of which are target-like. However, there are several productions that are not target-like, many of which have the incorrect voicing label, or fall in the 'other' category. The relative proportions of each of these categories are provided in table (4.28) below.

(4.28) Mean Values for Production in Word-medial Unstressed Position

a) Attempted forms:	565	
b) Target-like:	441	(78%)
c) Incorrect:	35	(6%)
d) Other:	89	(16%)

As the above table indicates, the attempted word-medial, unstressed singleton onset plosives are realized as target-like in 78% of the productions. Sonya realizes the plosive with incorrect voicing in 35 utterances (6%), or in some unsystematic fashion in 89 utterances (16%). I will discuss each production type in turn, first by illustrating examples of target-like production in table (4.29) below.

(4.29) Target-like Production in Word-medial Unstressed Position

Age	Orthography	Target	Realization
1;04.18	dada	ˈdædæ	ˈdɛdæʔ
1;04.18	Babar	ˈbæbaɪ	ˈbæbʌʔ
1;05.29	apple	ˈæpl̩	ˈpʰʌ
1;06.23	monkey	ʌˈmʌŋkij	ˈʊʔˌmɐ̃ŋkʰej
1;08.06	purple	ˈpʰɚpl̩	ˈpʰʌˌpʊ
1;08.22	newspaper	ˈnuwzˌpʰejpɚ	ˈowpʰɑpʰɑ
1;09.11	crocodile	ˈkʰɹɑkʰəˌdajəl̩	ˈkʰɑkʰəˌdajvə
1;09.11	mango	ˈmæŋgow	ˈmɛ̃gow
1;09.26	working	maʲwɚkɪŋ	ˈmajˌwʊkʰ̃ɪnə
2;00.04	chicken	ˈtʃɪkn̩	ˈt͡ʃɪkʰ̃ɪ

As we can see in the table above, the word-medial unstressed plosive in each of these words was realized with target-like voicing, even at the beginning of the corpus at 1;04.18. However, as mentioned above, there are 35 examples in which voicing is incorrectly produced. Similar to the incorrect voicing realizations for word-initial primary stressed position, the majority of these, 33, are voiceless targets that are realized as voiced when produced. Table (4.30) below illustrates representative examples of incorrect voicing realization.

(4.30) Voiceless Targets Realized as Voiced in WM-U

Age	Orthography	Target	Realization
1;08.11	blanket	ˈaʲwɑnt̚ˌblæŋkɪt	ʌjwãˈbædij
1;08.22	Mikey	ænˈmaʲki	ɛtˀnajgij
1;09.11	hippo	ðætsəhɪpow	dæsaˈbɐ̃mˌbow
1;11.08	purple	ˈpʰəˑpl̩	ˈpʰʊbʌ
2;02.03	Ichobad	ˈɪkəbɑd	ɪgəˈbɑːd
2;03.27	pickle	ˈpʰɪkl̩	ˈpʰɪgow
2;05.25	paper	ˈpʰejpəˑ	əˈpʰijba
2;05.25	chicken	ˈtʃɪkn̩	əˌt͡ʃɪˈgĩn
2;05.25	a cakey	ˈkʰejkij	ʌˈkʰejˌgij

Notice that a large number of the examples of incorrect voicing actually originate from a handful of words. Indeed, the [k] in "blanket" is realized as [g] three times, the word-medial [p] in "purple" is realized as [b] five times, and the [p] in "hippo" is realized as [b] eight times. The latter example, "hippo" appears to be a special case that Sonya frequently produces as either [ˈbɐ̃mˌbow] or [ˈpʰɐ̃mˌbow]. This observation suggest that this particular example should probably be attributed to a misrepresentation of the word in the child's lexicon, as opposed to an incorrect rendition of an accurately-represented contrast.

Finally, there are quite a few productions that are classified in the 'other' category. The words classified in this category are affected by processes such as syllable truncation, flapping, substitution, or deletion. I list each pattern, provide its relative proportion and realization in table (4.31) below.

(4.31) Patterns of Production in the "Other" Category in WM-U

Pattern	Number	Target	Realization
Substitution	17 (19%)	*dada* ['dædæ]	['dɛˌlø]
Plosive Deletion	17 (19%)	*sugar* ['ʃʌgɚ]	['dʊ.ow]
Truncation	16 (18%)	*teddy bear* ['tɛdiˌbɛɹ]	[ə'tʰejðɑ]
Hypochoristic	15 (17%)	*noodles* ['nudl̩z]	['nuwˌnuw]
Flapping	12 (13%)	*dada* ['dædæ]	['dæɾæ]
Other	11 (12%)	*dragonfly* ['dɹægənflaj]	['ɛmɪhĩ]

In this set of exceptional data, 15 examples of hypochoristic forms are attested, eight of which are of the word "noodles", which she regularly produces as [nuwnuw]. There are also 12 examples of flapping, which is common for coronal plosives in word-medial unstressed position. Example utterances from this category include "dada", "ladder", "feeding", and "party". Finally, there are several unclassifiable examples that were put in the other category. Examples of this type include the realization of "dragonfly" above being realized as ['ɛmɪhĩ].

We can conclude from all of the observations above that, overall, Sonya is very efficient in producing the correct voicing specification, not only in word-medial, unstressed position, but in all of the other positions covered in this chapter as well. While Sonya has a slightly higher error rate in word-initial, primary stressed position and word-medial, unstressed position, she appears to have acquired the contrast since the beginning of the corpus, even in these positions

In the next section, I summarize and discuss the results obtained in the various sub-parts of the investigation presented in this chapter.

4.6 Discussion

In sections 4.2 through 4.4, I provided a reflection in which impressionistic versus acoustic methods of analysis are confronted. I demonstrated that while many researchers assume that acoustic investigations are essentially more reliable methodologically, methods of acoustic analysis also have their challenges, especially in data interpretation of VOT in onset plosives. In section 4.2, I illustrated that a multiple-blind method of data transcription, when combined with a team-based method of data validation, does provide a reliable transcription-based empirical foundation for research in phonological development. In section 4.3, I demonstrated that challenges related to the interpretation of the acoustically-measured VOT, which include the need for an arbitrary threshold to classify the data on voicing contrasts, may directly affect the interpretation of the results. In section 4.4, I demonstrated that while we expect a correlation between borderline VOT values and low inter-transcriber agreement, this is not the case. However, the segments that were transcribed incorrectly, according to the VOT standards, generally have inter-transcriber rates that are less than 3/3. This implies that further investigations based on impressionistic transcriptions should rely on acoustic methods to verify the tokens that receive a low inter-transcriber reliability.

The results of my investigation confirm the general findings from Kager et al. (in press) that English-learning children acquire voicing contrasts much earlier than Dutch-learning children. Kager et al. also provide evidence that voicing contrasts in German, an aspiration language like English, are acquired earlier than in Dutch, a pre-voicing language.

We could conclude from this that that voicing contrasts are acquired earlier in aspiration languages such as English and German than in non-aspiration languages such as Dutch. This generalization, however would require further investigation before any firm conclusion can be drawn. Such an investigation would require studies of other non-aspirated languages such as French and Spanish, for example, or of languages that have a three-way voicing contrast (plain voiceless, voiceless aspirated and voiced) such as Hindi or Thai. Only with such studies will one be in a position to make strong claims concerning the factors that drive acquisition of voicing contrasts in child language.

Chapter 5 - Phonological Development of Branching Onsets and s+C Clusters

5.1 Introduction

In this chapter, I investigate the issue of positional effects from the perspective of phonological development. More specifically, I study the development of onset clusters in different prosodic positions in an attempt to detect positional effects. As we will see, however, this aspect of the study will turn in very few results, primarily due to a lack of data from most of the potentially relevant positions listed in 3.1. Despite this unfortunate outcome, this chapter provides an account of Sonya's phonological development from the perspective of the development of branching onsets and s+C clusters which raises interesting theoretical questions. As we will see throughout this chapter, Sonya's acquisition path for branching onsets is different from that of s+C clusters. This general finding is in line with other works on the development of onset clusters (e.g. Fikkert 1994, Barlow 1997, Bernhardt and Stemberger 1998, Goad and Rose 2004). At the stages during which she cannot achieve production of the clusters in an adult-like way, she displays various cluster reduction strategies, all of which are documented with the necessary detail in the next sections.

This chapter is organized as follows. I first discuss the phonological structure of branching onsets and s+C clusters in section 5.2. This discussion is followed by a presentation of the data extraction and compilation methods in section 5.3. In sections 5.4 through 5.10, I discuss Sonya's acquisition path for each of the different types of

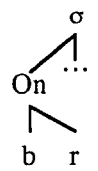
branching onsets and s+C clusters in the corpus. Finally, I provide a discussion of each of the different types of clusters in relation to each other in section 5.11.

5.2 The Structure of Branching Onsets and s+C Clusters

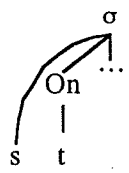
There are two main theoretical assumptions adopted for this portion of the thesis. The first is that branching onsets are defined as obstruent-initial, maximally binary and left-headed clusters (e.g. Kaye, Lowenstamm and Vergnaud 1990). This structure is illustrated in (5.1a) below. As opposed to these, s+C clusters are syllabified as an appendix followed by a singleton onset (e.g. Levin 1985) as illustrated in (5.1b). Following Goad and Rose (2004), I assume that this classification of /s/-initial clusters as appendix initial holds, even for the /s/-initial clusters that rise in sonority, (i.e. that have a sonority profile similar to that of branching onsets).

(5.1) Structure of a Branching Onset and an s+C cluster

a. Branching onset



b. s+C cluster



In English, branching onsets must obey the minimal distance constraint of at least two. This means that the consonants that make up a branching onset must be two sonority

levels apart. The sonority scale assumed is defined in (5.2), from lowest to highest levels of sonority.

(5.2) Sonority Scale (Clements 1990)

Obstruent > Nasal > Liquid > Glide > Vowel

From this scale, we can infer that a sequence formed by an Obstruent+Nasal (i.e. *pn) cannot form a branching onset in English because there is only one degree of sonority distance between these two types of consonants. However, an Obstruent+Rhotic cluster, as in example (5.1a) above, can form a branching onset in English since they meet the minimal sonority distance requirement.

While the s+Lateral and s+Glide clusters could potentially be considered as branching onsets with respect to rising sonority only, I am analyzing them as s+C clusters following Goad and Rose's (2004) hypothesis. This thesis will provide a test case for this hypothesis. Indeed, if the s+L and s+N clusters were to pattern similar to other s+C clusters, the results would support Goad and Rose. As opposed to this, if these clusters were to pattern similar to other branching onsets, the results would undermine their analysis as s+appendix clusters. As we will see, my findings, in fact, support Goad and Rose in that branching onsets develop independently from all types of s+C clusters, irrespective of the sonority of the latter. Also, both target structures show different patterns during development.

A complete list of the possible branching onsets in English is provided in table (5.3) below.

(5.3) Possible Branching Onsets in English (From Goad and Rose 2004)

Branching Onset	**Possible combinations**
Obs+L	pl, bl, kl, gl, fl
Obs+R	pr, br, tr, dr, kr, gr, fr, θr, ʃr
Obs+G	tw, dw, kw, gw, pj, bj, kj

Clusters in English such as [sp] in a word like "spin" or [sn] in a word like "snow" violate the conditions regulating the sonority relations within branching onsets in English. Observations such as this as well as considerations based on distributional restrictions and constraints related to place of articulation have led researchers such as Levin (1985) to posit that the [s] is syllabified as an appendix to the syllable node, rather than a constituent of the onset node. As mentioned in section 5.1.1 above, I assume that all /s/-initial clusters are syllabified as appendix-initial, regardless of the sonority pattern. A complete list of all /s/-initial clusters for English is provided in (5.4) below.

(5.4) Possible /s/-initial Clusters in English (From Goad and Rose 2004)

s+C cluster type	**Possible combinations**
s+Obs	sp, st, sk, sf
s+N	sn, sm
s+L	sl
s+G	sw

In the sections below, we will see that branching onsets and s+C clusters follow the expectations that I alluded to above in that they neither display the same developmental paths nor undergo the same types of reduction strategies at the stages when Sonya is unable to produce them in a target-like fashion. However, before discussing the data, I first introduce the main methodological aspects of the study in the next section.

5.3 Data extraction

The compilation of the two different types of onset clusters for this study involved making use of the program Phon (Rose et al. 2006) to extract every example of branching onsets and s+C clusters attempted by Sonya. In accordance with the description provided above, the branching cluster types searched for in *Phon* were Obstruent+Lateral (Obs+L), Obstruent+Rhotic (Obs+R), and Obstruent+Glide (Obs+G). The s+C cluster types that were searched for were s+Obstruent (s+Obs), s+Nasal (s+N), s+Lateral (s+L), and s+Glide (s+G).

Once the examples were extracted, they were imported into Microsoft Excel spreadsheets for compilation. The tokens were coded according to how they were realized and patterns of production were identified.[4] During the coding, eight different types of productions were identified. These production types are illustrated with the hypothetical examples of the word "blue", [bluw] in table (5.5) below.

[4] See Appendix C for the complete coding compilation.

(5.5) Coding for Branching Onsets

	Production	Code	Description
a.	[bluw]	TL	Target-like production
b.	[βluw]	C1Mod	Modification of the first target consonant
c.	[bwuw]	C2Mod	Modification of the second target consonant
d.	[fwuw]	CCMod	Modification of both target consonants
e.	[luw]	C1Del	Deletion of the first target consonant
f.	[buw]	C2Del	Deletion of the second target consonant
g.	[uw]	CCDel	Deletion of both target consonants
h.	[fij]	Other	Realization does not fall in any other category

In (5.5a), the [bl] cluster is realized as target-like. In (5.5b), the first consonant (C1), is modified in production, and realized as [β]. In (5.5c), the second consonant (C2), is modified is production and realized as [w]. (5.5d) illustrates the situation of both consonants (CC) being modified, with [bl] realized as [fw]. In (5.5e), C1 is deleted, while in (5.5f), it is C2 that is deleted. (5.5g) illustrates CC deletion, and, finally, (5.5h) illustrates those productions that fall in the "other" category, which will be used for all unclassifiable cases. For example, in (5.5h), the realized form does not resemble the target form, nor to any of the forms found in the other modification categories.

The patterns that were identified for each different cluster are used to define specific stages of phonological development. The clusters were acquired at different ages depending on the consonants involved. In the following sections, I discuss the acquisition stages for each individual cluster type.

5.4 Obstruent+Lateral Onset Clusters

In Sonya's acquisition of Obstruent+Lateral (Obs+L) onset clusters, there appear to be three distinct stages of development, each of which is characterized by distinctive patterns of production. In this section, I describe these stages from both qualitative and quantitative perspectives.

5.4.1 Stage 1: C2Del (1;04.18 - 1;09.26)

The first stage of Sonya's acquisition of Obs+L clusters is observed for approximately five and a half months, from the beginning of recordings, at Sonya's age of 1;04.18, until the age of 1;09.26. The relative proportion of each process attested during this stage is provided in (5.6) below.

(5.6) Mean Values for Obs+L clusters (1;04.18 - 1;09.26)

a. Attempted forms:	70	
b. C2Del:	50	(71%)
c. C2Mod:	7	(10%)
d. Target-like:	4	(6%)
e. CCMod:	2	(3%)
f. C1Del:	1	(1%)
g. Other:	6	(9%)

The numbers above clearly suggest that the main characteristic of this stage is the deletion of the lateral consonant (C2Del), which accounts for 71% of the data set. The second most prominent process, C2 modification, also suggests that even when the lateral is produced, it generally cannot be uttered in a target-like fashion. Indeed, target-like productions only account for 6% of the data at this stage.

Also, during the first month of this stage, Sonya's productions display no distinct pattern. There are only eight attempted productions of Obs+L onset clusters during this month, four of which are categorized in the "Other" category because they do not fall into any of the remaining categories. As seen in (5.7), which provides a listing of all of the productions attested during this first month, these examples are in fact, fairly remote from the target forms. The other four productions do not yield any clear pattern. Two display deletion of C2, and the other two show modification of C2, the first pattern being the leading one during the initial five and a half month stage.

(5.7) Obs+L Attempts (1;04.18 - 1;05.29)

Age	**Orthography**	**Realization**	**Code**
1;04.18	blue	ˈbuw	C2Del
1;05.29	blue	ˈbuw	C2Del
1;05.00	blue	əˈbwuːw	C2Mod
1;05.29	butterfly	ˈfwɑ	C2Mod
1;05.29	plate	hʊˈwɛː	Other
1;05.29	dragonfly	ˈɛ̃gmijtʰə	Other
1;05.29	dragonfly	ˈɛmɪhĩ	Other
1;05.29	airplane	ˈɛ̃fʊ	Other

As mentioned above, the leading pattern found during this stage is deletion of C2. The following table (5.8) provides representative examples of this pattern.

(5.8) C2Del in Obs+L Clusters (1;04.18 - 1;09.26)

Age	Orthography	Realization
1;06.10	blue	ˈbuw
1;06.10	plate	ˈpʰæː
1;06.10	plate	ɐ̃ˈpʰæː
1;08.22	clock	ˈkʰɑkʰ
1;09.11	glasses	ˈgæʃə
1;09.26	clothes	ˈkʰʌəd

While it is clear that the main pattern during this stage is C2 deletion, the data was re-examined to determine whether this pattern is prosodically determined. However, the distribution of the available examples does not enable us to verify this possibility. First, most of the examples (55 out of 70) come from a unique context, that of word-initial, primary stressed syllables. Second, the only other context available at this stage is the word-medial, secondary stressed syllables, in which 15 clusters were attempted but do not display any observable positional effects. Of these cases, one underwent C2 modification, four fell into the "other" category, while the remaining 10 underwent C2 deletion. It should also be noted that all of these patterns emerge from only three words: "dragonfly", "butterfly", and "airplane". Finally, while there is C2 deletion in 67% of the word-medial examples as opposed to 71% in the word-initial position, this difference cannot be taken as significant enough to deserve further attention.

5.4.2 Stage 2: Inter-stage (1;10.10 - 1;1.08)

The second stage in Sonya's acquisition of Obstruent+Lateral clusters occurs between the ages of 1;10.10 and 1;11.08, and can be categorized as a one-month inter-

stage during which Sonya begins to realize two consonants in a cluster. While Sonya does not systematically realize two consonants during this inter-stage, she does realize them 46% of the time, in addition to two target-like forms, and 11 forms with modification of C2. During this stage, the most common patterns for Sonya are to delete or to modify C2. The quantitative data for this stage is provided in (5.9) below.

(5.9) Mean Values for Obs+L Clusters (1;10.10 - 1;11.08)

a. Attempted forms:	28	
b. C2Del:	13	(46%)
c. C2Mod:	11	(39%)
d. Target-like:	2	(7%)
e. CCDel:	1	(4%)
f. Other:	1	(4%)

We can see from the above chart that Sonya is at an inter-stage. There is only a difference of two occurrences where Sonya deletes C2 instead of modifying it. The following chart (5.10) provides representative examples of the productions during this stage.

(5.10) Obs+L Attempts (1;10.10 - 1;11.08)

Age	Orthography	Realization	Code
1;10.10	plate	ˈpʰejtˀ	C2Del
1;10.24	airplane	ˈʔɛˌpʰɛ̃j	C2Del
1;11.08	blue	ˈbuw	C2Del
1;10.10	black	m̩ˈbwækʰ	C2Mod
1;10.24	plate	ˈpʰwejt	C2Mod
1;11.08	blue	ˈbwuw	C2Mod
1;11.08	flowers	ˈawʌs	CCDel
1;10.10	black one	ˈblækʰwʌ̃n	TL
1;10.24	uh, blow	ʌ̃ˈfuw	Other

Similar to the limitation encountered at Stage 1, potential effects of prosodic position could not be verified at this stage, due to a lack of relevant data. Indeed, Sonya is still only attempting Obs+L onsets in word-initial primary stressed and word-medial secondary stressed positions. Obs+L clusters undergo C2 deletion and C2 modification in both positions. The few examples that depart from these most prominent patterns (deletions of the entire cluster, target-like productions or other unclassifiable patterns) also occur regardless of position.

5.4.3 Stage 3: CC Production (1;11.27 - 2;06.02)

The final stage in Sonya's acquisition of Obs+L onset clusters emerges at the age of 1;11.27 and extends until the end of the data recording period at 2;06.02. This stage is a natural extension of the inter-stage described in the previous section and is characterized by a general mastery of the cluster. Indeed, starting at 1;11.27, Sonya has

acquired the Obs+L cluster, however only from the perspective of syllable structure. Indeed, while she generally produces both consonants of the target cluster, thereby forming a branching structure in onset, she continues to modify the liquid in most cases. This modification is attested in 54% of the clusters during this stage. Table (5.11) below provides a summary of the patterns found during this stage.

(5.11) Mean Values for Obs+L Clusters (1;11.27 - 2;06.02)

a. Attempted forms:	107	
b. C2Mod:	57	(53%)
c. Target-like:	24	(22%)
d. C2Del:	10	(9%)
e. C1Del:	4	(4%)
f. CCMod:	4	(4%)
g. C1Mod:	1	(1%)
h. Other:	7	(6%)

The above chart illustrates how Sonya is realizing her Obstruent+Lateral clusters. During this stage, she produces both consonants of the target cluster in 81% of the forms attempted. Although she continues to modify C2, and, in some instances, C1 or CC, she rarely deletes one of the consonants. This marginal pattern only represents 13% of the data. Table (5.12) below provides representative examples of Sonya's productions during this stage.

(5.12) Obs+L Attempts (1;11.27 - 2;06.02)

Age	Orthography	Realization	Code
2;04.29	claws	ˈwɑz	C1Del
2;03.17	flashing	ˈplæʃij	C1Mod
2;02.03	blue	ˌbuw	C2Del
1;11.27	plates	ˌpwejts	C2Mod
2;02.22	glasses	ˈkwæθɪz	CCMod
2;00.04	cleaning	ˌɬijə	Other
2;03.03	black	ˈblækʰ	TL

In the first example above, is of deletion of the first consonant, as Sonya deletes the initial [k] of "claws" The second example, "flashing" undergoes modification of the first consonant, as [f] is realized as [p]. The third example is of C2 deletion: Sonya deletes the target [l] from her production. The fourth example is of C2 modification as Sonya modifies the [l] in "plates" to [w]. The next example, "glasses", undergoes modification of both consonants of the cluster: [gl] is realized as [kw]. The example of "cleaning", falls in the "other" category as Sonya seemingly fuses both the [kl] together and produces [ɬ] in its place. The final example, "black" is realized as target-like. Sonya does begin to produce target-like segments during this stage, at a rate of 21%. These examples, precursors of the following stage, are not grouped near the beginning or end of the stage; they are scattered throughout the time period.

Finally, as noted for previous stages, there do not appear to be positional effects during Stage 3. Sonya attempts Obstruent+Lateral clusters in word-initial primary stressed, word-medial secondary stressed, and word-medial unstressed (WM-U)

positions. However there is no distinctive pattern of production according to position could be detected.

In the next section. I provide a compilation of the data on the acquisition of Obstruent+Rhotic (Obs+R) onset clusters. Overall, the acquisition path for this type of cluster is very similar to the acquisition of the Obstruent+Lateral cluster discussed above.

5.5 Obstruent+Rhotic Onset Clusters

Similar to the above, Sonya's acquisition path for Obstruent+Rhotic takes place during three stages, in the same order, and at ages similar to the ones observed for the acquisition of Obstruent+Lateral clusters. In addition, each of these stages is characterized by patterns of production similar to the ones seen with the Obstruent+Lateral clusters. Following the same method as the section above, I describe the stages of Obstruent+Rhotic acquisition from both qualitative and quantitative perspectives.

5.5.1 Stage 1: C2Del (1;04.18 - 1;09.26)

The first stage in Sonya's acquisition of Obstruent+Rhotic clusters is attested for approximately five and a half months, which is the same amount of time as Stage 1 of Obstruent+Lateral cluster acquisition. This occurs between Sonya's age of 1;04.18 until 1;09.26. This stage, like Stage 1 in the acquisition of Obstruent+Lateral clusters, is mainly characterized by a large amount of second consonant deletion (C2Del). The relative proportion of each process attested at this stage is provided in (5.13) below.

(5.13) Mean Values for Obs+R Clusters (1;04.18 - 1;09.26)

a. Attempted forms:	68	
b. C2Del:	49	(72%)
c. C2Mod:	3	(4%)
d. Target-like:	3	(4%)
e. CCMod:	2	(3%)
f. C1Mod:	1	(1%)
g. Other:	10	(15%)

The values listed above indicate that the acquisition path for Obstruent+Rhotic onset clusters is very similar to that of Obstruent+Lateral onsets. The main characteristic of this stage is indeed the deletion of the rhotic consonant, which accounts for 72% of the data. Table (5.14) below provides representative examples of the main process found during this stage.

(5.14) C2Del in Obs+R Clusters (1;04.18 - 1;09.26)

Age	**Orthography**	**Adult IPA**	**Realization**
1;06.10	brown	ˈbɹawn	ˈbɑkˀ
1;08.06	tree	ˈtɹij	ˈkʰij
1;08.22	green	ˈgɹijn	ˈgẽjn
1;09.11	crocodile	ˈkɹɑkədajəɬ	ˈkʰɑkʰəˌdajvə
1;09.26	brush	ˈbɹʌʃ	ˈbas

Unlike the acquisition of Obstruent+Lateral clusters, the second most prominent category noted is, unexpectedly, "Other". There are 10 unclassifiable examples during this first stage. These examples are listed in table (5.15) below.

(5.15) Obs+R Attempts in the "Other" Category (1;04.18 - 1;09.11)

Age	Orthography	Target	Realization
1;04.18	Gabriella	ˈgæbɹijˌɛɬa	ˈʃɛzɬæ
1;04.18	Gabriella	ˈgæbɹijˌɛɬa	ˈhɛðæ
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈɛ̃gmijtʰə
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈɛmɪhĩ
1;07.27	tractor(?)	ˈtɹæktəɹ	ə̃nnʊəˈkʰijm
1;07.27	gran	ˈgɹæn	ˈʔõnɑ
1;08.06	tree	ˈtɹij	ˈʃijʔ
1;08.11	truck	ˈtɹʌk	ˈʃɑʔ
1;09.11	fridge	ˈfɹɪd͡ʒ	ˈpʰr̃ɪmpʰ
1;09.11	drive	ˌdɹajv	ˌdəʁajf

As we can see from this chart, the first two words "Gabriella" and "dragonfly" fall into this category because the redundant syllables of the forms attempted have been truncated. The form "tractor" is not realized close to the target form. However, as indicated by the question mark next to the orthographic form, it is possible that "tractor" is not actuality the target form in this case. The other two forms containing a [tr] cluster seem to be realized as a merger between both consonants, resulting in the consonant [ʃ]. In the final example, Sonya does produce both consonants, however, she epenthesizes [ə] between the two consonants.

If we look past the relatively large number of forms from the "Other" category, we find the next most prominent type of production to be that characterized by C2 modification, as it was in Stage 1 of Obstruent+Lateral acquisition. Just as the attempted laterals in Stage 1 cannot be realized as target-like, neither can the rhotics during this stage. Also, as in Stage 1 of Obstruent+Lateral acquisition, Sonya produced target-like

productions of the cluster without modification of any consonant in 6% of the data at this stage.

While the main pattern during this stage is C2 deletion, which occurs 72% of the time, the data was re-examined to determine whether this pattern is prosodically-determined. Unfortunately, similar to the distribution of Obstruent+Lateral clusters, the distribution of the available Obstruent+Rhotic examples do not enable us to investigate this possibility. The main reason for this is that the majority of examples (65/69) occur in word-initial, primary stressed syllables, and undergo a variety of processes. The remaining four examples occur word-medially, in secondary stressed positions, and do not display any noticeable positional effects. Of these 4 examples, two undergo the main process of C2 deletion, while the other two fall into the "other" category.

5.5.2 Stage 2: Inter-stage (1;10.10 - 1;11.27)

The second stage in Sonya's acquisition of Obstruent+Rhotic clusters, is, again, very much comparable to Stage 2 in the acquisition of Obstruent+Lateral clusters. Sonya appears to be using a variety of strategies to utter the target cluster. While she continues to delete C2 in many of the occurrences, she exhibits other processes such as C2 modification and CC modification during this stage as well. This stage is labeled as an "inter-stage" as Sonya is beginning to prosodify the cluster correctly and to produce two consonants, even if she is not systematic in doing this. The relative prominence of each process during this stage is provided in table (5.16) below.

(5.16) Mean Values for Obs+R Clusters (1;10.10 - 1;11.27)

a. Attempted forms:	28	
b. C2Del:	12	(43%)
c. C2Mod:	11	(39%)
d. CCMod:	3	(11%)
e. CCDel:	1	(4%)
f. Other:	1	(4%)

It is clear from the above data that Sonya is at an inter-stage. Her productions undergo C2 deletion or C2 modification in near-equal proportions. While Sonya deletes one or both cluster consonants in 13 occurrences (47%), she also produces two consonants, even in modified forms, in 14 occurrences (50%). There are however, no occurrences during this stage, of Sonya producing a fully target-like cluster. Table (5.17) below provides representative examples of Sonya's productions during this stage.

(5.17) Obs+R Attempts (1;04.18 - 1;09.26)

Age	Orthography	Target	Realization	Code
1;11.27	ground	ˈgɹawnd	ˌgawn	C2Del
1;11.08	bruise	ˈbɹuwz	ˈbwuwd	C2Mod
1;10.10	grapes	ˈgɹejps	ˈɛgstʰ	CCDel
1;10.10	three	ˈθɹij	ˌfwij	CCMod
1;10.10	truck	ˈtɹʌk	tʰəˈɹʌkʰ	Other

The first example above, illustrates C2 deletion as Sonya produces deletes the [r] in "ground". In the second example, "bruise", Sonya realizes the cluster with C2 modification by producing the [r] of [br] as [w]. In the next example, "grapes", Sonya omits both consonants in the word-initial onset. The fourth example, Sonya produces two consonants in the cluster, even if she modifies both of them, producing [fw] for [θr]. The

final example is in the "other" category; Sonya realizes both consonants of the cluster correctly, however, she epenthesizes [ə] in the cluster.

Similar to the previous stages discussed for both Obstruent+Lateral and Obstruent+Rhotic clusters, the potential effect of prosodic position on cluster realization could not be investigated here either. Again, the majority of the examples (26 in 29) come from word-initial, primary stressed positions. While the final three examples come from word-medial, unstressed environments, all of which underwent C2 deletion, there is not enough data to fully investigate or make any conclusions about possible positional effects during this stage.

5.5.3 Stage 3: CC Production (2;00.04 - 2;06.02)

The third and final stage in Sonya's acquisition of Obstruent+Rhotic clusters begins at the age of 2;00.04 and lasts until the end of recording at 2;06.02. During this time, Sonya makes a leap from C2 deletion to primarily C2 modification or target-like productions. While she still has not perfectly mastered the Obstruent+Rhotic cluster, she definitely appears to have acquired the branching onset structure. Table (5.18) below provides the relative proportions of production during this stage.

(5.18) Mean Values for Obs+R Clusters (2;00.04 - 2;06.02)

a. Attempted forms:	146	
b. C2Mod:	69	(47%)
c. Target-like:	32	(22%)
d. C2Del:	19	(13%)
e. CCMod:	12	(8%)
f. C1Del:	7	(5%)
g. C1Mod:	4	(3%)
h. Other:	3	(2%)

The most prominent process observed at this stage is C2 modification. However, an analysis of the other types of processes reveals that Sonya produces two consonants together in a cluster quite regularly. To combine all examples where two consonants are produced in a cluster, with C2 modification, target-like productions, CC modification, and C1 modification, the total number of occurrences with CC production is 117 (80%). This value indicates that even though she still makes mistakes in production, the overall pattern is prosodically accurate in that a cluster is being produced. Target-like clusters occur at a rate of 22%, and are spread out fairly evenly over the time period covered by this stage. These values are quite similar to those found in Stage 3 of Obstruent+Lateral acquisition, as seen in (5.11) above. Representative examples of production during this stage are provided in (5.19) below.

(5.19) Obs+R Attempts (2;00.04 - 2;06.02)

Age	Orthography	Target	Realization	Code
2;02.22	gran	ˈgɹæn	ˈgwæ̃ːn	C2Mod
2;03.03	dry	ˈdɹaj	ˈdɹaj	TL
2;00.04	cream	ˈkɹijm	k^{h}ij	C2Del
2;05.12	green	ˈgɹijn	ˌkwijp	CCMod
2;03.17	frogs	ˈfɹɑgz	ˈwɑ	C1Del
2;03.27	try	ˈtɹaj	ˈfɹaj	C1Mod
2;02.03	trucks	ˈtɹʌks	ˈt^{h}ə̆ɹʌks	Other

In the first example, the word "gran", is produced with C2 modification as Sonya modifies the [r] in the [gr] cluster to a [w]. The second example, the word "dry", is produced in a target-like fashion, while in the third example, Sonya produces the word "cream" with C2 deletion as she deletes the [r] from the [kr] cluster. The fourth example is of CC modification in the word "green" as Sonya replaces both consonants in the cluster [gr] with [kw]. The next example of the word "frogs" is produced with C1 deletion. The word "try" undergoes C1 modification, and the final form of the word "trucks", falls in the "other" category as Sonya epenthesizes a [ə] between the [tr] cluster.

Finally, as discussed for the previous stages, there do not appear to be any positional effects during this stage. Sonya produces 124 examples of Obstruent+Rhotic clusters in word-initial, primary stressed position. However, she produces only one form in word-medial, primary stressed position as well as one form in word-medial, secondary stressed position. There are also 16 examples of Obstruent+Lateral cluster production in word-medial, unstressed positions, however, no positional patterns could be determined from these examples.

In the next section, I discuss the acquisition path for Obstruent+Glide onset clusters. As we will see, however, there were very little data from the production of these types of clusters. It is therefore difficult to determine the course of development in some of the cases.

5.6 Obstruent+Glide Onset Clusters

The cluster investigated in this section is Obstruent+Glide, such as the one in " "queen" [kwiːn]. Unlike the stages uncovered in the previous sections, however, no stages could be identified for this cluster type, as there were only nine examples of attempted production. The following table (5.20) provides a complete list of all of the occurrences of this type of onset cluster.

(5.20) Obs+G Attempts (1;11.27 - 2;06.02)

Age	Orthography	Target	Realization	Code
1;11.27	penguin	ˈpɛŋgwɪn	ˈpʰɛ̃ŋˌwʌ̃n	C1Del
2;02.03	penguin	ˈpɛŋgwɪn	ˈpʰɛ̃ŋwɪ̃n	C1Del
2;02.22	penguins	ˈpɛŋgwɪnz	ˈpʰɛ̃ŋwɪ̃nz	C1Del
2;03.03	penguin	ˈpɛŋgwɪn	ˈpʰɛ̃ŋwɪ̃n	C1Del
1;09.11	vacuum	ˈvækjuwm	ˈbækʰɪ̃nʌ̃	C2Del
1;09.11	cucumber	ˈkjuwkʌmbəɹ	ˈkʰʌ̃mabɑː	C2Del
1;08.22	vacuum	ˈvækjuwm	ˈvækjuw	TL
2;00.04	so cute	sowˈkjuwt	səʔsʊˈkʰjɨowtʰ	TL
2;06.02	square	ˈskwɛɹ	ˌkwɛ	TL

At first glance, it may appear that Sonya has not acquired the Obstruent+Glide cluster, and that the main process throughout production is C1 deletion. This is however not the case. By looking at all four occurrences of C1 deletion, we can see that they all occur in the word "penguin". This is most likely a special case that arises from the nasal+consonant sequence in which the nasal shares the place of articulation of the (deleted) consonant. An additional piece of evidence that supports this claim is that Sonya does not delete C1 in any other attempted form. For the remaining five examples, Sonya does display some degree of accuracy. She produces the Obstruent+Glide cluster as target-like in three words "vacuum", "cute" and "square". There are two examples of C2 deletion that occur very early, at the age of 1;09.11, in the production of the word "vacuum" as [ˈbækʰ̃ɪnʌ̃] and "cucumber" as [ˈkʰʌ̃mabɑ:]. Notice that in both cases, the deleted glide is [j]. Davis and Hammond (1995) argue that Obstruent+Glide clusters in English involve different structures depending on the glide involved. They claim that an obstruent+[w] cluster forms a branching onset, while an obstruent+[j] sequence is syllabified as a singleton onset followed by an on-glide in the nucleus. Given these considerations, and given that I do not have sufficient data to make firmer observations, I cannot draw any conclusions about the acquisition of Obstruent+Glide clusters or the absence thereof.

Similar to above, the potential effects of position on acquisition patterns were not attested, as the data was very limited. The majority of utterances (6 in 9) contained Obstruent+Glide clusters in word-medial, unstressed position, while the remaining three

examples were in word-initial, primary stressed position. None of these positions display any particular effects.

While there cannot be any conclusions drawn about the acquisition of Obstruent+Glide branching onsets, there is certainly a clear path for both Obstruent+Lateral and Obstruent+Rhotic. Both of these types of branching onsets were acquired in three stages at approximately the same age. Stage 2, the inter-stage showing partial evidence of mastery, started at the same age for both cluster types at 1;10.10. Also, the mastery stage for Obstruent+Rhotic clusters was attained just two weeks (2;00.04) after the Obstruent+Lateral cluster (1;11.27). Given potential effects related to data sampling and data density, it is plausible that both types of branching onsets were indeed acquired simultaneously. Coming back to the Obstruents+Glide clusters, the meager evidence available does not allow us to confirm or undermine the possibility that this cluster type was acquired at the same time as the other branching onsets.

Now that each of the branching onsets has been discussed, I move on to an analysis of the acquisition path of s+C onset clusters. An investigation of possible positional effects was not possible with these cluster types for two main reasons. First of all, the majority of data are of s+C clusters in word-initial position. In fact, there are only nine instances of s+C clusters in word-medial position, a situation which does not enable any conclusive analysis. Second, word-medial clusters should not be considered in any event, because they do not involve the appendix+onset structure required in the syllabification of word-initial s+C clusters. The analysis of word-initial s+C clusters remains relevant, however, in order to provide a comparison with the acquisition of

branching onsets from the perspective of the development of word-initial syllable structure. In the next section, I begin my discussion of these clusters with s+Obstruent clusters.

5.7 s+Obstruent Onset Clusters

In this section, I discuss the acquisition path for s+Obstruent clusters. As we will see, Sonya has not acquired this type of clusters during the time span covered by the recording. As with the other onset clusters, I attempted to find stages in Sonya's development of s+Obstruent clusters. However, there were no identifiable stages in the data; as Sonya continuously and regularly deletes C1, [s], from the production of such clusters, across the entire corpus. There were exceptional instances where Sonya made use of other processes such as C1 modification, and even some target-like productions. These realizations were however very scarce and displayed no systematicity. The following table (5.21) provides the relative proportions of each process throughout the entire corpus.

(5.21) Mean Values for s+Obstruent Clusters (1;04.18 - 2;06.02)

a. Attempted forms:	67	
b. C1Del:	59	(88%)
c. Target-like:	1	(1.5%)
d. C2Mod:	1	(1.5%)
e. Other:	6	(9%)

These values indeed indicate that Sonya has not acquired the s+Obstruent onset cluster, which is true even towards the end of the recording sessions. She deletes the [s] regularly

throughout recording at a rate of 88%. The second leading data category is, in fact, the "other" category, which accounts for 9% of the productions. There is only one occurrence (1.5%) that is target-like, and a single example (1.5%) of C2 modification. Table (5.22) below provides representative examples from the data.

(5.22) s+Obstruent Attempts (1;04.18 - 2;06.02)

Age	Orthography	Target	Realization	Code
1;05.29	spoon	ˈspuwn	ˈpʰũːw	C1Del
1;11.08	spoon	ˈspuwn	smuw	C2Mod
2;03.03	stubbed	ˈstʌbd	ˈstʰʌbˀ	TL
1;04.18	Steve	ˈstijv	ˈt͡ʃiːj	Other

The majority of the cases above occur near the beginning of recording, and include situations when Sonya would delete the entire syllable containing the cluster, or sometimes merge the target sounds into one. The following table (5.23) provides a complete list of the occurrences in the "other" category.

(5.23) s+Obstruent Attempts in the "Other" Category (1;04.18 - 2;05.12)

Age	Orthography	Target	Realization
1;04.18	uh, Steve	ʌˈstijv	ʌəˈt͡ʃiːj
1;05.29	stroller	ˈstɹowləɹ	ˈhɜtʰʌ
1;05.29	stroller	ˈstɹowləɹ	əˈd͡ʒɛphũ
2;02.03	stroller	ˈstɹowləɹ	t͡ʃɹʌlɑ
2;03.17	standing	ˌstændɪŋ	ˈðæ̃wij
2;05.12	store	ˈstɔɹ	ˌθɔwa

As we can see from the above table, the majority of clusters falling into this category involve [st]. For five of the utterances, Sonya merges the [s] and [t] in some way to produce one sound. We see that in the first word, "Steve", she produces a [t͡ʃ], as she does for the third example of "stroller" at 2;02.03. She also produces the [st] of "stroller" as [d͡ʒ] at 1;05.29, showing some degree of (unsystematic) variability in the voicing of her affricated outputs. In the final two forms, "standing" and "store", she produces an inter-dental fricative, either [ð] or [θ] for the cluster. For the example of "stroller" at 1;05.29, Sonya produces an [h] word-initially. However, as this cluster involves three consonants, which combines the complexity of an s+C cluster with that of a branching onset. This may have had an effect on Sonya's performance in her production of this cluster.

In the next section, I discuss the acquisition path for s+Nasal onset clusters. Unlike the acquisition of s+Obstruent clusters, Sonya does display acquisition of this type of cluster.

5.8 s+Nasal Onset Clusters

There are a limited amount of attempts at forms containing s+Nasal onset clusters. However, out of the 11 occurrences found, patterns of acquisition were noticeable. The first of these is characterized by Sonya's deletion of the [s] whereas, in the second, Sonya shows mastery of the structure, despite some distortion in the production of the consonants. I discuss each stage in turn in the next subsections.

5.8.1 Stage 1: ClDel (1;08.22 - 1;09.11)

From the beginning of recordings until age 1;09.11, Sonya only attempts two forms with an s+Nasal onset cluster. In both of these attempts, she deletes the first consonant ([s]). While two occurrences may not seem sufficient to un-controversially identify a stage, note as well that both examples display the same process and that there are no occurrences after 1;09.11 where Sonya deletes C1 again. In table (5.24) below, I provide both examples from this stage

(5.24) s+Nasal Attempts (1;08.22 - 1;09.11)

Age	Orthography	Target	Realization	Code
1;08.22	snow	ˈsnow	ˈnow	C1Del
1;09.11	snail	ˈsnejɫ	ˈmij	C1Del

In the first example of "snow", Sonya simply deletes the [s]. In the second example, "snail", Sonya continues to delete the [s] (and realizes the [n] as [m] for no clear reason).

5.8.2 Stage 2: CC Acquired (2;00.04 - 2;05.25)

During the second stage, nine attempts at an s+Nasal obstruent cluster are attested in the data. In all nine attempts, Sonya successfully produces two consonants together in a cluster. While she produces target-like clusters in five attempts (56%), she modifies C1 in the other four attempts (44%). In three of the latter cases, the /s/ is still produced as a coronal fricative. Thus, even though Sonya can only produce s+Nasal clusters in a target-

like fashion in 56% of her attempts, she accurately produces the CC cluster in 100% of the attempts. I provide each occurrence in table (5.25) below.

(5.25) s+Nasal Attempts (2;00.04 - 2;05.25)

Age	Orthography	Target	Realization	Code
2;00.04	smoke	'smowk	'θmowk^{h}	C1Mod
2;03.17	snowy	'snowij	'hnowij	C1Mod
2;05.25	snake	'snejk	'θnej	C1Mod
2;05.25	small	'smɑɫ	'θmɑ	C1Mod
2;02.03	smaller	'smɑləɹ	'smajɐ̃	TL
2;03.03	small	'smɑɫ	ˌsmɑɫ	TL
2;03.03	snow	'snow	'snowə	TL
2;03.17	snowy	'snowij	'snowĩŋ	TL
2;05.12	small	'smɑɫ	'smɑɫ	TL

In the next section, I provide an analysis of the s+Lateral onset cluster. As we will see, Sonya appears to have acquired this type of cluster sooner than she acquired the s+Nasal onset cluster, and earlier than any other cluster type discussed thus far.

5.9 s+Lateral Onset Clusters

There is only one stage of development evident in Sonya's acquisition of the s+Lateral onset cluster. From the beginning of attempted s+Lateral clusters at 1;08.11, Sonya produces target-like clusters in the majority (68%) of attempts. The following table (5.26) provides the relative proportions of production.

(5.26) Mean Values for s+Lateral Clusters (1;08.11 - 2;06.02)

a. Attempted forms:	15	
b. Target-like:	12	(68%)
c. CCMod:	1	(5%)
d. C1Mod:	1	(5%)
e. C1Del:	1	(5%)
f. C2Del:	1	(5%)
g. Other:	3	(14%)

While Sonya correctly produces the s+Lateral onset cluster as target-like in 68% of the utterances, she actually produces two consonants in a cluster for 77% of the cases. This value combines each of the occurrences that are target-like or undergo CC or C1 modification. While the largest category of data is of the "other" category, we can see by looking at these particular utterances that they are more target-like than they initially appear. First, consider the three examples in table (5.27) that I classified in the "other" category.

(5.27) s+Lateral Attempts in the "Other" Category (1;09.11 - 2;03.03)

Age	Orthography	Target	Realization
1;09.11	slide	ˌslajd	ˌɬajtʰ
2;00.04	sleepy	ˈslijpij	ˈɬijpʰij
2;03.03	slide	ˌslajd	t͡saj

As we can see from these examples, in each of these three productions, Sonya produces outputs that are highly characteristic of a fusion process, merging the two target sounds together into a single one. In the first two examples, she produces a consonant which keeps the fricative manner of [s] and the laterality of the [l]; whereas, in the last example,

she produces an affricate which could easily be interpreted as a version of the same sound which underwent a higher degree of closure in the vocal tract. Sonya produces these same words as target-like throughout the remainder of the data. Table (5.28) below provides representative data of s+Lateral attempts.

(5.28) s + Lateral Attempts (1;08.11 - 2;06.02)

Age	Orthography	Target	Realization	Code
1;08.22	slide	ˈslajd	ˈslajtʰ	TL
2;03.27	sleep	ˈslijp	slijpˀ	TL
2;02.22	slide	ˈslajd	ˈlaːjtʰ	C1Del
1;08.11	slide	ˈslajd	ˈθlaj	C1Mod
2;03.17	sleep	ˈslijp	ˈzejpʰ	C2Del
2;06.02	slide	ˈslajd	ˈfwajd	CCMod

In the first examples of "slide" and "sleep" are produced as target-like. In the third example, "slide", Sonya deletes C1, and in the fourth example, she modifies C1 by producing a [θ] instead of [s]. In the fifth example, "sleep", Sonya deletes C2, and the final example undergoes CC modification, as the [sl] cluster is realized as [fw].

In the next section, I outline the acquisition path for s+Glide onset clusters. As with the acquisition of s+Lateral clusters, the evidence suggests that Sonya has acquired the structure required to syllabify this cluster type fairly early.

5.10 s+Glide Onset Clusters

Similar to s+Lateral onset clusters, Sonya acquires the s+Glide cluster at an early stage. There is only one stage of development visible from the recorded data, during which Sonya has apparently already acquired the cluster. Unlike the acquisition of s+Lateral clusters, the majority (63%) of production for s+Glide clusters undergo C1 modification, while only 17% were target-like. Table (5.29) below provides the relative proportions of each pattern affecting s+Glide onset clusters.

(5.29) Mean Values for s+Glide Clusters (1;08.06 - 2;06.02)

a. Attempted forms:	30	
b. C1Mod:	19	(63%)
c. Target-like:	5	(17%)
d. C1Del:	5	(17%)
e. Other:	1	(3%)

From the above breakdown, we can see that the combined average for CC production is 80%. This value certainly indicates that while Sonya does not accurately pronounce the cluster, she has acquired the structure required for its production.

Concerning the cases of C1 modification, a significant pattern emerges from the examples. In all but one occurrence where C1 is modified, this consonant is realized as a labial consonant. The specific consonant varies between [p, f, ɸ], but regardless, it remains labial. The single example where this did not occur was the first production of [sw] at 1;08.06, where the [sw] was realized as [hw]. Sonya appears to have difficulties producing the [s] when followed by the labial glide [w]; therefore, she modifies the [s] as

a labial consonant for ease of articulation. Table (5.30) below provides representative examples of production.

(5.30) s + Glide Attempts (1;08.06 - 2;06.02)

Age	Orthography	Target	Realization	Code
1;08.06	swing	ˈswɪŋ	ˈpwijn	C1Mod
1;08.22	swing	ˈswɪŋ	ˈɸwĩŋ	C1Mod
2;05.25	sweepy	ˈswijpij	ˈfwɪðbij	C1Mod
2;06.02	swing	ˈswɪŋ	əˈfwĩŋ	C1Mod
1;08.11	swing	ˈswɪŋ	ˈʍĩŋ	C1Del
1;11.08	swim	ˈswɪm	ˌswẽm	TL
2;00.04	swimming	ˈswɪmɪŋ	ˌswĩmĩŋ	TL

In the first example above, the [s] is realized as the labial [p] through C1 modification. The second example is again of C1 modification in "swing". In the third example, C1 is modified from [s] to the labial [f], and again C1 modification occurs in the fourth example. The next example of "swing" illustrates the only instance of C1 deletion, while in the final two examples of "swim" and "swimming", Sonya produces the [sw] as target-like. While the examples illustrated above may suggest that she has not acquired the cluster, the main point here is that she seems to have acquired it from the perspective of syllable structure, even though she shows variable realizations of C1, which undergoes labial assimilation in a majority of the cases

There appears to be a unique acquisition path relevant to s+C clusters, that is not attested to in branching onsets. For s+C clusters, the larger the sonority distance is

between the [s] and the following consonant, the earlier the cluster is acquired. As we saw in the data above, the first s+C cluster type to be acquired was the s+Glide cluster, which had the furthest distance in sonority. The next s+C cluster acquired was the s+Lateral with a sonority distance of two, which was acquired at age 1;08.11. Next, the cluster s+Nasal, with a sonority distance of one, was acquired a little later at 2;00.04. Finally, the cluster s+Obstruent, having a sonority distance of zero, was never acquired during the time of this corpus which ended at 2;06.02.

The data indicate that acquisition takes place at around age 1;08.06 for s+Glide and s+Liquid occurs, but never for s+Obstruent clusters, during the period covered by the corpus. This raises the question as to whether the s+Glide and s+Liquid clusters are analyzed by the child as s+C clusters or as branching onsets. In order to address this question, I conducted a comparison between these clusters and other Fricative+C clusters. Since there were no Fricative+Glide clusters in the child's vocabulary, I focused on a comparison of Fricative+Liquid and s+Liquid clusters.[5] As we will see, the Fricative+Liquid cluster behaves quite differently from the s+Liquid cluster, indicating that the two are indeed different cluster types.

In order to compare these cluster types, a list of the Fricative+Liquid clusters attempted by the child was compiled using Microsoft Excel spreadsheets, and sorted according to Fricative+[r] and Fricative+[l]. The coding system of acquisition was the same as that for the other branching onsets and s+C clusters seen in table 5.5. With regards to the acquisition of the Fricative+[r], there was some variation to the acquisition

[5] A direct comparison with s+[r] clusters was not possible here as this type of cluster does not exist in English.

patterns. First of all, Sonya regularly produced target [θ] as [f], a substitution often observed in first language acquisition, which presumably arises because of perceptual factors (e.g. Levitt et al. 1987). Given this, I ignored this substitution in my compilations of the clusters. These Fricative+[r] clusters are realized primarily with C2 modification to [w], which occurs in 51% (25/49) of the productions. Target-like forms emerged at 2;02.03, and occurred in 14% (7/49) of attempted forms. There were also instances of C2 deletion, C1 deletion and CC modification. Table (5.31) below, provides representative examples of production.

(5.31) Fricative+[r] Attempts (1;08.11 - 2;02.03)

Age	**Orthography**	**Target**	**Realization**	**Code**
1;08.11	throw	ˈθɹow	ʃow	C2Del
1;09.11	fridge	ˈfɹɪd͡ʒ	ˈpʰ̃ɪmp	Other
1;11.08	frogs	ˈfɹɑgz	ˈfwɑ	C2Mod
2;02.03	French	ˈfɹɛnt͡ʃ	ˈfɹɛ̃n	TL

With the exception of target-like productions, which first occurs at 2;02.03, all patterns above were concurrent throughout the corpus. In the first example, "throw", C2 [r] is deleted in the realization. The example of "fridge" falls in the "other" category as it does no resemble the target form. The next example, "frogs" is categorized as C2 modification as the [r] is realized as [w]. The Fricative+[r] cluster in "French" is realized as target-like. A comparison of Fricative+[l] and s+[l] clusters was conducted as well, and the results of this comparison reveal a difference in the structure of the two cluster types.

The data on the Fricative+[l] clusters, namely [fl], show a pattern of C2 deletion at a rate of 50% (8/16) of production. There are no occurrences of a target-like production of the cluster in the corpus, and few occurrences of other realizations such as C2 modification (3/16), productions in the "other" category (4/16), and CC deletion (1/16). Table (5.32) below provides representative examples of realizations.

(5.32) Fricative+[l] Attempts (1;05.29 - 2;02.03)

Age	Orthography	Target	Realization	Code
1;05.29	butterfly	ˈbʌtəɹˌflaj	ˈfwɑ	C2Mod
1;08.11	flower	ˈflawəɹ	ˈhwɑdʊ	Other
1;11.08	flower	ˈflawəɹ	ˈawʌs	CCDel
2;03.17	flying	ˈflajɪŋ	ˈfʌnə	C2Del

In the first example above, the [l] is modified as [w] in "butterfly". The second example, "flower" is categorized in the "other" category as the production does not resemble the target. The next example of "flower" is produced with CC deletion as the whole cluster is deleted. Finally, the cluster in "flying" is realized with C2 deletion as the [l] is deleted in production.

As opposed to the lack of target-like productions with Fricative+[l] clusters, the data on s+[l] clusters reveals a different pattern: 68% (15/22) of these clusters are produced in a target-like fashion. There are very few occurrences in the remaining categories. Productions fell in the "other" category at 14% (3/22), and the categories of CC and C1 modification, and C1 and C2 deletion at 5% (1/22) each. Table (5.33) provides representative examples of these productions.

(5.33) s+[l] Attempts (1;08.11 - 2;06.02)

Age	Orthography	Target	Realization	Code
1;08.11	slide	ˈslajd	ˈθlaj	C1Mod
1;08.22	slide	ˈslajd	ˈslaj	TL
2;00.04	sleepy	ˈslijpij	ˈɬijpʰij	Other
2;02.22	slide	ˈslajd	ˈlaːjtʰ	C1Del
2;03.17	sleep	ˈslijpij	ˈzejpʰ	C2Del
2;06.02	slide	ˈslajd	ˈfwajd	CCMod

As seen in the examples above, C1 modification occurs in the first example of "slide" as the [s] is realized as [θ], and the second example is target-like. The example of "sleepy" is categorized as "other". The next example of "slide" is the only occurrence of C1 deletion as the [s] is not produced. The only occurrence of C2 deletion is with the [l] in "sleep". Finally, CC modification occurs in one example of "slide" as it is realized as [fw]. A direct comparison of the productions of Fricative+[l] and s+[l] clusters illustrates the differences between both cluster types. Table (5.34) below provides this comparison.

(5.34) Comparison of the Production of Fricative+[l] and s+[l] Clusters

Fricative+[l]	Realization	s+[l]
0%	TL	68%
0%	CCMod	5%
0%	C1Mod	5%
19%	C2Mod	0%
0%	C1Del	5%
50%	C2Del	5%
6%	CCDel	0%
25%	Other	14%

In sum, the differing results between the Fricative+[l] and s+[l] clusters indicate that s+[l] is not analyzed by the child in the same way as Fricative+[l] cluster. These findings are consistent with the assumption adopted in section 5.2, after Goad and Rose (2004), that s+[l] clusters are structurally different from Obs+Liq clusters, which predicts that the child should analyze these two structures in different ways.

In the next section, I will provide a discussion of the findings from throughout this chapter.

5.11 Discussion

While an investigation of potential positional effects was not possible because of a lack of relevant data, this study has offered insight into the development of these two types of onset clusters. The results of this study indicate that branching onsets and s+C clusters do indeed develop differently, and exhibit different patterns of production. The following table (5.35) illustrates the ages of acquisition between branching onsets and s+C clusters.

(5.35) A Comparison of the Age of Acquisition of Branching Onsets and s+C Clusters

Branching Onset	**Age of Acquisition**	**s+C Cluster**	**Age of Acquisition**
Obs+L	1;11.27	s+G	1;08.06
Obs+R	2;00.04	s+L	1;08.11
Obs+G	inconclusive	s+N	2;00.04
		s+Obs	after 2;06.02

As we can see from the above table, an increase in the sonority distance between [s] and the following consonant results in earlier acquisition of the cluster. However, this

situation is not observed for the branching onsets. This difference, in addition to the different dates assigned for each stage, illustrates the independent development of these two types of clusters. Also, while it may appear that Obstruent+Lateral clusters are acquired earlier than Obstruent+Rhotic clusters, the data strongly suggests that these two clusters were actually acquired simultaneously. These results support the claim by Goad and Rose (2004) that the two cluster types are indeed different structures.

However, while s+C clusters in general should, according to Goad and Rose (2004), share a unique structure, their acquisition across multiple stages does not support this claim. Without directly undermining a structural-based account, the patterning of these clusters strongly suggests that sonority constraints such as the ones discussed in Prince and Smolensky (1993), Gnanadesikan (2004) and Goad and Rose (2004) are playing a central role in the surface realization of these clusters. This issue, however, goes beyond the scope of this thesis, and is left for future research.

Chapter 6 - Conclusion

In this final chapter, I provide a summary of the thesis and discuss some of implications of my study. The main observations from chapters 4 and 5 are summarized and discussed in section 6.1. In section 6.2, I address some of the limitations of this study, offering suggestions for further investigations in this area of research.

6.1 Thesis Summary

The intent of this thesis was to study the issue of positional effects, and determine whether or not these effects are generalized or limited to specific children. The data available from Sonya's corpus do not yield any clear indication that positional effects manifest themselves across-the-board in developing phonologies. This lack of any conclusive results may come from the objects studied in the thesis; however, it is possible that positional effects do exist in the child's system, but not for the objects or contexts covered in the preceding chapters. Despite the lack of evidence toward positional effects in this study, this thesis has raised a number of issues with regard to methods of investigation of child language phonology, and has yielded results with regard to the phonological development of onset clusters, further documenting this topic from a longitudinal perspective.

In chapter 4, I demonstrated that despite common assumptions that acoustic investigations are inherently more reliable from a methodological perspective, these computer-assisted methods also present challenges, especially in terms of data interpretation specifically for analysis of VOT in onset plosives, which should not be

neglected. On the one hand, the difficulties in interpreting acoustic data include the level of arbitrariness required to classify the measurements along a continuum, something which directly affects the interpretation of the results. On the other hand, the high rates of inter-transcriber reliability uncovered in section 4.1 provide a basis to support the claim that the multiple-blind method of data transcription, when combined with a team-based method of data validation, provide a reliable empirical foundation for research in phonological development.

As part of this study, I also investigated the development of voicing contrasts in plosives. The results of this portion of the study were compared with recent work by Kager, van der Feest, Fikkert, Kerkhoff and Zamuner (in press). My findings indicate that voicing contrasts in English are acquired very early, presumably before the beginning of the period covered by Sonya's corpus, at 1;04.18. This finding supports the claim made by Kager et al., that English-learning children acquire the voicing contrast earlier than Dutch-learning children. My results yielded results similar to those from Kager et al. in terms of voicing errors as well. Kager et al. found voicing errors to be quite complex. They also demonstrate that in the data they considered, the devoicing errors are motivated by voicing harmony with another voiceless plosive in the word. The errors made through voicing a target voiceless consonant, however, are not motivated by such harmony. My results were simpler in that the majority of errors made were of inaccurate voicing of a target voiceless consonants, and no patterns of harmony was detected to predict the occurrence of such errors. The combined research from Kager et al. and this thesis suggests that more research needs to be done on the development of voicing contrasts

across languages, and that, concerning English in particular, this research should be conducted on a fairly young population, and presumably extend into experimental settings involving children who are still at the babbling stage.

In addition to the methodological considerations discussed in this thesis, the data uncovered by my study yields some significant findings in the area of phonological (prosodic) development. More specifically, concerning the development of onset clusters, I found that sonority plays a role in the development of Sonya's s+C clusters, a situation that was not matched in the development of branching onsets. In sum, a high sonority distance between an [s] and following consonant (e.g. [sw]) favored earlier acquisition, while a low sonority distance (e.g. [sp]) caused the clusters to be acquired at a later time. This finding has two main implications. First of all, with regard to the acquisition of onset clusters in general, these findings suggest that because they behave in different ways, the two cluster types, branching onsets and s+C clusters, require a different syllable structure, an observation that supports Goad and Rose's (2004) general hypothesis. Second, the development of these clusters, especially the s+C clusters in the context of my study, may be affected differently by constraints such as those regulating the sonority profile within the cluster.

In the next section, I discuss the limitations of my study, and provide suggestions for future research in this area.

6.2 Discussion

In this thesis, I have presented and discussed a number of observations made from a case study on the acquisition of English phonology. These findings have implications from methodological, empirical and theoretical perspectives. First of all, this study investigates the productions of only one child. This situation has its limitations, mainly because the findings from this child were not directly compared to those from other children. This, in turn, limits the analysis by referring to the observations as specific to one child instead of making broad observations about English-learning children in general. Another limitation of this study comes from the contexts under investigation. Because of time and, especially, gaps in the coverage of the phonological contexts documented in the corpus, not every phonological context could be investigated in this thesis. For example, no word-final clusters were studied, and a number of word-medial clusters had to be left out of the analysis. Also, at times there were not enough data across contexts to draw any firm observation on the possibility that there could have been subtle effects related to positions in Sonya's phonological development. Indeed, the vast majority of utterances studied in this thesis were in word-initial, primary stressed position. Positions such as word-initial secondary stressed and word-medial primary stressed were insufficiently represented in the corpus.

Another perspective on these issues is that it may be the case as well that this particular child did not in fact display any positional effects. This possibility is reinforced by the fact that some of the positional effects found in other studies (e.g. Rose 2000, Kehoe and Hilaire-Debove 2003) come from studies that were fairly comparable to the

current one from a methodological standpoint. Also, these findings appear to be difficult to reproduce across studies (Kehoe and Hilaire-Debove 2003).

Building on these issues, several suggestions can however be made to improve the method of investigation of positional effect in future studies. The first suggestion would be to first obtain data with higher-density sampling, and, the second, would be to collect data from children at an earlier age. Higher-density sampling, as well as the integration of an experimental component probing phonological contexts that are infrequent in the language, would probably result in production of more of the contexts that were poorly represented in this corpus. In addition, as we saw in the results for the acquisition of voicing contrasts, the contrasts appear to be acquired before the start of the corpus, thus preventing a look at the possibility of positional effects. If the recording of the corpus had begun earlier, an investigation of possible positional effects may have been possible before the contrast was fully acquired. A longitudinal study involving more children would also enhance the odds of yielding more conclusive results. Such an approach, similar to that taken, for example, by Fikkert (1994) and Levelt (1994) in their respective studies on the development of Dutch phonology, facilitate cross-child comparisons that could enable us to yield conclusions regarding the generality or specificity of the patterns observed in child productions. Furthermore, if such an approach could be extended to integrate data from more than one target language, then the results and, especially, the relative prominence of the phenomena observed within and across the populations of learners, could also be discussed in light of their universal versus language-specific origins. Indeed, as alluded to in chapter 4 in light of Kager et al.'s (in press) study on the

acquisition of voicing contrasts, cross-linguistic studies do yield important results which can in turn contribute to the development of a better understanding of the factors enhancing or hindering language acquisition. From this understanding, better theoretical models could be proposed and used in both formal and applied fields related to phonological development.

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Appendix Legend

Ortho.	Utterance Orthography
Rec. #	Record Number
WI-1S	Word-initial Primary Stressed Position
WI-2S	Word-initial Secondary Stressed Position
WI-U	Word-initial Unstressed Position
WM-1S	Word-medial Primary Stressed Position
WM-2S	Word-medial Secondary Stressed Position
WM-U	Word-medial Unstressed Position
Label	Voicing Label
TL	Target-like
CCMod	Modification of Both Consonants in the Cluster
C1Mod	Modification of the First Consonant in the Cluster
C2Mod	Modification of the Second Consonant in the Cluster
C1Del	Deletion of the First Consonant in the Cluster
C2Del	Deletion of the Second Consonant in the Cluster
CCDel	Deletion of Both Consonants in the Cluster
Oth	"Other" Category

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1	cup	[ˈkʌp]	[ˈkʰʌ]	[ˈkʌʔ]	[kˣɐːʔ]	[ˈkʰʌʔ]	3.00	
4	dada	[ˈdædæ]	[ˈdɛdæʔ]	[ˈɛdæʔ]	[ˈtɛtɐʔ]	[ˈdɛdæʔ]	1.00	2.00
5	papa	[ˈpapa]	[ˈpʰʌˌpʰɑ]	[ˈpʰʌpˌpʰaʔ]	[ˈkʰʌˈpʰɐʔ]	[ˈpʰʌpˌpʰɑʔ]	3.00	3.00
19	dada	[ˈdædæ]	[əˈdædɛ]	[ʌˈdædɛ]	[ʊˈdædɛʔ]	[ʌˈdædɛ]	3.00	3.00
20	dada	[ˈdædæ]	[ʌˈdædɛ]	[ʌˈdædæ]	[ʌˈdʲædæʔ]	[ʌˈdædæ]	3.00	3.00
22	cup	[ˈkʰʌp]	[ˈgʌʔ]	[ˈgʊpʰ]	[gʷʌʔf]	[ˈgʌʔ]	3.00	
23	Peter	[ˈpʰijəɹ]	[ˌbʌˈbʊʔ]	[ˈbʌplɛ]	[ˈbɐːˈɬæʔ]	[ˈbʌˌbʊ.ɛʔ]	3.00	2.00
24	dada	[ˈdædæ]	[ˈdæˌdæ]	[ˈdæʔdæʔ]	[ˈtætɐʔ]	[ˈdæˌdæ]	2.00	2.00
25	dada	[ˈdædæ]	[ˈdæˌdɛ]	[ˈdædæʔ]	[ˈdædɐʔ]	[ˈdæˌdɛ]	3.00	3.00
27	Booboo	[ˈbuwbuw]	[ˌbʊˈbuːʔ]	[ˈbʊbuː]	[bʊˈbʊə]	[ˌbʊˈbuː]	3.00	3.00
30	Keesha	[ˈkʰijʃa]	[ˈkʰijʃɪ]	[ˈkʰijʃɛ]	[ˈkiʃɛʔ]	[ˈkʰijʃɪ]	3.00	
43	Babar	[ˈbæbaɹ]	[ˈbæbʊ]	[ˈbæbə]	[ˈbæˈβʌʔ]	[ˈbæbʌʔ]	3.00	3.00
45	Babar's dada	[ˌbæbaɪzˈdæd æ]	[ˈgowˌdædæ]	[ˌbawˈdædæ]	[ˌbaʊʷʔ ˈdɛdæʔ]	[ˈbowˌdædæ]	3.00	3.00
45	Babar's dada	[ˌbæbaɪzˈdæd æ]	[ˈgowˌdædæ]	[ˌbawˈdædæ]	[ˌbaʊʷʔ ˈdɛdæʔ]	[ˈbowˌdædæ]	3.00	
46	a book...cup	[əˈbʊk...ˈkʌp]	[əˈbʊ..kʰˌkʰʌpˀ]	[əˈbʊkˀ...kʰ̥kʰʌp]	[ɛˈbuːʔ...kʲç...kʰʌːpˀ]	[əˈbʊkˀ...kʰ̥ɪkʰʌpˀ]	3.00	
46	a book...cup	[əˈbʊk...ˈkʌp]	[əˈbʊ..kʰˌkʰʌpˀ]	[əˈbʊkˀ...kʰ̥kʰʌp]	[ɛˈbuːʔ...kʲç...kʰʌːpˀ]	[əˈbʊkˀ...kʰ̥ɪkʰʌpˀ]	3.00	
47	apple	[ˈæpəɬ]	[ˈpʰuw]	[pʰuw]	[kʰʊbˀ]	[ˈkʰuw]	3.00	
48	apple	[ˈæpəɬ]	[ˈpʰuw]	[pʰuw]	[pʰʊʷ]	[ˈpʰuw]	3.00	
49	apple	[ˈæpəɬ]	[ʌˈpʰɑ]	[ʌˈpʰa]	[ʌˈpʰæːʔ]	[ʌˈpʰɑ]		3.00
50	apple	[ˈæpəɬ]	[ˈpʰɑ]	[ˈpʰæ]	[ˈpʰɛæʔ]	[ˈpʰɑ]	3.00	
54	apple	[ˈæpəɬ]	[ˈpʰɑʔ]	[pʰæʔ]	[pʰæːʔ]	[ˈpʰɑʔ]	3.00	
58	car	[ˈkɑɹ]	[ˈkʰow]	[ˈkʰʌw]	[kʰœːʷ hə]	[ˈkʰʌw]	3.00	
59	colour	[ˈkʌləɹ]	[ˈkʰowjæʔ]	[kʰʊˈjæʔ]	[ˈkʰʊjæʔ]	[ˈkʰʌwjæʔ]	3.00	
60	colour	[ˈkʌləɹ]	[ˈkʰʌlʌ]	[ˈkʰʌlə]	[ˈkʰʊjəʔ]	[ˈkʰʌlə]	3.00	
61	blue	[ˈbluw]	[ˈbuw]	[ˈbuw]	[buː]	[ˈbuw]	3.00	
67	apple	[ˈæpəɬ]	[ˈpʰʊʔow]	[ˈpʰʌʔʌ]	[ˈpʰʊʔə]	[ˈpʰʊʔʌ]	3.00	
69	dada	[ˈdædæ]	[ˈdæˌdʌ]	[ˈdædæ]	[ˈdæˈdɐʔ]	[ˈdæˌdæ]	3.00	3.00
70	dada	[ˈdædæ]	[ˈdædʌ]	[ˈdædæʔ]	[ˈdɛdæʔ]	[ˈdædʌ]	3.00	3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
73	cat	[ˈkæt]	[ˈkʰæʔ]	[ˈkʰætˈ]	[tʰæʔ]	[ˈkʰæʔ]	3.00	
79	keys	[ˈkijz]	[ˈkʰij]	[ˈhij]	[kʰiʲ]	[ˈkʰij]	3.00	
80	Peter	[ˈpʰijtəɹ]	[ˈpʰʌbʊʔ]	[ˈbʌbʌʔə]	[ˈbəbʊʔ]	[ˈbʊbʊ]	2.00	3.00
81	keys	[ˈkijz]	[ˈkʰij]	[ˈkij]	[kʰiːʲ]	[ˈkʰij]	3.00	
83	keys	[ˈkijz]	[ˈkʰij]	[ˈkʰij]	[kʰiː]	[ˈkʰijʔ]	3.00	
84	dada	[ˈdædæ]	[ˈdɛdæ]	[ˈdɛdæʔ]	[ˈdɛˈdæʔ]	[ˈdɛdæ]	3.00	3.00
108	cat	[ˈkæt]	[...ˈkʰɛ]	[ʊdɛˈkʰæ]	[ʊdə ˈkʰæːʔhə]	[ˈkʰæ]	3.00	
113	dada	[ˈdædæ]	[ˈdædɛ]	[ˈdædə]	[ˈdædə]	[ˈdæˌdɛ]	3.00	3.00
114	Keesha	[ˈkijʃa]	[ˈkʰijʃij...]	[ˈkʰijʃɪ]	[ˈhiʃihəh]	[ˈkʰijʃɪ]	3.00	
115	baby	[ˈbejbij]	[...ˈbejˌbij]	[bijʔˈbejbi]	[bi ˈbeʲbi]	[bijʔˈbejˌbij]	3.00	3.00
116	baby	[ˈbejbij]	[uwˈbejbej]	[ˈbejbɛ]	[m̥ ˈbejbi]	[ˈbejbɪ]	3.00	3.00
118	baby	[ˈbejbij]	[ˈbejbej]	[ˈbejbɪ]	[ˈbeʲbi]	[ˈbejbɪ]	3.00	3.00
119	apple	[ˈæpəɬ]	[hʊˈpʰʊ]	[huwˈpʰʌ]	[ʊˈpʰahə]	[hʊˈpʰʌ]		3.00
120	baby	[ˈbejbij]	[ˈbɛbij]	[ˈbejbij]	[beʲˈbi]	[ˈbɛbij]	3.00	3.00
123	pig	[ˈpʰɪg]	[ˈpʰij]	[ˈpʰɪg]	[pʰeʔ]	[ˈpʰej]	3.00	
124	pig	[ˈpʰɪg]	[ˈpʰej]	[ˈpʰej]	[pʷʰiː]	[ˈpʰej]	3.00	
127	keys	[ˈkijz]	[əˈkʰej]	[ˈkʰɛ]	[ʔkʰeʲ]	[əˈkʰɪʔ]	3.00	
136	dada cookie	[ˈdædæˌkʊkij]	[gʌʔˈdædʌˈkʰɪhʊ]	[dʌʔɪdædæˈkʰʊkij]	[ʔdʌʔ ˈdædæ ˈkʰiçi]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	3.00	3.00
136	dada cookie	[ˈdædæˌkʊkij]	[gʌʔˈdædʌˈkʰɪhʊ]	[dʌʔɪdædæˈkʰʊkij]	[ʔdʌʔ ˈdædæ ˈkʰiçi]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	3.00	3.00
149	tail	[ˈtejɬ]	[ɐ̃ˈtʰɛlij]	[ʊnˈtʰɛlij]	[ʊntʰeˈlih]	[ʊ̃ˈtʰɛlij]	3.00	
156	dada	[ˈdædæ]	[ˈdɛdæ]	[ˈdædæ]	[ˈdæˈdæ]	[ˈdɛdæ]	3.00	3.00
158	cookie	[ˈkʊkij]	[uwˈtʰejkʰej]	[huwəˈkʰejkɪ]	[uʷɪˈkʰeʲkʰeʲ]	[huwəˈtʰejkʰɪʔ]	3.00	3.00
159	oh, cookie	[owˈkʊkij]	[ˈowˌtʰejkʰɛ]	[ojˈkʰejkɛ]	[oʲˈkʰɛʲkʰeʲ]	[ˈowəˌtʰejkʰɛ]	3.00	3.00
163	cat	[ˈkæt]	[əˈkʰɛ]	[əˈkʰæ]	[ʔkʰeʔhd]	[əˈkʰɛ]	3.00	
168	bear(?)	[ˈbɛɹ]	[ˌkʰowˈbɑː]	[kowˈbɑː]	[koʷˈbɑːː]	[ˌkʰowˈbɑː]	3.00	
175	bird	[ˈbɜɹd]	[ˈbow]	[ˈbow]	[boʷ]	[ˈbow]	3.00	
177	cookie	[ˈkʊkij]	[...ˈtʰɪtʃej]	[hɪmojˈtʰijkɪ]	[ˈhʷʊmˈtʃiˌkʰej]	[hɪmojˈtʰejkʰɪʔ]	3.00	3.00
178	cookie	[ˈkʊkij]	[ˈkʰɪkʰɪ]	[kʰɪˈkʰɪ]	[ˈkʰɪˈkʰɪ ʔəh]	[ˈkʰɪˈkʰɪ]	3.00	3.00
183	colour	[ˈkʌləɹ]	[ĩnˈkʰʌlʊ]	[ŋˈkʰaj.jɔ]	[ʊŋkʰɑːˈjøʔ]	[ĩŋˈkʰʌlʊ]	3.00	
188	turtle	[ˈtɜɹtəɬ]	[ˈtʰɪrtʰæ̃]	[ˈtʰuwtʰĩn]	[ˈtʰuːtʰə]	[ˈtʰɜ̯ːtʰɛ̃]	3.00	3.00
194	ball	[ˈbɑɬ]	[ˈbɑɐ̃ʔ]	[ˈbɑɬ]	[ˈbɑːəɬ]	[ˈbɑˌəʔɐ̃]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
204	lion king	[ˈlajən,kɪŋ]	[ˈsaw,kʰɛ]	[ˈlʌjkʰɛ]	[ˈdɛlʲjkʰeː]	[ˈzɛw,kʰɛ]	3.00	
209	lion king	[ˈlajən,kɪŋ]	[ˈlaj,kʰɛ̃]	[ˈlaj,kʰĩ]	[ˈlaʲ,kʰĩ]	[ˈlaj,kʰɛ̃]	3.00	
260	shoe	[ˈʃuw]	[ˈʒuw]	[ˈkʰəʒuw]	[ˈθɪjuʷ]	[ˈkʰəʒuw]	2.00	
273	turtle	[ˈtɜɹtəɬ]	[ˈtʰɪrtʰuw]	[ˈtʰʌjtʰuw]	[ˈtʲʰyʲtʲʰuː]	[ˈtʰɜ,tʰuw]	3.00	3.00
279	monkey	[ˈmʌŋkij]	[hej‘kʰij]	[ˈej,kʰij]	[meʲˈkʰɪkˀ]	[hej‘kʰij]		3.00
280	duck	[ˈdʌk]	[ˈdʌ]	[ˈdæ]	[da]	[ˈda]	3.00	
292	bean ... noodles	[ˈbijn,nuwdəɬz]	[ˈbij...ˈnuw,nuw]	[ˈbĩjuwəkʰa,nuwluw]	[ˈbiə̃ ˈkʰɔf nũə̃]	[ˈbĩjuwəkʰa,nuwnuw]	3.00	
300	garbage truck	[ˈgaɹbəʤ,tɹʌk]	[ˈbejtʃʌ]	[ˈbejtʃʌʔ]	[ˌbeʲˈʧʌʔ]	[ˈbejtʃʌ]	3.00	
303	oh, garbage truck	[owˈgaɹbəʤ,tɹʌk]	[ˈowbɪʃɛ]	[ˌowbejˈʃæ]	[ˌoːʷ beʲˈʃæ]	[ˌoːwbejˈʃæ]	3.00	
304	...key, key	[ˈkij,kij]	[...ˈkʰij,kʰij]	[.....kijkij]	[wə ˈwʌ ʔʌ wa ˌkʰiˈkʰij]	[.....ˈkʰij,kʰij]	3.00	3.00
321	lion king	[ˈlajən,kɪŋ]	[ˈlʌkʰæ]	[ˈlʊ,kʰæ]	[ˈlʏ,kʰækˀ]	[ˈlʊ,kʰæ]	3.00	
323	lion king	[ˈlajən,kɪŋ]	[ˈlejkʰæ̃]	[ˈlij,kʰæ̃]	[ˈleʲ,kʰæ̃]	[ˈlij,kʰæ̃]	3.00	
324	lion king	[ˈlajən,kɪŋ]	[ˈlejkʰɛ]	[ˈlɛ,kæ]	[ˈʎe,kæʔh]	[ˈlɛ,kʰæ]	3.00	
327	cat	[ˈkæt]	[ˈkʰæ]	[ˈkʰæʔ]	[kʰætˀ]	[ˈkʰæʔ]	3.00	
330	lion king	[ˈlajən,kɪŋ]	[ˈlʊkʰɛ]	[ˈlʊ,kʰɛʔ]	[ˈu,kʰɛ̃ʔ]	[ˈlʊ,kʰɛʔ]	3.00	
332	heart	[ˈhɑɹt]	[owˈkʰɑ]	[ˈka]	[əʷˈkʰaʔ]	[owˈkʰɑ]	3.00	
334	lion king	[ˈlajən,kɪŋ]	[ˈlajkʰɛʔ]	[ˈlej,kʰɛ]	[ˈlɛʲ,kʰəʔ]	[ˈlʊ,kʰɛʔ]	3.00	
351	keys	[ˈkijz]	[ˈkʰij]	[ˈkʰij]	[kʰi]	[ˈkʰij]	3.00	
363	towel	[ˈtɑwəɬ]	[ˈkʰɐ̃mij]	[ˈkʰɑməwej]	[kʰaːˈmuʔ]	[ˈkʰɐ̃məwɪ]	3.00	
386	again	[əˈgɛn]	[ˈægɛʔ]	[ˈægɛʔ]	[ˈʔæˈgɛʔ]	[ˈægɛʔ]		3.00
388	again	[əˈgɛn]	[ˈʌgæʔ]	[æˈgɛʔ]	[æˈgɛʔ]	[æˈgɛʔ]		3.00
396	again	[əˈgɛn]	[ˈʌgæʔ]	[ˈægæʔ]	[æˈgeʔ]	[ˈʌjgæʔ]		3.00
399	again	[əˈgɛn]	[ʌˈgæʔ]	[ˈʌjgæʔ]	[ʔʌˈgæʔ]	[ʌjˈgæʔ]		3.00
400	again	[əˈgɛn]	[ɛˈgæʔ]	[ɛˈgæ]	[ɛˈgæʔ]	[ɛˈgæʔ]		3.00
404	two, three, go	[ˌtuw,θɹijˈgow]	[ˌtʰuwːˌfwajːˈgowːː]	[ˌtʰuw,fwajˈgow]	[ˌtʰuʷˌfwaːjˈgaʊʷ]	[ˌtʰuːw,fwaːjˈgoːw]	3.00	
405	again	[əˈgɛn]	[ɛˈgæʔ]	[æˈgæʔ]	[æˈgæʔ]	[ɛˈgæʔ]		3.00
414	uh, monkey	[ʔʌˈmʌŋkij]	[ʊpˈˈmɐ̃ŋkʰej]	[ˈʌʔ,mʌŋkij]	[ˌɯpˈmɐ̃ŋˈkeʲ]	[ˈʊʔ,mɐ̃ŋkʰej]		3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
421	lion king	[ˈlajən,kɪŋ]	[əˈlawkʰʊ]	[ʌˈlʊkʰɛ]	[ʊˈlʌʲkʰəʔ]	[əˈlawkʰɛ]	3.00	
422	lion king	[ˈlajən,kɪŋ]	[ˈlaj,kʰɛ]	[əˈlajkʰæ]	[uˈlaʲkʰæ]	[əˈlajkʰɛ]	3.00	
423	lion king	[ˈlajən,kɪŋ]	[ˈlaj,kʰæ]	[ˈlajkʰæ]	[ˈlaʲkʰæʔ]	[ˈlaj,kʰæ]	3.00	
424	uh, car	[ʔʌˈkɑɪ]	[ã̰ʔã̰ʔəˈkʰɑ]	[ʌʔʌʔɛkʰɑː]	[ˈʔʊˈʔʌʔɐʲˈkʰaːʔ]	[ã̰ʔʌʔejˈkʰɑː]	3.00	
425	car	[ˈkɑɪ]	[əˈkʰɑː]	[ˈkʰɑː]	[ˈkʰaː]	[ˈkʰɑː]	3.00	
426	car	[ˈkɑɪ]	[uwˈkʰɑ]	[əʔˈkʰɑ]	[ʔukʰaːpˀ]	[uwˈkʰɑ]	3.00	
427	oh, car	[owˈkɑɪ]	[owˈkʰɑ]	[owˈkʰɑ]	[ʔo̞ʲkʰa]	[owˈkʰɑ]	3.00	
428	lion king	[ˈlajən,kɪŋ]	[ˈlɛkʰɛ]	[ˈlɛkʰɛ]	[ˈlɛkʰɛ]	[ˈlɛkʰɛ]	3.00	
430	lion king	[ˈlajən,kɪŋ]	[ˈlajkʰɛ]	[ˈzʌjkʰɛ]	[ˈzʌʲkʰɛkˀ]	[ˈlajkʰɛ]	3.00	
432	car	[ˈkɑɪ]	[ˈkʰʊʌ]	[ˈkʰʌː]	[kʰɯaː]	[ˈkʰʌː]	3.00	
433	lion king	[ˈlajən,kɪŋ]	[lʊˈkʰɛ]	[ˈlʌjkʰɛ]	[ˈlʌʲkʰɛkˀ]	[ˈlajkʰɛ]	3.00	
446	potato head	[pəˈtejtow,hɛd]	[ˈtʰɛ,hɑr]	[ˈtʰejhʌ]	[ˈtʰeʲhʌʔ]	[ˈtʰej,hɑɪʔ]	3.00	
448	okay	[ˈowkej]	[ʌ,kʰej]	[ˈʌkej]	[ˈã̰keʲ]	[ʌ,kʰej]		3.00
461	turtle	[ˈtɜɹtəɬ]	[ˈtʰʊtʰʌ]	[ˈtʰʊtʰʌ]	[ˈtʰɔtʰɔ]	[ˈtʰʊtʰʌ]	3.00	3.00
462	uh, cow	[ʔʌˈkaw]	[õʔã̰mˈkʰaw]	[ʌmˈkaw]	[ʌ̃ːmˈkaʊ]	[õʔã̰mˈkʰaw]	3.00	
467	garbage truck	[ˈgaɹbədʒ,tɹʌk]	[ˈbæ,tʃɛkʰ]	[bæˈtʃɛkʰ]	[ˈbæˈʧɛkʰʲː]	[bæˈtʃɛkʰ]	3.00	
469	a big cow	[ə,bɪgˈkaw]	[ʌæɛːˈbij,kʰaw]	[ʌæ,bijˈkʰɑw]	[ʔʌ ˈæʔɛ ,bikˀˈkʰaʷ]	[ʌ.æ.ɛːˈbij,kʰɑw]	3.00	
469	a big cow	[ə,bɪgˈkaw]	[ʌæɛːˈbij,kʰaw]	[ʌæ,bijˈkʰɑw]	[ʔʌ ˈæʔɛ ,bikˀˈkʰaʷ]	[ʌ.æ.ɛːˈbij,kʰɑw]	3.00	
470	peacock	[ˈpijkɑk]	[ˈpʰij,kʰɑ]	[ˈpʰijka]	[ˈkʰikʰaː]	[ˈpʰij,kʰɑ]	3.00	3.00
471	peacock	[ˈpijkɑk]	[pʰijˈkʰɑ]	[ˌpʰijˈkʰaː]	[ˌpʰɪˈkʰaː]	[pʰijˈkʰɑː]	3.00	3.00
472	apple	[ˈæpəɬ]	[ˈæpʰɑː]	[ˈæ,pɑ]	[ˈæ,pɑ̃ː]	[ˈæ,pʰɑː]		3.00
473	uh, peacock	[ʔʌˈpijkɑk]	[ã̰õ̰ã̰ə,pʰijˈkʰɑ]	[ʌʔʌʔʌ,pʰijˈkɑ]	[ʌʌʌ,pʰiˈkʰɑ]	[ã̰ʔã̰ʔã̰ʔə,pʰijˈkʰɑ]	3.00	3.00
474	uh, cow	[ʔʌˈkaw]	[ã̰ʔəˈkʰawː]	[ʌʔˈkʰɑw]	[ã̰ʔʌˈkʰaʊ]	[ã̰ʔəˈkʰɑːw]	3.00	
476	cat	[ˈkæt]	[ˈkʰætʰ]	[ˈkʰæk]	[ˈqækʰ]	[ˈkʰɑtʰ]	3.00	
478	cow	[ˈkaw]	[ˈkʰɑawː]	[ˈkʰɑw]	[kʰaːu]	[ˈkʰɑːw]	3.00	
481	uh, tractor(?)	[ʔʌˈtɹæktəɹ]	[ɛðnʊˈʧʲij]	[ənʧˈnəˈkijm]	[ʔən nəˈʧʲiːm]	[ə̃n.nʊ.əˈkʰijm]	3.00	
483	monkey	[ˈmʌŋkij]	[ˈmajkʰij]	[ˈmækij]	[ˈmækʰi]	[ˈmækʰij]		3.00
490	cookie	[ˈkʊkij]	[ˌkʰijˈkʰij]	[ˈkɪkij]	[ˈkʰɪˈkʰiʲ]	[ˈkʰɪˈkʰij]	3.00	3.00

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
493	monkey	[ˈmʌŋkij]	[ˈmækʰijː]	[ˈmækij]	[ˈmækʰiː]	[ˈmækʰiːj]		3.00
496	cat tail	[ˈkæt,tejɬ]	[ˈkʰæʔ,tʰejʌ]	[ˈkʰæʔ,tʰijæ]	[ˈkʰæʔ,tʲɪʲæ]	[ˈkʰæʔ,tʰijʌ]	3.00	
496	cat tail	[ˈkæt,tejɬ]	[ˈkʰæʔ,tʰejʌ]	[ˈkʰæʔ,tʰijæ]	[ˈkʰæʔ,tʲɪʲæ]	[ˈkʰæʔ,tʰijʌ]	3.00	
499	uh, key	[ʔʌˈkij]	[ˈɐ̃ʔ,kʰij]	[ˈʌʔə,kij]	[ˈʌ,kʰi]	[ˈɐ̃ʔə,kʰij]	3.00	
500	candle	[ˈkændəɬ]	[ˈkʰæːdɑː]	[ˈkʰæːdæː]	[ˈkʰæːdaː]	[ˈkʰæːdaː]	3.00	3.00
501	cookie	[ˈkʊkij]	[ˈkʰijkʰij]	[ˈkʰɪkʰij]	[ˈkʰɪʰjʲ]	[ˈkʰɪkʰij]	3.00	3.00
502	monkey	[ˈmʌŋkij]	[ˈmɛ,kʰij]	[ˈmɛ,kʰij]	[ˈmɛ̃,kʰi]	[ˈmɛ,kʰij]		3.00
504	cookie	[ˈkʊkij]	[ˈkʰijkʰij]	[ˈkɪkij]	[ˈkʰɪkʰjʲ]	[ˈkʰij,kʰij]	3.00	
512	bicycle	[ˈbʌjsɪkəɬ]	[ˈpʰʊtʰʌ]	[ˈpow,tʰʊ]	[ˈpo,tʰɔʔ]	[ˈpʰow,tʰʌ]	3.00	3.00
513	bicycle	[ˈbʌjsɪkəɬ]	[wɛɪˈpʰʊ,tʰʊ]	[ˌbɛʔjəˈpʰʊtʰə]	[ˌbɛʔəˈpʰʊ,tʰə]	[ˌbɛʔjəˈpʰʊtʰʌ]	3.00	3.00
523	um, uh, dada	[ʔʌmʌˈdædæ]	[õmõnˈdædæ]	[ˌʊmʔʊˈdædæ]	[ˌʊmˌʔõ dæˈdæʔ]	[m̩ʔõnˈdædæ]	3.00	3.00
526	car	[ˈkɑɪ]	[ˈkʰɑː]	[ˈkʰaː]	[kʰaː]	[ˈkʰɑː]	3.00	
533	...Cathy ... paper	[ˈkæθij,pejpəɪ]	[...ˈkʰæʃej...ˈpʰɑpʰɑ]	[ˈkʰæʃɛˈpʰa,pʰa]	[ˈkʰæʂɛ...ˈpʰʌ,pʰʌ]	[...ˈkʰæʃej...ˈpʰɑpʰɑ]	3.00	
534	Cathy	[ˈkæθij]	[...əˈkʰæθʌ]	[ˈkʰæθæ]	[...əˈkʰæθæ]	[...əˈkʰæθa]	3.00	
541	dada	[ˈdædæ]	[ˈdɛdæ]	[ˈdædæ]	[ˈdɛda]	[ˌdɛˈda]	3.00	3.00
551	keys	[ˈkijz]	[hæ̃ˈkʰij]	[hæˈkij]	[ˌhæʔˈkʰjʲ]	[hãˈkij]	3.00	
553	purple	[ˈpɜɹpəɬ]	[ˈpʰʌbow]	[ˈpʰʌ,pʊ]	[ˈbʌ,pʰu]	[ˈpʰʌ,pʊ]	2.00	2.00
558	cat	[ˈkæt]	[ˈkʰætʰ]	[ˈkʰæt]	[kʰætˀ]	[ˈkʰætˀ]	3.00	
561	cat	[ˈkæt]	[ˈkʰætʰ]	[ˈkʰætʰ]	[tʰætʰ]	[ˈkʰætʰ]	3.00	
562	...up high	[ʔʌpˈhaj]	[...ʌˈpʰaj]	[həˈpʰaj]	[....hʊˈpʰaʲ]	[həˈpʰaj]	3.00	
563	apple	[ˈæpəɬ]	[ˈæpʰɑ]	[ˈæ,pʰa]	[ˈʔæ,pʰa]	[ˈʔæ,pʰɑ]		3.00
630	make castle	[ˌmejkˈkæsəɬ]	[ʊwɑ̃n,mejkʰəˈkʰæʃuw]	[ʌ,mejkʔɑ̃ˈkʰæʃuw]	[əʷˈmeʲkʲʰˈʔõˈkʰæθuː]	[ʊwɑ̃,mejkʰʔɑ̃ˈkʰæʃuw]	3.00	
635	cow	[ˈkaw]	[ˈkʰɑw]	[ˈkʰɑw]	[kʰɑw]	[ˈkʰɑw]	3.00	
639	cat...tail	[ˌkætˈtejɬ]	[ˈkʰækʰə,tʰejə]	[ˌkʰæʔəˈtʰejə]	[ˌkʰæʔ kʰ ʊˈtʰeʲə]	[ˈkʰæʔkʰ̪ʔə,tʰejə]	3.00	
639	cat...tail	[ˌkætˈtejɬ]	[ˈkʰækʰə,tʰejə]	[ˌkʰæʔəˈtʰejə]	[ˌkʰæʔ kʰ ʊˈtʰeʲə]	[ˈkʰæʔkʰ̪ʔə,tʰejə]		3.00
647	airplane	[ˈɛɹplejn]	[ˈɛpʰejn]	[ˈɛpʰejʔuw]	[ˈɛpʰeʲlɻ]	[ɛˈpʰẽjn]	3.00	
649	apple	[ˈæpəɬ]	[ˈæpʰʌ]	[ˈæ,pʰæ]	[ˈæ,pʰæ]	[ˈʔæ,pʰa]		3.00
650	apple	[ˈæpəɬ]	[ˈæpʰʊːlə]	[ˈæpʰuwa]	[ˈæpʰuʷæ]	[ˈʔæ,pʰuwə]		3.00
666	dada	[ˈdædæ]	[ˈdædɛ]	[ˈdædæ]	[ˈdædæʔ]	[ˈdædæ]	3.00	3.00
669	dada	[ˈdædæ]	[ˈdædæ]	[ˈdædæ]	[ˈdædæ]	[ˈdædæ]	3.00	3.00
673	bird	[ˈbɜɹd]	[ˈbʌ]	[ˈʌ.æ]	[mʊatˀ]	[ˈbʌ.æ]	3.00	

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
677	cow	['kaw]	['kʰaw]	['kʰaw]	[kʰaʷ]	['kʰɑw]	3.00	
678	tractor	['tɹæktəɹ]	['kʰætʃɑ]	[ˌkʰʌt'ɬaʔ]	[ˌkʰæ'ʧʌʔ]	['kʰætʃˌɬɑ]	3.00	
680	cat	['kæt]	['kʰæ]	['kʰæ]	[kʰæt̚]	['kʰæ]	3.00	
690	painting	['pejntɪŋ]	['pʰejtʰij]	['pʰejˌtʰij]	['pʰeʲˌtʰi]	['pʰejˌtʰij]	3.00	3.00
693	I want blanket	[ˌajwant'blæŋ kət]	[ajwɑ̃'bægij]	[ʌwant'pædij]	['aɪ̯ntʃ'pæˌd͡ʒi]	[ʌjwɑ̃'bædij]	1.00	3.00
695	want blanket	[want'blæŋkə t]	[õʔ'bædiːj]	[ʌ'pʰædij]	[up̚'pædʲiː]	[ɐ̃ʔ'bædiːj]	1.00	3.00
696	guitar	[gə'taɹ]	[ɪ'tʰæ]	[ə'tʰaː]	[i'tʰæ]	[ə'tʰæ]	3.00	
700	teddybear	['tɛdijˌbɛɹ]	['tʰejbʌ]	['tʰejbɑʔ]	['tʰeʲˌbɑʔ]	['tʰejˌbʌʔ]	3.00	3.00
704	garden(?)	['gaɹdən]	[ə'gɑrdʌ]	[ˌɪz'gɑdə]	[ðɪθ'gɑkæ̰ʔ]	[ə'gɑˌdʌ]	3.00	2.00
706	carrot	['kɛɹət]	['kʰɛrɪ]	['kʰejɹɪt̚]	['kʰɛʲˌɹɪt̚]	['kʰɛˌɹɪʔ]	3.00	
707	potato(?)	[pə'tejtow]	['tʃuwdij]	['tʰuwdij]	[t̪'ʧu'di]	[tʰʊ'dij]	3.00	3.00
711	airplane	['ɛɹplejn]	[uw'pʰɛ̃ːn]	[ə̃'pɛ̃jn]	[ɪ'peʲˌn̪]	[ʊ'pʰɛ̃n]	3.00	
712	a castle	[ə'kæsəɬ]	[uw'kʰæʃuw]	[ə'kʰæsjuw]	[u'kʰæʃju]	[ʊ'kʰæʃjuw]	3.00	
717	monkey	['mʌŋkij]	['mɪˌgij]	['majkʰij]	['mɪk̚'kʰiʲ]	['mejk.gij]		1.00
728	bicycle	['bʌjsɪkəɬ]	[ˌbawːs'tʰʌtʰʌ]	[ˌbwaws'tʰʌtʰʌpʰ]	[ˌbʷæ̃ʷ'θtʰoˌtʰʌp̚]	[ˌbʷaws'tʰʌtʰʌ]	3.00	3.00
728	bicycle	['bʌjsɪkəɬ]	[ˌbawːs'tʰʌtʰʌ]	[ˌbwaws'tʰʌtʰʌpʰ]	[ˌbʷæ̃ʷ'θtʰoˌtʰʌp̚]	[ˌbʷaws'tʰʌtʰʌ]	3.00	
729	cake	['kejk]	['kʰejkʰ]	['kʰejkʰ]	[kʰækjkʲʰ]	['kʰejkʰ]	3.00	
734	kip, cup	['kɪpˌkʌp]	['kʰɪpʰˌkʰʌpʰ]	['kʰɪpʰˌkʰʌpʰ]	['kʰepʰˌkʰʌpʰ]	['kʰɪpʰˌkʰʌpʰ]	3.00	
734	kip, cup	['kɪpˌkʌp]	['kʰɪpʰˌkʰʌpʰ]	['kʰɪpʰˌkʰʌpʰ]	['kʰepʰˌkʰʌpʰ]	['kʰɪpʰˌkʰʌpʰ]	3.00	
737	...cookie	['kukij]	[...'kʰɪkʰij]	['kʰɪkij]	[...'kʰiʲɪkʰʲi]	[...'kʰijkʰij]	3.00	3.00
746	cat	['kæt]	['kʰæ]	['kʰæ]	[kʰæt̚]	['kʰæ]	3.00	
761	uh, apple	[ʔʌ'ʔæpəɬ]	[ʌ'æpʰuw]	[ə'ʔæpʰuw]	[ʊ'ʔæˌpʰuʷ]	[ɛ̃'ʔæˌpʰuw]		3.00
767	moo-cow	['muwˌkaw]	[nə'muwˌkʰaw]	['muwkʰɑw]	[m̩'muʷkʰʌʷ]	[nə'muwˌkʰʌw]	3.00	
769	cow	['kaw]	['kʰaw]	['kʰaw]	[kʰaʷ]	['kʰɑw]	3.00	
785	cookie	['kʊkij]	['kʰejkʰij]	['kʰejkij]	['kʰæʲkʰi]	['kʰejkʰij]	3.00	3.00
790	a cow	[ə'kaw]	[ə'kʰawːɔ]	[ə'kʰaw]	[ɔ'kʰaʷw]	[ə'kʰɑːwə]	3.00	
792	cat	['kæt]	['kʰætʰ]	['kʰætʰ]	[kʰæt]	['kʰætʰ]	3.00	
794	wheelbarrow	['wijɬˌbɛɹow]	[o'wejbɪbɑ]	[ow'wajbɛbɑ]	[oʷ'waʲbɛbɑʔ]	[ow'wejbɛbɑ]		3.00
804	oh, purple...	[ow'pɜɹpəɬ]	[ow'pʰɪrpʰəˌwɐ̃n]	[ɐ̃'pʰʊpʰʊˌwʌn]	[ow'pʰʊpʰʊˌwæŋ]	[ow'pʰɜpʰʊˌwɐ̃n]	3.00	3.00
805	squeeze	['skwijz]	['kʰejːf]	['ʧejf]	[tʃeʲɸ]	['kʰeːjv]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
810	okay	[‘owkej]	[ow,kʰej]	[ow‘kʰej]	[oʷ‘kʰe̯ʔe]	[ow‘kʰɛʔɛ]	3.00	
819	okay	[‘owkej]	[ʌ,kʰej]	[‘ʌ,kʰej]	[ˌʔɔ‘kʰeʲç]	[‘ʔʌ,kʰej]		3.00
821	okay	[‘owkej]	[ə‘kʰej]	[ˌʌ‘kʰʌj]	[ˌɔ‘qʰɛʲ]	[ʌ‘kʰøj]	3.00	
822	Cathy	[‘kæθij]	[uw‘kʰæʃij]	[ə‘kʰæˌʂij]	[u‘kʰæˌʃi]	[uw‘kʰæˌʂij]	3.00	
837	clock	[‘klɑk]	[‘kʰɑkʰ]	[‘kʰɑkʰ]	[kʰɑːkʰ]	[‘kʰɑkʰ]	3.00	
840	hippo	[‘hɪpow]	[‘hʌbowæ]	[‘hɛɬpowa]	[‘hɛlˌpwoʔæ]	[‘hʌpʰowæ]		3.00
847	apple	[‘æpəɬ]	[‘æpʰuw]	[‘æpuw]	[‘æpʷɬ]	[‘ʔæˌpʰuw]		3.00
854	pail	[‘pejɬ]	[‘pʰejæ]	[‘pʰeja]	[ʊ‘pʰeʲæ]	[‘pʰeˌja]	3.00	
861	newspaper	[‘nuwzˌpejpəɹ]	[‘owpʰɑpʰɑ]	[‘tʰowˌpʰæpʰæ]	[‘tʰoʷˌpapa]	[‘owpʰɑpʰɑ]	3.00	3.00
867	elephant ... bicycle	[‘ɛləfɪntˌbʌjsɪkəɬ]	[æ̃nə‘ɛləfɛ...pʰʌtʰæ]	[ã‘ɛ̃ɬfʌ‘pʰʌtʰæ]	[ʌ‘ʔæɬfʌɑ ə ʔɛçɪ mˌ‘pʰʊtʰæ]	[æ̃nə‘ɛɬfɛ̃...‘pʰʌtʰæ]	3.00	3.00
868	aligator on bicycle	[ˌæləgejtəɹ.ɑn‘bʌjsɪkəɬ]	[mˌ‘ælgələã?õnpʰʌtʰhɑ]	[‘ægɛlə?ʌ?ʌnˌpʰʊtɛ?]	[mˌ‘ʔægɛðə ʔã?ũn‘pʰʊtʰɛ?]	[mˌ‘ægɛlə?ã?õnˌpʰʌtʰɑ]	3.00	3.00
873	teddybear (?)	[‘tɛdijˌbɛɹ]	[ə‘tʰɛˌbɑː]	[‘tʰɛˌbɑː]	[‘tʰɛˌbɑː]	[ə‘tʰɛˌbɑː]	3.00	3.00
874	cake	[‘kejk]	[‘kʰejːkʰ]	[‘kʰejkʰ]	[kʰɛʲk]	[‘kʰejkʰ]	3.00	
876	cup	[‘kʌp]	[‘kʰʌpʰʌ]	[‘kʰʌpʰʊ]	[‘kʰʌˌpʰʊʷ]	[‘kʰʌˌpʰʌ]	3.00	
890	eating..... ...	[‘ijtɪŋ]	[‘ejtʰ̃in...]	[‘ejtʰ̃ẽ]	[ə‘ʔeʲtʰeʔə‘dænəpfrədæt]	[‘ʔejtʰ̃ĩ...]		3.00
900	window	[‘wɪndow]	[wĩnˌdowːn]	[‘wɪnˌdown]	[‘ʔĩnˌdõːn]	[‘wĩnˌdowən]		3.00
902	cook	[‘kʊk]	[‘kʰʊkʰ]	[‘kʰʊkʰ]	[kʰʊkʰ]	[‘kʰʊkʰ]	3.00	
903	that's a cow	[ˌðætsə‘kaw]	[tʰ̃ãtʰə‘kʰawə]	[ˌtʰʌtʔʌ‘kʰɑwɑ]	[ˌtʰʊtʔʌ‘kʰæwɑ]	[tʰ̃ãtʰəʔʌ‘kʰɑwa]	3.00	
905	cat	[‘kæt]	[‘kʰætʰ]	[‘kʰætʰ]	[kʰæːtʰ]	[‘kʰætʰ]	3.00	
906	that's a piggy	[ˌðætsə‘pɪgij]	[‘pʰætʰəˌpʰɪgij]	[‘tʰætæˌpʰɪgij]	[‘tʰætæˌpʰɪgiʲ]	[‘tʰætʰaˌpʰɪgij]	3.00	3.00
906	that's a piggy	[ˌðætsə‘pɪgij]	[‘pʰætʰəˌpʰɪgij]	[‘tʰætæˌpʰɪgij]	[‘tʰætæˌpʰɪgiʲ]	[‘tʰætʰaˌpʰɪgij]	3.00	3.00
915	daddy duck	[‘dædijˌdʌk]	[dætʰənõm‘dætʰej]	[ˌdæhajmˌ‘dʌgej]	[ˌdæhaʲũmː‘dʌgeʲ]	[dæθajnõm‘dʌgej]	3.00	2.00
925	book	[‘bʊk]	[‘bʊkʰ]	[‘bʊkʰ]	[bʊk]	[‘bʊkʰ]	3.00	
926	clock	[‘klɑk]	[‘kʰɑkʰ]	[‘kʰɑkʰ]	[kʰɑk]	[‘kʰɑkʰ]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
932	what's that	[wats'ðæt]	[huwn'dæt^{h}]	[huw'dæ:]	[hu^{w}'dæt]	[ʔuwn'dæt$^{\neg}$]	3.00	
934	crocodile	['kɹɑkədajəɬ]	['k^{h}ɑk^{h}ədajlə]	['k^{h}ɑk^{h}ɑ,dæwə]	['k^{h}ɑk^{h}ɑ,dæðə]	['k^{h}ɑk^{h}ə,dajvə]	3.00	3.00
934	crocodile	['kɹɑkədajəɬ]	['k^{h}ɑk^{h}ədajlə]	['k^{h}ɑk^{h}ɑ,dæwə]	['k^{h}ɑk^{h}ɑ,dæðə]	['k^{h}ɑk^{h}ə,dajvə]		3.00
936	guitar	[gə'taɹ]	[ɑ̃ŋ't^{h}ɛɑ]	[ɑ̃n't^{h}ɛ:]	[aʲnʲ't^{h}ɛa:]	[ɑ̃ŋ't^{h}ɛ.a]		3.00
937	cat	['kæt]	['k^{h}æt^{h}æn'duwĩn]	['k^{h}ætaduwijɛn]	[hætə,dujənə]	['k^{h}æt^{h}a$^{\neg}$duwijɛn]	3.00	
945	apple	['æpəɬ]	['æp^{h}ʊ]	['æpʊ]	['ʔæpʊ]	['ʔæp^{h}ʊ]		3.00
947	apple	['æpəɬ]	['æp^{h}ʊ]	['æpwʊ]	['ʔæpwʊʲ]	['ʔæp^{h}ʊ]	3.00	
949	that's a carrot	[ˌðætsə'kɛɹət]	[dæsə'k^{h}ɛɹæ]	[ˌdæsɪ'k^{h}æwæ]	[ˌʤæʦsɪˌk^{h}æ'ɹæ]	[ˌdæsɨ'k^{h}ɛɹæ]	3.00	
956	water	['wɑtəɹ]	['wɑdʊ]	['wʌdə]	['wʌˌdʌ]	['wʌdʊ]		3.00
957	boat ... drive	['bowtˌdɹajv]	['bowt^{h}ʌwãnədə'drajv]	['bowt^{h}ədə'dwajv]	['bo^{w}tə ʔə̃:ɖə'ɖˌɻaʲf]	['bowt^{h}əʔɐ̃wãnədə'dɹajv]	3.00	
961	hippo	['hɪpow]	[ajm'p^{ɦ}ĩmbow]	[ajɪm'p^{h}ʌmˌbow]	[aʲɪm'p^{ɦ}ĩmˌbo^{w}]	[ajm'p^{ɦ}ĩmˌbow]	3.00	3.00
962	that's a hippo	[ˌðætsə'hɪpow]	[dæsə'bɐ̃mˌbow]	[dæsæ'bʌmˌbow]	['dæθæ'bʌmˌbo^{w}]	[dæsa'bɐ̃mˌbow]	3.00	3.00
967	blue and red and purple too	[bluwənɹɛdən'pɜɹpəɬˌtuw]	[wuwãnəwɛdãn'p^{h}ɪɾp^{h}ʌˌt^{h}uw]	[ˌwuwænə'wɛdə̃'p^{h}ʊpʌ't^{h}uwə]	['wu:ənə'ʁɛdʔə̃n'p^{h}up$^{\backprime}$ɸəl't^{h}u:ə]	[ˌwuwãnə'wɛdʔãn'p^{h}ɜp^{h}ʌˌt^{h}uwə]	3.00	3.00
967	blue and red and purple too	[bluwənɹɛdən'pɜɹpəɬˌtuw]	[wuwãnəwɛdãn'p^{h}ɪɾp^{h}ʌˌt^{h}uw]	[ˌwuwænə'wɛdə̃'p^{h}ʊpʌ't^{h}uwə]	['wu:ənə'ʁɛdʔə̃n'p^{h}up$^{\backprime}$ɸəl't^{h}u:ə]	[ˌwuwãnə'wɛdʔãn'p^{h}ɜp^{h}ʌˌt^{h}uwə]		3.00
969	kite	['kajt]	['k^{h}ajt^{h}]	['k^{h}ajt]	[k^{h}aʲt^{h}]	['k^{h}ajt^{h}]	3.00	
970	monkey	['mʌŋkij]	['majˌk^{h}ij:]	['majʔˌk^{h}ij]	['maʲʔˌt^{h}i:]	['majʔˌk^{h}i:j]		3.00
974	airplane	['ɛɹˌplejn]	['ɐ̃mp^{h}ejn]	['ʔʌmp^{h}ẽjn]	['ʔʌmˌp^{h}æʲn]	[ʔɐ̃m'p^{h}ẽjn]	3.00	
976	vacuum	['vækjuwm]	['bæk^{h}ijnʌ]	['væk^{ɦ}ĩnɐ̃]	['fæk^{h}ĩjõ]	['bæk^{ɦ}ĩnɐ̃]	2.00	
978	...monkey and hippo	[ˌmʌŋkijən'hɪpow]	[...ə'mɛk^{h}ijɐ̃nˌp^{h}ɐ̃mbow]	[ˌmajk^{h}ijʔɐ̃'p^{h}ʌmbow]	[k^{h}apa õ bəɹˌmaʲk^{h}iʲõ'p^{h}ə̃mbo^{w}]	[...ə'mɛk^{h}ijʔɐ̃n'p^{h}ɐ̃mˌbow]	3.00	3.00
978	...monkey and hippo	[ˌmʌŋkijən'hɪpow]	[...ə'mɛk^{h}ijɐ̃nˌp^{h}ɐ̃mbow]	[ˌmajk^{h}ijʔɐ̃'p^{h}ʌmbow]	[k^{h}apa õ bəɹˌmaʲk^{h}iʲõ'p^{h}ə̃mbo^{w}]	[...ə'mɛk^{h}ijʔɐ̃n'p^{h}ɐ̃mˌbow]		3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
979	paper	[ˈpejpəɹ]	[ˈpʰejpʰʌ]	[ˈpʰejˌpʰʊ]	[ˈheʲˌpʷɑ]	[ˈpʰejˌpʰʊ]	3.00	3.00
987	...crocodile	[ˈkɹakədajəɬ]	[...ˈhɑkʰɛdə]	[ˈhajkʰædə]	[ˈhaʲkʰædə]	[ˈhajkʰɛdə]		3.00
987	...crocodile	[ˈkɹakədajəɬ]	[...ˈhɑkʰɛdə]	[ˈhajkʰædə]	[ˈhaʲkʰædə]	[ˈhajkʰɛdə]		3.00
990	candle	[ˈkændəɬ]	[ˈkʰæ̃nʊ]	[ˈkænɔ]	[ˈkænʲʊl]	[ˈkʰæ̃ˌnõw]	3.00	
991	eating cookie	[ˌijtɪŋˈkʊkij]	[ajˈejtʰĩnəˈkʰijkʰij]	[ajˌẽjtĩʔʌ̃ˈkɪkʰij]	[aʲˌeʲtĩʔəˈkʲikʲiʲ]	[ʔajʔə̃ˈejtʰĩʔəˈkʰijkʰij]	3.00	3.00
993	cookie	[ˈkʊkij]	[əˈkʰɪkʰijs]	[ˈkʰɪˌkʰijs]	[ʊˈk̃ʰiˌkʰiʲs]	[əˈkʰɪˌkʰijs]	3.00	3.00
1002	airplane	[ˈɛɹˌplejn]	[ˈɛpʰ̪ejn]	[ˈɛˌpwejn]	[ˈʔæˌpʰẽʲn]	[ˈʔɛˌpʰẽjn]	3.00	
1006	doggie	[ˈdɑgij]	[ˈbijkʰˌdɑgij]	[ˈdejkˌdɑgij]	[ˈdeʲkʲˌdɑgiʲç]	[ˈbɪkʰˌdɑgij]	3.00	3.00
1006	doggie	[ˈdɑgij]	[ˈbijkʰˌdɑgij]	[ˈdejkˌdɑgij]	[ˈdeʲkʲˌdɑgiʲç]	[ˈbɪkʰˌdɑgij]	3.00	
1012	hippo like it	[ˈhɪpowˌlajkɪt]	[ʌ̃mˈpʰʌ̃ːmbowˌlajkʰɪtʰ]	[ʌ̃ˈpʰʌmbowˌlajkɪnt]	[ʌ̃ˈpʰʌmboʷˌʎaʲkɪt]	[ʔʌ̃mˈpʰʌ̃mˌbowˈlajkʰɪtʰ]	3.00	3.00
1016	green one	[ˈgɹijnwʌn]	[ˈgĩnwʌ̃n]	[ˈgɪŋˌwæn]	[ˈgɪŋˌmæn]	[ˈgɪ.uw.ˌwʌ̃n]	3.00	
1020	hippo	[ˈhɪpow]	[ˈbʌ̃ːmˌbowː]	[ˈbʌmˌbow]	[ˈmʌmˌbɔʷ]	[ˈbʌ̃mˌboːw]	3.00	3.00
1021	going ... car	[ˌgowɪŋˈkɑɹ]	[gowijn....ˈkʰɑr]	[ˌgowɪnawʔəpʰ̪ʔʌʔəˈkʰɑ]	[ˌgowɪna əpʰ̪ə̃ əˈkʰɑ]	[ˌgowijnawʔəpʰ̪ʔʌʔəˈkʰɑ]	3.00	
1021	going ... car	[ˌgowɪŋˈkɑɹ]	[gowijn....ˈkʰɑr]	[ˌgowɪnawʔəpʰ̪ʔʌʔəˈkʰɑ]	[ˌgowɪna əpʰ̪ə̃ əˈkʰɑ]	[ˌgowijnawʔəpʰ̪ʔʌʔəˈkʰɑ]	3.00	
1027	monkey drive	[ˈmʌŋkijˌdɹajv]	[ˈmɛkʰijˌdʒaj]	[ˈmækĩjˌdʒajvˀ]	[ˈmækʰiːˌdʒaʲ]	[ˈmɛkʰijˌdʒaj]		3.00
1028	hippo drive	[ˈhɪpowˌdɹajv]	[ʌ̃ʔˈpʰĩːmbowːˌdrajf]	[ɛ̃ʔəˈpømbõwĩdəʁajf]	[ɛ̃ʔˈpʊmːbõwĩdɪˌʁaʲf]	[ʌ̃ʔəˈpʰɛ̃mbowĩˌdəʁajf]	3.00	3.00
1029	hippo drive	[ˈhɪpowˌdɹajv]	[mˌˈpʰĩːmbowˌdʒajv]	[mˌˈpʰʌmˈbowə̃ˌdʒaj]	[ɛ̃ʔˈpʊmːbõʷldɪˌʁaʲ]	[mˌˈpʰɛ̃mˈbowə̃ˌdʒaj]	3.00	3.00
1035	I like cookies	[ajˈlajkˌkʊkijz]	[ɑlajˈkʰuwkʰijs]	[jælajkˀˈkʰɪʔkʰijs]	[ˈæleʲˈkʰɪʔkʰiʲs]	[ˌlalajˈkʰɪʔkʰijs]	3.00	3.00
1042	hippo ... towel ... toys	[hɪpowtɑwəɬtojz]	[əˈθĩːmbow...ˈtʰowʌ...ˈtʰɔjs]	[əˈθɪmbowəˌtʰʌwɑˈtʰojs]	õmˈtʂɪm[boʷ ʔɛˌtʰalaˈnæʲʔʊˌtʰʌwɑɛ̃ ˌʌθəzə ˌʔæ̃s ɛmpˀ ʔeˈtʰɔʲsʲ]	[əˈθĩmbow...ˈtʰʌwa...ˈtʰɔjs]	3.00	

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1042	hippo ... towel ... toys	[hɪpowtɑwəɬt ojz]	[ə'θĭ:mbow...'tʰo wʌ...'tʰɔjs]	[ə'θɪmbowə,tʰʌwɑ 'tʰojs]	õm'ʦɪm[boʷ ʔɛ ,tʰala'næʲʔʊ,tʰʌwɑ ɛ̃ ˌʌθəzə ˌʔæs ɛ mpˀ ʔe'tʰɔʲsʲ]	[ə'θĭmbow...'tʰʌw a...'tʰɔjs]		3.00
1043	monkey	['mʌŋkij]	[maj,ʧʲij]	['maj,kij]	['maʲ,ʧʲi:]	['maj,kʰij]		3.00
1047	okay	['owkej]	[ow,kʰej]	['owkʰej]	[oʷ'kʰɛʲʎ]	[ʔow'kʰej]		3.00
1048	cutting knife	['kʌtɪŋ,najf]	['kʰʌtʰə'najfwɪf]	[,kʰʌtə'nejf,wɪθ]	[,kʰʌtə'nʲaʲf,wɪθ]	['kʰʌtʰə'najfwɪf]	3.00	3.00
1058	...apple	['æpəɬ]	[....'æpʰow]	['æp,hɔ]	[....'ʔæpoʷ]	[....'ʔæpʰow]		3.00
1062	...that's a daddy one	[,ðætsə'dædij wʌn]	[...dædə'dædij,wɐ̃ n]	[dædə'dædijwʌn]	[,daʔn̩'teɾi 'dætə'dæɾiwʌn]	[...dædə'dædij,wɐ̃ n]	3.00	3.00
1063	that's a tiny one	[,ðætsə'tajnij wʌn]	[dætʰə'tʰajnij,wɐ̃n]	[,dætɛn'tʰajnijwɛn]	[,dætʊn'tʰaʲniwɛn]	[dætʰə'tʰajnij,wɐ̃n]	3.00	
1064	I wanna turn page	['ajwɑnə,tɜɹn pejd͡ʒ]	[ʌ'mɐ̃n,tʰuw:pʰejd]	[ɐ̃'mɐ̃ntʰjuwəpʰejt]	[ə'mɑnθɬuʷəpeʲtʃ]	[ɐ̃'mɐ̃n,tʰu:wpʰejd]	3.00	
1064	I wanna turn page	['ajwɑnə,tɜɹn pejd͡ʒ]	[ʌ'mɐ̃n,tʰuw:pʰejd]	[ɐ̃'mɐ̃ntʰjuwəpʰejt]	[ə'mɑnθɬuʷəpeʲtʃ]	[ɐ̃'mɐ̃n,tʰu:wpʰejd]	3.00	
1068	lot of pictures...l ook a	['lɑtəv,pɪktʃəɹ z,lʊkə]	[lɑʌpʰɪ...'lʊkʰətʰʌ]	[lɑʔɑ'pʰɪ.ɐ̃'ʃuwdĕ n'tʰɛɬ'lʌkʌ,tʰɛ]	[lɑʔɑ'pʰɪ... ə̃'ʃuʷdɛn'tʰɛɬ 'lʌkʌ,tʰɛ]	[lɑʔɑ'pʰɪʔɐ̃'ʃuwdĕ n'tʰɛ'lʊkʰʌ,tʰɛ]	3.00	
1073	oh cat, hi cat	[ow'kæt,hajk æt]	[ɐ̃'kʰætʰɐ̃'haj,kʰæt ʰ]	[ow'kʰætʰɐ̃'haj'kʰ æʔtʰ]	[,õʷ,kʰæt,ʔɐ̃'haʲkʰæ ʔtʰ]	[õ'kʰætʰɐ̃'haj,kʰæʔ tʰ]	3.00	
1073	oh cat, hi cat	[ow'kæt,hajk æt]	[ɐ̃'kʰætʰɐ̃'haj,kʰæt ʰ]	[ow'kʰætʰɐ̃'haj'kʰ æʔtʰ]	[,õʷ,kʰæt,ʔɐ̃'haʲkʰæ ʔtʰ]	[õ'kʰætʰɐ̃'haj,kʰæʔ tʰ]	3.00	
1074	cat	['kæt]	['kʰʌtʰ]	['kʰʌt]	[kʰʌtʰ]	['kʰʌtʰ]	3.00	
1077	...cat	['kæt]	[dæsə'kʰætʰ]	['kʰæt]	['đavɑ'kʰætʰ]	[,dæzə'kʰætʰ]	3.00	
1078	call phone	['kɑɬ,fown]	[ə,kʰɑɬ'fownə]	[ə,kʰɑl'ɸwownə]	[,kʰɑl'hwoʷnə]	[ə,kʰɑɬ'ɸownə]	3.00	
1084	that's a man	[,ðætsə'mæn]	[dætʰə'mæ̃n]	[dætæm̩'mæn]	[tætæm̩'mæn]	[dætʰam̩'mæ̃n]	2.00	
1085	cat	['kæt]	['kʰætʰ]	['kʰæt]	[kʰæt]	['kʰæt]	3.00	
1086	couch	['kawʧ]	[m̩'pʰɐ̃nʧ]	[m̩'pʰʌnʧ]	[m̩'pɐ̃mtʰ]	[m̩'pʰɐ̃nʧ]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1091	colour, colouring	[ˌkʌləɹˈkʌləɹɪŋ]	[ˈkʰʌləɐ̃mˌˈkʰʌlɪr̃ŋ ɪtˀ]	[ˈkʰʌlɑʔaʔə̃ˈkʰʌlʌɪˌ nĩ]	[ˈkʰʌlɑ ʔe̯ ŋˈkʰʌlʌʲɪˌnɛ̃]	[ˈkʰʌlɑʔɐ̃ʔə̃ˈkʰʌlʌ̃ˌ nɛ̃]	3.00	
1091	colour, colouring	[ˌkʌləɹˈkʌləɹɪŋ]	[ˈkʰʌləɐ̃mˌˈkʰʌlɪr̃ŋ ɪtˀ]	[ˈkʰʌlɑʔaʔə̃ˈkʰʌlʌɪˌ nĩ]	[ˈkʰʌlɑ ʔe̯ ŋˈkʰʌlʌʲɪˌnɛ̃]	[ˈkʰʌlɑʔɐ̃ʔə̃ˈkʰʌlʌ̃ˌ nɛ̃]	3.00	
1093	that's a purple	[ˌðætsəˈpɜɹpəɬ]	[ðætsəˌpʰɔrpʰʊ]	[ˌætæˈpʰʊˌpʰʊ]	[ˌʔæt̪ʂæˈpʰoˌpʰʌ]	[ˌʔætʰaˈpʰɜˌpʰʊ]	3.00	3.00
1097	that's a blue and a purple	[ðætsəˌbluwɛndəˈpɜɹpəɬ]	[ˈdætʰəbluwæ̃nəˈpʰɔrpʰʌ]	[əˈdætʰʌˌbuwənəˈbuwpə]	[ˌməmə əˈdætʰʌˌbuːənənˈpupə]	[əˈdætʰʌˌbuwə̃nəˈbɔpʰʌ]	2.00	3.00
1098	...a cat, a boy	[əˌkætʔəˈboj]	[...əˈkʰætʰəˈbɔjʌ]	[əˈkʰæpʰʔɐ̃ˈbojɑ]	[əˈkʰæpʰə əˈborʲɑh]	[...əˈkʰætʰəʔɐ̃ˈbɔjʌ]	3.00	
1098	...a cat, a boy	[əˌkætʔəˈboj]	[...əˈkʰætʰəˈbɔjʌ]	[əˈkʰæpʰʔɐ̃ˈbojɑ]	[əˈkʰæpʰə əˈborʲɑh]	[...əˈkʰætʰəʔɐ̃ˈbɔjʌ]	3.00	
1103	little baby	[ˌlɪtəɬˈbejbij]	[ɬejˈbijbij]	[ˌlejˈbijbij]	[leˈpiʲpi]	[ˌlejˈbijbij]	2.00	2.00
1106	baby	[ˈbejbij]	[ˈbejbij]	[ˈbejbij]	[ˈpeʲpi]	[ˈbejbij]	2.00	2.00
1107	diaper	[ˈdajpəɹ]	[ˈtʰɛpʰɛkʰ]	[ˈtʰɛpe]	[ˈtʰɛpɛk]	[ˈtʰɛpɛʔ]	3.00	3.00
1109	high chair	[ˈhajˌtʃɛɹ]	[ɳˈdætʰˌʤɜr]	[ɳˈdɛtʰɪˌdɛ]	[nˈdɛtʰˌʧɛəˎ]	[ənˈdætʰɪˌdɛ.ə]	3.00	
1111	...man cooking	[ˌmænˈkʊkɪŋ]	[...ˈmæ̃nˈkʰʊkʰijn]	[ˌmænɐ̃ˈkʰʌkɪŋə]	[mæn ə ʊ̃ˈmænʌmˈkʰukʰɪŋ ə]	[...ˌmænɐ̃ˈkʰʊkʰɪŋə]	3.00	3.00
1124	carrot	[ˈkɛɹət]	[ˈkʰɛrwɛ]	[ˈkʰɛˌvæ]	[ˈkʰɛjˌvæ]	[ˈkʰɛˌvæ]	3.00	
1129	apple	[ˈæpəɬ]	[ˈætʰæbɑ]	[ˈætʰætæt̚]	[ˈætæpæʔ]	[ˈʔætʰæbæʔ]		1.00
1131	mango	[ˈmæŋgow]	[ˈmejgow]	[ˈmɛgow]	[mɛˈgoʷ]	[ˈmɛ̃gow]		
1132	that	[ˈðæt]	[ɳˌdæ]	[ɳˈðæ]	[uʷˈdæʷ]	[ɳˈdæ]	2.00	
1133	cracker,cheese, ice cream	[ˌkɹækəɹˌtʃijzˈʔajskɹijm]	[dætəˈkʰɔrkʰɐ̃dætəˈʧijʌejkʰij]	[dæta'kʰɔkətædən'ʧijəˈɪkʰij]	[ˈkʰɔkəːˈtætənˈʧiːəːˈʔijkʰiːʲ]	[dætʰaˈkʰɔkʰɐ̃ˌdædənˈʧijʔʌˌɪkʰij]	3.00	3.00
1136	putting that	[ˌpʊtɪŋˈðæt]	[ɱˌpʰɪdɛ̃nˈdætʰ]	[ɱˌpʰɪtʰɛnˈdæd]	[ɱˌpʰetənˈdæt̪n]	[ɱˌpʰɪtʰɛ̃nˈdæd]	3.00	2.00
1137	spoon cook	[spuwnˈkʊk]	[əˈpʰuwnɛ̃nkʰʊ]	[ˌpʰuwənˈkʰʊkə]	[ˈpʰuʷənˈkʰʊkˀ]	[əˈpʰuwɛ̃nˈkʰʊkə]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1137	spoon cook	[spuwn'kʊk]	[ə'pʰuwnɛ̃nkʰʊ]	[ˌpʰuwən'kʰʊkə]	['pʰuʷən'kʰʊk˺]	[ə'pʰuwɛ̃n'kʰʊkə]	3.00	
1141	clock	['klɑk]	['kʰɑkʰ]	['kʰɑk]	[kʰɑk]	['kʰɑkʰ]	3.00	
1146	that's a baby and thats' a lady	[ðætsəˌbejbijɛ ndðætsə'lejdij]	['ðæsɑbejbijĩnðæs ə'lejdij,kʰɻɪkʰɪtʰ]	[ˌæsæ'bejbijə̃,tæs æˌlejdij'kɹɪkət]	[ˌθætə'beʲbi ʔɪ ˌtætæˌleʲdi 'kwiket]	[ˌðæsɑ'bejbijʔə̃tʰæ sə'lejdij'kʰɹɪkʰɪtʰ]	3.00	3.00
1146	that's a baby and thats' a lady	[ðætsəˌbejbijɛ ndðætsə'lejdij]	['ðæsɑbejbijĩnðæs ə'lejdij,kʰɻɪkʰɪtʰ]	[ˌæsæ'bejbijə̃,tæs æˌlejdij'kɹɪkət]	[ˌθætə'beʲbi ʔɪ ˌtætæˌleʲdi 'kwiket]	[ˌðæsɑ'bejbijʔə̃tʰæ sə'lejdij'kʰɹɪkʰɪtʰ]		3.00
1147	dada	['dædæ]	[m̩'dædɛ]	[ʌm'dædæ]	[ʌm'dætæ]	[ɐ̃m'dæda]	3.00	2.00
1149	that's a ... purple	[ˌðætsə'pɜɹpəɬ]	['ðæsʌ...'pʰɔrpʰʌ]	[ˌdætshʊˌdæteɴ'pʰ ʊpʰwʌ]	[ˌdæθʊˌðæteɴ'pʰʊp ʰəʷ]	[ˌðætshɐ̃ˌdætʰɛn'pʰ ɔpʰwʌ]	3.00	3.00
1154	apple	['æpəɬ]	['æpʰow]	['æpʰow]	['æpʰɬ]	['ʔæpʰow]		3.00
1167	cat	['kæt]	['kʰætʰ]	['kʰæt]	[kʰæt]	['kʰætʰ]	3.00	
1179	clothes	['klowðz]	[kʰɪ'kʰʊds]	['kʰʌ.əd]	[ki'kʰɔəd˺t]	['kʰʌ.əd]	3.00	
1181	airplane	['ɛɹˌplejn]	['ɛpʰejlə]	['ɛ̃ˌplɛ̃jʌ]	['ʔɛˌpʰejl]	['ʔɛ̃ˌpʰɛ̃jlə]	3.00	
1186	cats	['kæt]	['kʰætʰ]	['kʰæt]	[kʰæt̪ʰ]	['kʰæt˺]	3.00	
1189	peacock	['pijˌkɑk]	['pʰejˌkʰɑkʰ]	['pʰejˌkʰɑkʰ]	['pʰeʲˌkʰɑkʰ]	['pʰejˌkʰɑkʰ]	3.00	3.00
1196	whiskers	['wɪskəɹz]	[ɪʔˌtʰɛ]	['ɪʔˌkʰɛ]	['ek˺ˌtʰɛ]	[ʔɪk˺'tʰɛ]	3.00	
1202	purple	['pɜɹpəɬ]	[m̩'pʰʌpʰʌ]	[m̩'pʰʊpʊ]	[mː'pʰʊpʰʊ]	[m̩'pʰʌpʰɔ]	3.00	3.00
1204	slippers	['slɪpəɹz]	['tʃɪpʰɛ]	[ʃɪ'pʰɛ̃]	[ʧɪ'pʰɛ]	['tʃɪpʰɛ]		3.00
1206	cat too	['kætˌtuw]	[əˌkʰæ'tʰuw]	[ʌ'kʰæˌtʰuw]	[əkʰæ'tʰuː]	[əˌkʰæ'tʰuw]	3.00	
1206	cat too	['kætˌtuw]	[əˌkʰæ'tʰuw]	[ʌ'kʰæˌtʰuw]	[əkʰæ'tʰuː]	[əˌkʰæ'tʰuw]	3.00	
1207	cat hair	['kætˌhɛɹ]	['kʰæt˺ɐ̃ʔˌhaw]	[ˌkʰætʌʔ'haw]	[ˌkʰæt˺ ʔʌʔ'haʷ]	['kʰæt˺ʔɐ̃'haw]	3.00	
1217	rabbit	['ɹæbɪt]	[ə'ræpʰʌtʰ]	[ʌ'wæpʰɛtʰ]	[ʌ'ɹæpʰætθ]	[ə'wæˌpʰʌtʰ]		3.00
1219	piggy too	['pɪgijˌtuw]	[ə'pʰɪgijˌtʰuw]	[ʌˌpʰɪgij'ˌtʰuw]	[ʌˌpʰɪgi'tʰuʷ]	[ə'pʰɪgijˌtʰuw]	3.00	3.00
1219	piggy too	['pɪgijˌtuw]	[ə'pʰɪgijˌtʰuw]	[ʌˌpʰɪgij'ˌtʰuw]	[ʌˌpʰɪgi'tʰuʷ]	[ə'pʰɪgijˌtʰuw]	3.00	
1220	Cathy, a horse	[ˌkæθijʔə'hɔɹs]	[əˌkʰæʃijɐ̃ə'hɔjs]	[ʌˌkʰæʃijʔʌʔʌ'hojs]	[ʌˌkʰæθiʔʌʔʌ'hoʲʃʲj]	[əˌkʰæʃijʔɐ̃ʔə'hɔjs]	3.00	
1225	guitar	[gə'taɹ]	[gɛ'tʰɑ]	[gʌ'tʰɑː]	[gɛ'tʰɑː]	[gɛ'tʰɑ]	3.00	3.00
1227	comb mama	['kowmˌmama]	['kʰʌmajˌhow]	[kʰajˌmajˌ'hɑ]	[kʰæʲˌmɑ̃nɛ̃'kʰɑː]	[ˌkʰʌj'majˌhɔ]	3.00	

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1236	corn	[ˈkɔɹn]	[ˈkʰɑ̃n]	[ˈkʰɔn]	[kχɔn]	[ˈkʰɔ̃n]	3.00	
1238	apple	[ˈæpəɬ]	[ˈʌpʰʊ]	[ˈʌpɔ]	[ˈʔæpʰoʷ]	[ˈʌpʰɔ]		3.00
1239	mm, potato	[m̩pəˈtejtow]	[m̩ˈtʰejdow]	[m̩ˈtʰejdow]	[mːˈtʰeʲˌdoʷ]	[m̩ˈtʰejdow]	3.00	3.00
1245	guitar	[gəˈtaɹ]	[ˈtʰɑː]	[ˈtʰɑː]	[tʰɑː]	[ˈtʰɑː]	3.00	
1250	piggy	[ˈpɪgij]	[ˈpʰɪgijʃ]	[ˈpʰɪgijʂ]	[ˈpʰɯgiʂ]	[ˈpʰɪgijʂ]	3.00	3.00
1253	cat	[ˈkæt]	[ˈkʰætʰ]	[ˈkʰætʰ]	[kʰætʰ]	[ˈkʰætʰ]	3.00	
1257	my working on a tie-dye	[maj˛wɜɹkɪŋɑn əˈtaj˛daj]	[...majwɪrkʰ͡ɪŋɑ̃nəˈtʰajdaj]	[˛majnwʊkɪnɑnˈtʰajdaj]	[˛maʲnwʊkɪmənəˈtʰaʲdaʲ]	[˛mãjwɜkʰ͡ijnɑ̃nɜ̆ˈtʰajdaj]	3.00	3.00
1257	my working on a tie-dye	[maj˛wɜɹkɪŋɑn əˈtaj˛daj]	[...majwɪrkʰ͡ɪŋɑ̃nəˈtʰajdaj]	[˛majnwʊkɪnɑnˈtʰajdaj]	[˛maʲnwʊkɪmənəˈtʰaʲdaʲ]	[˛mãjwɜkʰ͡ijnɑ̃nɜ̆ˈtʰajdaj]		3.00
1263	apple	[ˈæpəɬ]	[ˈæpʰow]	[ˈæpʰow]	[ˈæpʰoʷ]	[ˈʔæpʰow]		3.00
1264	piggy come	[ˈpɪgijkʌm]	[˛pʰɪgijˈkʰɑ̃mnɑ]	[ˈpʰɪgij˛kʰʌmə]	[ˈpʰɪgi˛kʰʌmmə]	[˛pʰɪgijˈkʰɑ̃mna]	3.00	3.00
1264	piggy come	[ˈpɪgijkʌm]	[˛pʰɪgijˈkʰɑ̃mnɑ]	[ˈpʰɪgij˛kʰʌmə]	[ˈpʰɪgi˛kʰʌmmə]	[˛pʰɪgijˈkʰɑ̃mna]	3.00	
1265	carrots	[ˈkɛɹəts]	[ˈkʰɛræ]	[ˈkʰɛwæʔ]	[ˈkʰɛɹæʔ]	[ˈkʰɛɹæʔ]	3.00	
1266	...my working	[˛majˈwɜɹkɪŋ]	[...majwʊrkʰ͡ɪŋ...]	[ˈmajwʊkɪn]	[maʲwʊkɪn...]	[...ˈmajwʊkʰ͡ɪnə]		3.00
1269	my working	[majˈwɜɹkɪŋ]	[ˈmajwʊrkʰ͡ɪŋ...]	[majˈwʊkɪŋ]	[maʲˈwʊkiŋ ˈtæræ]	[majˈwʊkʰ͡ɪŋ]		3.00
1270	birdies	[ˈbɜɹdijz]	[ˈbʌdijz]	[ˈbʌdejz]	[ˈmɑdeʲʃ]	[ˈbʌdejz]	3.00	3.00
1271	apples	[ˈæpəɬz]	[ˈæpʰɔjz]	[ˈæpʌjz]	[ˈæpɔʲsʲ]	[ˈʔæpʰɔjs]		3.00
1272	chicken	[ˈtʃɪkən]	[ˈtʃɪkʰijn]	[ˈtʃɪkijn]	[ˈtʃikiŋ]	[ˈtʃɪʔkʰijn]		3.00
1277	cat	[ˈkæt]	[ˈkʰætʰ]	[ˈkʰæːt]	[kʰætʰ]	[ˈkʰætˈ]	3.00	
1281	Cathy	[ˈkæθij]	[əˈkʰætʰij]	[ˈkæɬij]	[kʰæθɬi]	[əˈkʰæʈij]	3.00	
1283	two rabbits	[tuwˈɹæbɪts]	[tʰuwʔˈræbɛtʰ]	[tʰuwʔˈwæbɛt]	[tʰuʔˈwæˌbɛtʰ]	[tʰuwʔˈwæbɛtˈ]	3.00	3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1292	turtle	[ˈtɜɹtəɬ]	[ˈtʰɪɾtʰəɬ]	[ˈtʰʊˌtow]	[ˈtʰɔˌtʰɔʷ]	[ˈtʰʊˌtʰow]	3.00	3.00
1300	piggy	[ˈpɪgij]	[ˈpʰɪgij]	[ˈpɪgij]	[ˈpɪgɪd̚]	[ˈpʰɪgij]	3.00	3.00
1301	piggy	[ˈpɪgij]	[pʰɪːgijː]	[ˈpʰɪˌgij]	[ˈpʰɪˌgiː]	[ˈpʰɪgiːj]	3.00	3.00
1307	knife	[ˈnajf]	[kʰəˈnajf]	[kəˈnajf]	[kˈnaʲf]	[kʰəˈnajf]	3.00	
1325	no want that kind	[nowˈwantðæ tˌkajnd]	[nowɑˈdæˌkʰajn]	[nowɑˈdæʔkʰajn]	[noʷɑˈdæʔˌkʰaʲn]	[nowɑˈdæʔkʰajn]	3.00	
1329	I want ... a popsicle	[ajˌwantəˈpɑp səkʌɬ]	[ʌwə̃...əˈpʰɑkʰʌ]	[awə̃.ajwɑntʰɛdədtʰə̰.ɛðəʔɛnˈpʰɑˌkʰɑ]	[ɑwən aˈwɑ̃tʰɛɾedtʰ ɛ̃nə̃ æˈpʰɑˌkʰɑ]	[ʌwə̃ʔawɑ̃tʰɛdədtʰə̰ʔɛðəʔɛnˈpʰɑˌkʰʌ]	3.00	3.00
1331	want popsicle on my plate	[wantˈpɑpsək ʌɬɑnmajˌplejt]	[ʌnˌpʰɑkʰəĩnmajˈpʰajtʰ]	[ə̃ˈpɑkə.ə̃majˈpʰajt]	[ə̃ˈpɑkənəmaʲˈpʰaʲt̪s]	[ə̃ˌpʰɑkʰəʔĩmajˈpʰajtʰ]	3.00	3.00
1331	want popsicle on my plate	[wantˈpɑpsək ʌɬɑnmajˌplejt]	[ʌnˌpʰɑkʰəĩnmajˈpʰajtʰ]	[ə̃ˈpɑkə.ə̃majˈpʰajt]	[ə̃ˈpɑkənəmaʲˈpʰaʲt̪s]	[ə̃ˌpʰɑkʰəʔĩmajˈpʰajtʰ]	3.00	
1340	and corn pie	[ɛndˈkɔɹnˌpaj]	[æ̃nˌkʰɔrnˈpʰaj]	[ə̃ˌkʰowmˈpʰaj]	[kʊmˈpʰaʲ]	[æ̃nəˌkʰə̃mˈpʰaj]	3.00	
1340	and corn pie	[ɛndˈkɔɹnˌpaj]	[æ̃nˌkʰɔrnˈpʰaj]	[ə̃ˌkʰowmˈpʰaj]	[kʊmˈpʰaʲ]	[æ̃nəˌkʰə̃mˈpʰaj]	3.00	
1341	my cooking	[majˈkʊkɪŋ]	[ˈmajkʰʊˌkʰɛ̃n]	[mˌˈmajkʊˌkɛn]	[mːˈmaʲkʰʊˌkʰɛn]	[əˈmajkʰʊˌkʰɛ̃n]	3.00	3.00
1345	potato	[pəˈtejtow]	[ˈtʰejdow]	[ˈtʰejdow]	[ˈtʰeʲˌdoʷ]	[ˈtʰejdow]	3.00	3.00
1346	...cook a duck	[ˌkʊkəˈdʌk]	[ˌkʰʊkəˈdækʰ]	[ˌkʰʊkəˈdakʰ]	[wʊtəderiˌkʰʊkæˈdak̚]	[ˌkʰʊkʰəˈdækʰ]	3.00	
1346	...cook a duck	[ˌkʊkəˈdʌk]	[ˌkʰʊkəˈdækʰ]	[ˌkʰʊkəˈdakʰ]	[wʊtəderiˌkʰʊkæˈdak̚]	[ˌkʰʊkʰəˈdækʰ]	3.00	
1347	cook a chicken	[ˌkʊkəˈʧɪkən]	[əˈkʰʊkʰəˌʧɪkʰ̃ĩn]	[ʌˌkʰʌkʰəˈʧɪkĩjn]	[əˌkʰʊkʰəˈʧɪkĩː]	[əˈkʰʊkʰəˌʧɪkʰ̃ĩn]	3.00	3.00
1348	cook a chicken	[ˌkʊkəˈʧɪkən]	[ə̃ˈkʰʊkʰəˈʧɪkʰ̃ĩn]	[ˌkʰʊkəˈʧɪkɪn]	[ˌkʰoʷkˈ̚ʔəˈʧɪken]	[ə̃ˈkʰʊkʰəˈʧɪkʰ̃ĩn]	3.00	3.00
1349	cook a chicken	[ˌkʊkəˈʧɪkən]	[əˌkʰʊkʰəˈʧɪkʰ̃ĩnʊˈwə̃n]	[ʌˌkʰʌkəˈʧɪkɪnə]	[ʌˌkʰʌkəˈʧɪkɪnə]	[əˌkʰʊkʰəˈʧɪkʰ̃ĩnəˈwə̃n]	3.00	3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1357	...they're eating their food	[ðɛɹˌʔijtɪŋðɛɹˈfuwd]	[ðɪrijdĩŋðɪrˈfuwdə]	[dejˌijɾɪŋdəˈfuwdə]	[ðeʲˌiɾɪŋgeʲˈfuʷdə]	[ðɪʔijdĩŋðɪˈfuwdə]	3.00	
1383	turtle	[ˈtɜɹtəɬ]	[ˈtʰɪrtʰʌ]	[ˈtʰʊˌtʰɑ]	[ˌtʰʊˈtʰɑ]	[ˈtʰʊˌtʰʌ]	3.00	3.00
1389	doggie, mom read that	[ˌdɑgij,mɑmˈridðæt]	[dɑgijˈmɑ̃mwij,dæ]	[ˌdɑgijəˈmɑɹij,dæ]	[ˌdɑːgijɪˈmɑɹiˌdætˀ]	[ˌdɑgijəˈmɑ̃ɹij,dæ]	3.00	3.00
1395	birdies	[ˈbɜɹdijz]	[ˈbʊdij]	[ˈbʊˌdij]	[ˈbɔˌdiʲə]	[ˈbʊˌdij]	3.00	3.00
1397	tractor	[ˈtɹæktəɹ]	[ˈkʰɑtʃ̃ʌm]	[ˈkʰætʃʌm]	[ˈkʰætʃʌm]	[ˈkʰɑtʃ̃ʌm]	3.00	
1405	no my take knife	[nowˈmajtejk, najf]	[nowˈmajtʰɛkʰˌnajf]	[nowˈmajətʰɛkʰˌn̩nejf]	[noʷˈmaʲɪ tʰɛkʰˌnɪːɛʲf]	[nowˈmajətʰɛkʰˌnejf]	3.00	
1406	piggy, two piggy	[ˌpɪgijˈtuwpɪgij]	[ˈpʰɪgijtʰuwˌpʰijgij]	[ˈpʰɪgijtʰuwˌpʰijgij]	[ˈpʰigitʰuʷˌpʰigi;]	[ˈpʰɪgijtʰuwˌpʰijgij]	3.00	3.00
1406	piggy, two piggy	[ˌpɪgijˈtuwpɪgij]	[ˈpʰɪgijtʰuwˌpʰijgij]	[ˈpʰɪgijtʰuwˌpʰijgij]	[ˈpʰigitʰuʷˌpʰigi;]	[ˈpʰɪgijtʰuwˌpʰijgij]	3.00	3.00
1408	carrots	[ˈkɛɹəts]	[ˈkʰɛrets]	[ˈkʰɛɹɛts]	[ˈkʰɐˌɹɛts]	[ˈkʰɛɹɛts]	3.00	
1424	elbow	[ˈɛɬbow]	[ˈæbow]	[ˈæbow]	[ˈæbo]	[ˈʔæbow]		3.00
1433	a guitar, guitar	[agəˈtaɹgəˌtaɹ]	[ðægəˈtʰɑːrgæˈbɑ]	[ɛgɪˈtʰɑːgɛˌtʰɑː]	[dɛgɪˈtʰɑːdɛˌgɑː]	[ðægəˈtʰɑːˌgɛˈdɑ]	3.00	2.00
1433	a guitar, guitar	[agəˈtaɹgəˌtaɹ]	[ðægəˈtʰɑːrgæˈbɑ]	[ɛgɪˈtʰɑːgɛˌtʰɑː]	[dɛgɪˈtʰɑːdɛˌgɑː]	[ðægəˈtʰɑːˌgɛˈdɑ]	3.00	3.00
1434	peacock	[ˈpijkɑk]	[ˌpʰiˈkʰɑːkʰ]	[ˈpʰijˌkʰɑkʰ]	[ˈkiˌkʰɑkʰ]	[ˈpʰijˌkʰɑkʰ]	3.00	3.00
1436	wheelbarrow	[ˈwijɬˌbɛɹow]	[ˈwijbəˌlow]	[ˈwijbʌ.ow]	[ˈwiboˌoʷ]	[ˈwijbʌ.ow]		3.00
1444	kids like toast	[ˈkɪdzlajkˌtowst]	[ˈkʰɪdəˈlajkˀˌtʰows]	[ˌkʰɪdəˈlajkˀˈtʰows]	[ˌkʰerəˈlaʲkˀˈtʰoʷeʔ]	[ˈkʰɪdəˈlajkˀˌtʰows]	3.00	
1444	kids like toast	[ˈkɪdzlajkˌtowst]	[ˈkʰɪdəˈlajkˀˌtʰows]	[ˌkʰɪdəˈlajkˀˈtʰows]	[ˌkʰerəˈlaʲkˀˈtʰoʷeʔ]	[ˈkʰɪdəˈlajkˀˌtʰows]	3.00	
1445	kids like toast	[ˈkɪdzlajkˌtowst]	[kʰɪdˈlajkˀˌtʰows]	[kʰɪdˈlajktʰows]	[kʰedˈlaktʰoʷs]	[kʰɪdˈlajkˀˌtʰows]	3.00	
1445	kids like toast	[ˈkɪdzlajkˌtowst]	[kʰɪdˈlajkˀˌtʰows]	[kʰɪdˈlajktʰows]	[kʰedˈlaktʰoʷs]	[kʰɪdˈlajkˀˌtʰows]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1448	doggies	[ˈdɑgijz]	[ˈdɑgijæ]	[ˈdɑgija]	[ˈdɑkijæ]	[ˈdɑgija]	3.00	3.00
1450	potato	[pəˈtejtow]	[ənʊˈtʰejːdow]	[ˈtʰejdow]	[ˈtʰæʲdoʷ]	[ənʊˈtʰeːjdoːw]	3.00	3.00
1457	Cathy	[ˈkæθij]	[ˈkʰæːtʃij]	[ˈkætʃɪ]	[ˈqætʃɪ]	[ˈkʰætʃij]	3.00	
1460	potato	[pəˈtejtow]	[ˈtʰejdow]	[ˈtʰejdʌ]	[ˈtʰædoʷ]	[ˈtʰejdow]	3.00	3.00
1461	give it mom, to Cathy	[gɪvɪt.tuw,mɑmtuwˈkæθij]	[ʌ̃gevɪəˈmɑ̃mdəˈkʰæːtʰij]	[gɪʊə,mã.əˈkætijə]	[əˈgevaˈmãː ʔəˈkʰæʲθji]	[ʌ̃gɛvɪ.əˈmɑ̃ʔəˈkʰæs.tʰijə]	3.00	3.00
1461	give it mom, to Cathy	[gɪvɪt.tuw,mɑmtuwˈkæθij]	[ʌ̃gevɪəˈmɑ̃mdəˈkʰæːtʰij]	[gɪʊə,mã.əˈkætijə]	[əˈgevaˈmãː ʔəˈkʰæʲθji]	[ʌ̃gɛvɪ.əˈmɑ̃ʔəˈkʰæs.tʰijə]	3.00	
1462	give it Cathy	[,gɪvɪtˈkæθij]	[ˈgɪvɪˈkʰætʃij]	[ˈgɪvə,kætij]	[ˈgeðəˈkʰætʲji]	[ˈgɪvɪˈkʰætʰij]	3.00	3.00
1462	give it Cathy	[,gɪvɪtˈkæθij]	[ˈgɪvɪˈkʰætʃij]	[ˈgɪvə,kætij]	[ˈgeðəˈkʰætʲji]	[ˈgɪvɪˈkʰætʰij]	3.00	
1478	a rabbit	[əˈɹæbɪt]	[əˈræbɛtʰ]	[ʌdˈwæbɪt]	[æˈgɹæ,vetʰh]	[ədˈɹæbɛtʰ]		3.00
1480	airplane	[ˈɛɹ,plejn]	[ˈɛr,pʰej]	[ˈɛpʰejn]	[ˈæpʰʷẽj]	[ˈʔɛ,pʰẽj]		3.00
1483	airplane	[ˈɛɹ,plejn]	[ɪr,pʰejn]	[ˈhʌ̃pʰejn]	[pə̃-pfʷəj]	[ˈhɜ,pʰẽj]		3.00
1494	heart	[ˈhɑɹt]	[ˈkʰɔrɛ]	[ˈkʰʊ.ɪ]	[ˈkʰoɛ]	[ˈkʰɔ.ɛ]	3.00	
1504	pig	[ˈpɪg]	[ˈpʰɪtʰ]	[ˈpɪk]	[pɪkʰ]	[ˈpʰɪkʰ]	3.00	
1507	that guy ... purple	[ˈðætgaj,pɜɹpəɫ]	[dæˈgajːɛtˈʔõn,pʰɪrpʰɫ]	[dætˈgʌjəʔʌ̃ʔ,pʰʊpʰə]	[datˈgʊaj ʔɛʔə ʔ pɵə-pʰəʷ]	[dæˈgajʔɛtˈʔõn,pʰɜɹpʊ]	3.00	
1511	...somebody coming sit down	[sʌmbɑdijˈkʌmɪŋsɪt,dawn]	[ˈmɑ̃mijɛæ̃nd,sʌ̃mbʌrijˈkʰʌ̃mijnæ̃nʃijˈdawn]	[,sʌmbajˈkʌmɪnə̃sɪˈdawn]	[ˈmami ʔə ʔə ˈθʌ̃mbər̥i kʰʌmɪnətʲidʌʷn]	[ˈmɑ̃mijʔɛʔæ̃ndə,sʌ̃mbʌ.ijˈkʰʌ̃mijnæ̃nʃijˈdawn]	3.00	
1511	...somebody coming sit down	[sʌmbɑdijˈkʌmɪŋsɪt,dawn]	[ˈmɑ̃mijɛæ̃nd,sʌ̃mbʌrijˈkʰʌ̃mijnæ̃nʃijˈdawn]	[,sʌmbajˈkʌmɪnə̃sɪˈdawn]	[ˈmami ʔə ʔə ˈθʌ̃mbər̥i kʰʌmɪnətʲidʌʷn]	[ˈmɑ̃mijʔɛʔæ̃ndə,sʌ̃mbʌ.ijˈkʰʌ̃mijnæ̃nʃijˈdawn]	3.00	
1511	...somebody coming sit down	[sʌmbɑdijˈkʌmɪŋsɪt,dawn]	[ˈmɑ̃mijɛæ̃nd,sʌ̃mbʌrijˈkʰʌ̃mijnæ̃nʃijˈdawn]	[,sʌmbajˈkʌmɪnə̃sɪˈdawn]	[ˈmami ʔə ʔə ˈθʌ̃mbər̥i kʰʌmɪnətʲidʌʷn]	[ˈmɑ̃mijʔɛʔæ̃ndə,sʌ̃mbʌ.ijˈkʰʌ̃mijnæ̃nʃijˈdawn]		3.00

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1512	mama is cooking	[ˌmamaʔɪzˈkʊ kɪŋ]	[ˌmãməĩnˈkʰʊkʰĩŋ]	[ˌmɑmɑ̃ˈkʰʊkʰijŋ]	[ˈmama ʔe ˈkʰukʰiŋ]	[ˌmãməʔĩnˈkʰʊkʰĩj nə]	3.00	3.00
1513	...mama cooking, somebody eat to	[mama,kʊkɪŋ,s ʌmbɑdij'ʔijt.t uw]	[ˈmãmijtʰejẽnʌː,m ãmijˈtʰɛkʰɪtˀʌʒ̃ʌ̃m bʌrijʌijˈtʰuw]	[mɑmɛtʰijkʰə.əsʌ mˈbɑdijə̃.ə̃ʔij,tʰuw]	['mami tʰə ə̃ ə ˈmamie,tʰɪʲkə ˌʦʌmbarieˈɛʲtˀ,tʰu]	[ˈmãmijtʰejʔẽnʌː, mãmijˈtʰɛkʰɪtˀʌʒ̃ʌ̃ mbʌ.ijʔʌ̃ʔijˈtʰuw]	3.00	3.00
1513	...mama cooking, somebody eat to	[mama,kʊkɪŋ,s ʌmbɑdij'ʔijt.t uw]	[ˈmãmijtʰejẽnʌː,m ãmijˈtʰɛkʰɪtˀʌʒ̃ʌ̃m bʌrijʌijˈtʰuw]	[mɑmɛtʰijkʰə.əsʌ mˈbɑdijə̃.ə̃ʔij,tʰuw]	['mami tʰə ə̃ ə ˈmamie,tʰɪʲkə ˌʦʌmbarieˈɛʲtˀ,tʰu]	[ˈmãmijtʰejʔẽnʌː, mãmijˈtʰɛkʰɪtˀʌʒ̃ʌ̃ mbʌ.ijʔʌ̃ʔijˈtʰuw]	3.00	
1526	carrots	[ˈkɛɹəts]	[əˈkʰɛrɛtʰ]	[ˈkɛvɛts]	[ˈkʰe,vetθ]	[əˈkʰɛvɛtʰ]	3.00	
1528	wagon	[ˈwægɪn]	[ˈwɛgĩn]	[ˈwægɪn]	[ˈmægen]	[ˈwægĩn]		3.00
1537	I wanna... Bean in blanket	[ajwɑnəˈbijnɪ n,blæŋkət]	[ʌˈwãnəbijndɪblɛ̃ŋ kʰɪtʰbɛ̃nĩn,bɛ̃ŋkʰɛ̃n tˀ]	[ˈawənəˈbɛŋgə,bw ejkejˈbɛ̃jkɪn]	[ˈaʷənəˈbɛŋgɪ,bʷeʲ kɪt eːʲˈbɛ̃nkɪŋ]	[ʌˈwãnəbĩŋdɪbwɛ̃ ŋkʰɪtʰʔɛ̃nĩ,bɛ̃ŋkʰɛ̃n tˀ]	3.00	3.00
1537	I wanna... Bean in blanket	[ajwɑnəˈbijnɪ n,blæŋkət]	[ʌˈwãnəbijndɪblɛ̃ŋ kʰɪtʰbɛ̃nĩn,bɛ̃ŋkʰɛ̃n tˀ]	[ˈawənəˈbɛŋgə,bw ejkejˈbɛ̃jkɪn]	[ˈaʷənəˈbɛŋgɪ,bʷeʲ kɪt eːʲˈbɛ̃nkɪŋ]	[ʌˈwãnəbĩŋdɪbwɛ̃ ŋkʰɪtʰʔɛ̃nĩ,bɛ̃ŋkʰɛ̃n tˀ]	3.00	
1538	blanket	[ˈblæŋkət]	[ˈbrejkʰɪtʰ]	[ˈbwejkɪn]	[bɹɛʲkĩθ]	[ˈbwejkʰɪn]		3.00
1546	walking ... Bean	[ˌwɑkɪŋˈbijn]	[ˈwɑkijnãnɑːbijn]	[ˈwækɪnə̃ʔə,bijn]	[ˈwɔkɪŋʌ,ʔhʌˈbĩŋ]	[ˈwɑkʰijnə̃ʔɑːbijn]	3.00	3.00
1548	turtle	[ˈtɜɹtəɬ]	[ˌʌˈtʰɔrtʰɪɬ]	[ʌʔˈtʰʊtʰə]	[ʊ̃ ʈɔ[ʰɬa]	[ˌʌˈtʰɔtʰɪ]	3.00	3.00
1566	can't find cow	[ˌkæntfajndˈk aw]	[ˌkʰæ̃ntʰfajnˈhaw]	[kæ̃nfã̄jˈhaw]	[ˌkʰæ̃rˈfaj̃ ˈhaʷ]	[ˌkæ̃.fã̄jˈhaw]	3.00	
1586	Cathy ... too	[ˈkæθij,tuw]	[ʊlɑːˈkʰæʔijðæwɑˈ tʰuw]	[ˌkæʔij...ˈtʰuw]	[ˈhæθʲi ... tʰuʷ]	[ˌkʰæʔij...ˈtʰuw]	3.00	
1586	Cathy ... too	[ˈkæθij,tuw]	[ʊlɑːˈkʰæʔijðæwɑˈ tʰuw]	[ˌkæʔij...ˈtʰuw]	[ˈhæθʲi ... tʰuʷ]	[ˌkʰæʔij...ˈtʰuw]	3.00	
1592	country	[ˈkʌntɹij]	[ˈowhɪrkʰɤ̃ntʃij]	[ˈkʌntʃij]	[ˈaɔʷ ˌkənˈʧʲiʲ]	[ˈkʰɤ̃ntʃij]	3.00	
1604	that's a cow	[ˌðætsəˈkaw]	[ˈðætəˌkʰawː]	[ˈdætʰəˌkaw]	[ˈʔætsəkʰɑː]	[ˈðætəˌkʰaw]	3.00	
1616	can't find my spoon	[kant,fajndma j'spuwn]	[ˌkʰɛ̃nˈfwajmajsm uw]	[kʰæ̃ˈfã̄jmajmuw]	[kʰæˠfã̄jmaʲˌspʷu]	[ˌkʰɛ̃ˈfwajmajsmu w]	3.00	
1625	o.k.	[ˈowkej]	[owˈkʰej]	[owˈkʰej]	[ʔoˈkʰeʲh]	[owˈkʰej]		3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1642	cutting	[ˈkʌtɪŋ]	[ˈkʰʌtʰijn]	[ˈkʌtʰɪnə]	[ˈkʌˌtiŋ̩]	[ˈkʰʌtʰijn]	3.00	3.00
1643	haircut	[ˈhɛɹkʌt]	[ˈhɛrkʰɛtʰ]	[ˈhækʌtʰ]	[ˈhæʲk̟ʰætʰ]	[ˈhɛkʰætʰ]	3.00	
1647	windy	[ˈwɪndij]	[əwĩnˈdij]	[əˈwɪndijə]	[ˈõnˈdih]	[əwĩnˈdij]		3.00
1654	baby chicks	[ˌbejbijˈtʃɪks]	[ˌbejbijˈtʃɪks]	[ˌbejbijˈtʃɪks]	[ˌpʲɛʲbiˈʧekˈs]	[ˌbejbijˈtʃɪks]	2.00	3.00
1657	yucky	[ˈjʌkij]	[]	[ˈlɛkʰij]	[ˌʎaˈkʰiʲ]	[ˈlɛkʰij]		2.00
1658	that's yucky	[ˌðætsˈjʌkij]	[ˈðædʒʌpʰij]	[ˈðætˌjʌkij]	[ˌðæˈtɑkiˌ]	[ˈðæˌdjʌpʰij]		3.00
1668	airplane	[ˈɛɹˌplejn]	[ˈɛpʰejn]	[ˈɛpʰejn]	[ˈʔæʲpɛʲn]	[ˈɛpʰẽjn]		3.00
1669	purple	[ˈpɜɹpəɬ]	[ˈpʰʊrbʌ]	[ˈpʰʊpʰə]	[ˈpʰupɑ]	[ˈpʰʊbʌ]	3.00	2.00
1678	they're waking up	[ðɛɹˌwejkɪŋˈʔʌp]	[ɪrwejkʰijnˈʌpʰ]	[əˌwejkɪnˈʔʌp]	[ʔəˌˌʔeʲkɪŋˈapʰ]	[ʔœwejkʰijnˈʔʌpʰ]		3.00
1684	racoons	[ɹæˈkuwnz]	[wæˈkʰuwns]	[wæˈkʰuwnz]	[maʲˈkʰuːns]	[wæˈkʰuwns]		3.00
1688	rabbits	[ˈɹæbɪts]	[ˈræbɪts]	[ˈɹæbɪts]	[ɹæˈbeʔt̟s]	[ˈɹæbɪts]		3.00
1691	cats	[ˈkæts]	[ˈkʰætʰ]	[ˈkʰæts]	[kʰæt̟s]	[ˈkʰætʰ]	3.00	
1701	yogurt	[ˈjowgəɹt]	[ˈjʌgɛtʰ]	[ˈlʌgɛtʰ]	[ˈdɔgætʰ]	[ˈjʌgɛtʰ]		3.00
1704	telephone	[ˈtɛləfown]	[tʰɛləˈfawn]	[tɛɬəˈfæwn]	[ˈtʰɛ̃mfæõn]	[tʰɛləˈfɛwn]	3.00	
1723	I want the puppets	[ajˌwantðəˈpʌ pəts]	[ãndəˈpʰʌpʰʌts]	[wãndəˈpʰʌˌpʰɪts]	[wɔ̃təˈpʰʌpʰɪt̟s]	[wɑ̃ndəˈpʰʌpʰʌjts]	3.00	3.00
1726	we'll eat something	[wijɬˈʔijtˌsʌmθɪŋ]	[wəˈijsʌ̃mpʰijŋ]	[ʌˈʔijtˌsʌmpʰɪŋ]	[wiˈʔeʲtˌsa̰mθiŋˌgə]	[wəˈʔijtˈsʌ̃mpʰijnə]		3.00
1730	o.k. I get a pillow	[ˌowkejʔɑjˌgɛtəˈpɪlow]	[ʊkʰejˈajgɛrəˌpʰɛluw]	[owkejˌajgɛrəˈpʰɛluw]	[æʷˈkʰɛʲ ˈaʲgɔ̃rə ˈpʰɪloʷ]	[ʌkʰejˈʔajgɛrəˌpʰɛluw]	3.00	3.00
1730	o.k. I get a pillow	[ˌowkejʔɑjˌgɛtəˈpɪlow]	[ʊkʰejˈajgɛrəˌpʰɛluw]	[owkejˌajgɛrəˈpʰɛluw]	[æʷˈkʰɛʲ ˈaʲgɔ̃rə ˈpʰɪloʷ]	[ʌkʰejˈʔajgɛrəˌpʰɛluw]	3.00	
1771	daddy	[ˈdædij]	[ˈdædij]	[ˈdædij]	[ˈdædi]	[ˈdædij]	3.00	3.00
1775	dancing	[ˈdænsɪŋ]	[ˈdæ̃ntʰ̃ɪŋ]	[ˈdæntʰɪŋ]	[ˈdæntʰɪŋ]	[ˈdæ̃ntʰ̃ɪŋ]	3.00	3.00
1777	upside down	[ˌʔʌpsajdˈdawn]	[sajˈdawn]	[ˌfaˈdawn]	[ˌfaʲˈdaʷn]	[sajˈdawn]	3.00	
1795	other house	[ˈʔʌðəɹˌhaws]	[ʌdʌˈhaws]	[ˌʌdʌˈhaws]	[ˌʌdeɹˈhæʷs]	[ʔʌdʌˈhaws]		3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1796	want the puppet	[ˌwantðəˈpʌpə t]	[ˈãdəˈpʰʌpʰɪtʰ]	[ˌʌdɪˈpʰʌˌpʰɛtʰ]	[ˌʔʌɾəˑˈpʰʌˌpʰɛtʰ]	[ʔˈãdəˈpʰʌpʰɛtʰ]	3.00	3.00
1811	cat go	[ˈkætˌgow]	[ˈkʰæˌdow]	[ˈkʰætˈdow]	[ˈkʰætˈˌdoʷ]	[ˈkʰæˌdow]	3.00	
1811	cat go	[ˈkætˌgow]	[ˈkʰæˌdow]	[ˈkʰætˈdow]	[ˈkʰætˈˌdoʷ]	[ˈkʰæˌdow]	3.00	
1823	I'll get doggy	[ˌajɬgɛtˈdɑgij]	[ʌɬˈgɛtˈˌdɑgij]	[ˌagɛʔˈdɑˌgij]	[ˌaʔˌgɛʔˈdɑˌgʲi]	[aˈgɛtˈˌdɑgij]	3.00	3.00
1823	I'll get doggy	[ˌajɬgɛtˈdɑgij]	[ʌɬˈgɛtˈˌdɑgij]	[ˌagɛʔˈdɑˌgij]	[ˌaʔˌgɛʔˈdɑˌgʲi]	[aˈgɛtˈˌdɑgij]	3.00	
1834	okay	[ˈowkej]	[ˈʌˌkʰej]	[ˈʌˌkʰej]	[ˈɔˌkʰeʲ]	[ˈʌˌkʰej]		3.00
1839	cut its, cut its	[ˌkʌtɪtsˈkʌtɪts]	[ˈkʰɛɹætsˈkʰɛɹæt˞]	[ˌkʰɪɹætsˈkʰɪɹæts]	[kʰɪˌɹæsˈkʰɪɹæs]	[ˈkʰɛɹætsˈkʰɛɹæt˞]	3.00	
1839	cut its, cut its	[ˌkʌtɪtsˈkʌtɪts]	[ˈkʰɛɹætsˈkʰɛɹæt˞]	[ˌkʰɪɹætsˈkʰɪɹæts]	[kʰɪˌɹæsˈkʰɪɹæs]	[ˈkʰɛɹætsˈkʰɛɹæt˞]	3.00	
1840	I want go, something a cookie	[ajwantgowˌsʌmθɪŋəˈkʊkij]	[ãgowɔ̃nˈsãmpʰĩŋ ejˈkʰʊˌkʰij]	[ˌʌmgowˌ̃dʒʌmpɪne jˈkʰʌkij]	[ˌʌmðoʷˌθʌmpɪnɛʲˈ kʰɔkʰi]	[ˌʔãmgowɔ̃ˌdʒãmpʰ ĩnejˈkʰʌkʰij]	3.00	3.00
1840	I want go, something a cookie	[ajwantgowˌsʌmθɪŋəˈkʊkij]	[ãgowɔ̃nˈsãmpʰĩŋ ejˈkʰʊˌkʰij]	[ˌʌmgowˌ̃dʒʌmpɪne jˈkʰʌkij]	[ˌʌmðoʷˌθʌmpɪnɛʲˈ kʰɔkʰi]	[ˌʔãmgowɔ̃ˌdʒãmpʰ ĩnejˈkʰʌkʰij]	3.00	
1841	I want chocolate	[ˌajwantˈtʃɑklət]	[ʌˌwuwnˈtʃɑkʰɑtʰ]	[ʌwɔnˈtʃɑˌkatʰ]	[ʌwə̯nˈʧɑˌkʰʌtʰ]	[ʌˌwɑ̃nˈtʃɑkʰɑtʰ]		3.00
1844	a turtle	[əˈtɜɹtəɬ]	[əˈtʰɔrdʌɬ]	[aˈtʰʊdɑɬ]	[æˈtʰoˈdɑɬh]	[əˈtʰɔdɑɬ]	3.00	3.00
1846	another turtle	[əˈnʌðəɹˌtɜɹtəɬ]	[ɛ̃ntʰɔrʔəˈnʌˌtʰɔrdɬ]	[əˈnʌˌtʰʊdow]	[ənˌtʰɔ əˈnæˌtʰorɑɬh]	[ɛ̃ntʰɔʔəˈnaˌtʰɔdo w]	3.00	3.00
1849	a ducky	[əˈdʌkij]	[əˈdʌkʰij]	[ʌˈdʌkʰij]	[əd˞ˈdʌˌkʰej]	[əˈdʌkʰij]	3.00	3.00
1856	another rabbit	[əˈnʌðəɹˌɹæbɪt]	[ˌnʌˈræbɪt˞]	[ˈlʌvˌɹæbɪtʰ]	[ˈlʌvˌɹæbɪt]	[ˈnʌvˌɹæbɪtʰ]		3.00
1857	a ducky	[əˈdʌkij]	[əˈdʌkʰij]	[əˈdʌkʰij]	[æˈdʌˌkʰiʲ]	[əˈdʌkʰij]	3.00	3.00
1883	wash the cookie	[ˌwɑʃðəˈkʊkij]	[ajwɪɬˈæpjuwɑʃðə ˈkʰʊkʰij]	[ˌwʌsdɪˈkʰʊkij]	[ˌʔewʊˈʔaviː ˌɔçðeˈkʰʊʷkʰiʲ]	[wɑʃðəˈkʰʊkʰij]	3.00	3.00

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
1893	rabbits	[ˈɹæbɪts]	[ˈwæbɛtʰ]	[ˈwæbɪtʰ]	[ˈɹæbɛt̪θ]	[ˈwæbɛtʰ]		3.00
1902	came back	[kejmˈbæk]	[ˈkʰejmˌbæːkʰ]	[ˈkʰejmˌbæːkʰ]	[ˈkʰeʲmˌbækʰ]	[ˈkʰejmˌbæːkʰ]	3.00	
1902	came back	[kejmˈbæk]	[ˈkʰejmˌbæːkʰ]	[ˈkʰejmˌbæːkʰ]	[ˈkʰeʲmˌbækʰ]	[ˈkʰejmˌbæːkʰ]	3.00	
1904	come	[ˈkʌm]	[ˈkʰɐ̃m]	[ˈkʰʌm]	[kʰʌm]	[ˈkʰɐ̃m]	3.00	
1912	monkey	[ˈmʌŋkij]	[dəˈmɐ̃nkʰij]	[əˈmɐ̃kʰij]	[ɪˈmʌˌk̟ʰi]	[dəˈmɐ̃kʰij]		3.00
1936	...cookie	[ˈkʊkij]	[ˈæ̃nəˈkʰʊkʰij]	[ˈkʰʊkij]	[...ˈkʰʊki]	[...ˈʔæ̃nəˈkʰʊkʰij]	3.00	3.00
1946	making a quesadilla	[ˌmejkɪŋəˌkejsəˈdijə]	[ˈwejkʰ̃ĩŋəˌkʰijsəˈdijɑ]	[ˌʊkɪnəˌkʰijsəˈdijæ]	[ˌlʊkɪnəˌkʰiʃəˈdijæ]	[ˈwejkʰ̃ĩnəˌkʰijsəˈdija]	3.00	3.00
1946	making a quesadilla	[ˌmejkɪŋəˌkejsəˈdijə]	[ˈwejkʰ̃ĩŋəˌkʰijsəˈdijɑ]	[ˌʊkɪnəˌkʰijsəˈdijæ]	[ˌlʊkɪnəˌkʰiʃəˈdijæ]	[ˈwejkʰ̃ĩnəˌkʰijsəˈdija]		3.00
1958	getting more	[ˌgɛtɪŋˈmɔɹ]	[gɪdĩŋˈmɔːr]	[gɛdijnˈmɑː]	[tɛɾiˈmɑː]	[gɪdĩˈmɔː]	2.00	3.00
1961	eating the	[ˈijtɪŋðə]	[ˈijtʰ̃ĩŋnɛ]	[ˈijtʰɪŋnɛ]	[ˈitiŋˌnɛdˀ]	[ˈʔijtʰ̃ĩŋnɛ]		3.00
1963	here a quesadilla	[hɛɹəˌkejsəˈdijə]	[ˈhijɑːkʰejsəˈdijæ]	[ˌhijɑːkʰijsəˈdijæ]	[ˌhijɑːkʰʲʲθəˈd̪ɪjæ]	[ˈhijɑːkʰijsəˈdija]	3.00	3.00
1979	this guy happy	[ˌðɪsgajˈhæpij]	[dɪsgʌˈhæpʰij]	[ˌdɪʔgajˈhæpij]	[ˌdɪʔkaʲˈhæpi]	[dɪsgʌˈhæpʰij]	2.00	
1979	this guy happy	[ˌðɪsgajˈhæpij]	[dɪsgʌˈhæpʰij]	[ˌdɪʔgajˈhæpij]	[ˌdɪʔkaʲˈhæpi]	[dɪsgʌˈhæpʰij]	3.00	
1979	this guy happy	[ˌðɪsgajˈhæpij]	[dɪsgʌˈhæpʰij]	[ˌdɪʔgajˈhæpij]	[ˌdɪʔkaʲˈhæpi]	[dɪsgʌˈhæpʰij]		3.00
1980	happy	[ˈhæpij]	[ˈæpʰij]	[ˈæpij]	[ˈhæpi]	[ˈʔæpʰij]		3.00
2000	rabbits	[ˈɹæbɪts]	[ˈwæbɛtˀ]	[ˈwæbɛts]	[ˈɹæˌbɛtˀs]	[ˈwæbɛts]		3.00
2004	and that rabbit	[ɛndˈðætˌɹæbɪt]	[uwə̃nˈðæwæbɪθej]	[uwˈnædæðæsʌ]	[ˈuʷəˈnæbˌɹæbɛtʌ]	[uwʔə̃ˈðæˌwæbɪθʌ]		3.00
2005	eating	[ˈijtɪŋ]	[ˈijdijn]	[ˈijdijn]	[ˈiˌriŋəʔ]	[ˈʔijdijnə]		3.00
2010	water	[ˈwɑtəɹ]	[ˈwɑdɑ]	[ˈwɑdɑː]	[ˈwɑrɑx]	[ˈwɑdɑː]		3.00
2014	cleaning water	[ˈklijnɪŋˌwɑtəɹ]	[ˈkʰ̪ijəwɑdə]	[ˌkʰ̪ijˈwɑdɑ]	[ˌdiʲˈwɔrɑ]	[ˌɬijəˈwɑdɑ]		3.00

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2017	all the rabbits	[ˌɑɬðəˈɹæbɪts]	[ɑɬˈwæbɛts]	[ˌɑɬˈwæbɪts]	[ˌɑɬˈlæˌbɐʔtsː]	[ʔɑɬˈwæbɛt]		3.00
2020	racoons	[ɹæˈkuwnz]	[wɑˈkʰuwnz]	[æˈkʰuwnzə]	[ʷæˈkʰyʷnzə]	[wæˈkʰuwnzə]		3.00
2039	sweeping	[ˈswijpɪŋ]	[swəˈpʰijdə]	[wɪˈpʰijdə]	[twɪˈpʰiɾʌ]	[fwɪˈpʰijdə]	3.00	
2046	rattle	[ˈɹætəɬ]	[ˈwɛdɬ]	[ˈwædɔ]	[ˈwæˌɾɑːɬh]	[ˈwædɔɬ]		3.00
2048	the baby	[ðəˈbejbij]	[dɪˈbejbij]	[ˈdɪʔbejbij]	[ˈtɪʔˌpeʲpi]	[dɪˈbejbij]	2.00	2.00
2051	apple	[ˈæpəɬ]	[ˈæpʰɬ]	[ˈæpʌɬ]	[ˈæpʌˈ]	[ˈʔæpʰʌɬ]		3.00
2059	apple	[ˈæpəɬ]	[ˈæpʰɬ]	[ˈæpɔ]	[ˈʔæpoʷ]	[ˈʔæpʰɔɬ]		3.00
2062	banana	[bəˈnæna]	[bəˈnæ̃nɑ]	[bʌˈnæ̃næ]	[ʔʌˈnænah]	[bəˈnæ̃na]	2.00	
2063	radish	[ˈɹædɪʃ]	[ˈwædow]	[ˈwædow]	[ˈæɾoʷ]	[ˈwædow]		3.00
2065	and a pear and a apple	[ɛndəˌpɛɹɛndə ˈʔæpəɬ]	[æ̃ndəˈpʰeɾæ̃ndˈæ pʰɬ]	[ʌnəˌpʰæʔændəˈʔæ pʌɬ]	[ˌæ̃nəˈpʰæ ʔænˈʔæˌqoɬ]	[æ̃nəˌpʰæʔæ̃ndəˈʔ æpʰʌɬ]	3.00	3.00
2094	doggie	[ˈdɑgij]	[ˈdɑgij]	[ˈdɑgij]	[ˈʔɑgi]	[ˈdɑgij]	2.00	3.00
2098	bus	[ˈbʌs]	[ˈbɪs]	[ˈbɪs]	[pɪʃ]	[ˈbɪs]	2.00	
2101	zebra	[ˈzijbɹa]	[ˈzijbɑ]	[ˈzijba]	[ˈziba]	[ˈzijba]		3.00
2110	all sleepy	[ɑɬˈslijpij]	[ˈɑɬs̥lijpʰij]	[ˌaɬˈhlijpʰijnə]	[ɑɬˈθliːtʰiˌə]	[ˌʔɑɬˈɬijpʰijnə]		3.00
2111	candle	[ˈkændəɬ]	[ˈkʰændijdə]	[ˈkʰændijdə]	[ˈkʰændiðə]	[ˈkʰæ̃ndijðə]	3.00	3.00
2142	a rabbit	[əˈɹæbɪt]	[əˈræbɪt]	[ˈɹæbɪt]	[ˈɹæˌbetˈ]	[əˈɹæbɪtˈ]		3.00
2166	potato	[pəˈtejtow]	[ˈtʰejdow]	[ˈtʰejdow]	[ˈtʰeʲɾoʷ]	[ˈtʰejdow]	3.00	3.00
2167	pickles	[ˈpɪkəɬz]	[ˈpʰɪkʰɬs]	[ˈpʰɪkowɬs]	[pʰɪˈkɔɬt̪s]	[ˈpʰɪkʰɔɬs]	3.00	3.00
2195	a rabbit	[əˈɹæbɪt]	[əˈwæbɪtʰ]	[əˈwæbɪt]	[əˈwæbɪt]	[əˈwæbɪtʰ]		3.00
2198	turtle	[ˈtɜɹtəɬ]	[ˈtʰɔrɾɬ]	[ˈtʰʊdɑɬ]	[ˈtʰɔɾɑ̰ɬ]	[ˈtʰɔdʌɬ]	3.00	3.00
2199	a zebra	[əˈzijbɹa]	[əˈd͡ʒijbəɑ̃n]	[əˈʒijbɑ]	[əˈʒibɑː]	[əˈʒijbəʔɑ̃n]		3.00
2200	beetle	[ˈbijtəɬ]	[ˈbijdɬ]	[ˈbijdɑɬ]	[ˈbiɾɑ̰ˌ]	[ˈbijdʌɬ]	3.00	3.00
2205	and a panda	[ɛndəˈpænda]	[æ̃nəˈpʰæ̃ndɑ]	[æ̃nəˈpʰænda]	[æneˈpʰæ̃da]	[ʔæ̃nəˈpʰæ̃ndɑ]	3.00	3.00
2207	and a caterpillar	[ɛndəˈkætəpɪl əɹ]	[ˈæːndəkʰærəpʰɪlə]	[æːnəˈkʰælə,pʰɪlʌ]	[æːnɪˈkʰæɾɪˌpʰɪɾʌx]	[ʔæːnəˈkʰælə,pʰɪlʌ]	3.00	3.00
2208	and a hippopotamus	[ɛndəˈhɪpowp ɑtəmɪs]	[ˈæːnhɪpʰowpʰɑʌ]	[æːnˈhɪpowˈpɑːʌ]	[ˈæːŋ ˌhɪpoˈpɑːʌ]	[ˈæːnhɪpʰowˈpʰɑ.ʌ]		3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
2208	and a hippopotamus	[ɛndə'hɪpowpɑtəmɪs]	['æ̃:nhɪpʰowpʰɑʌ]	[æ:n'hɪpow'pɑ:ʌ]	['æ̃:ŋ ˌhɪpo'pɑ:ʌ]	['æ̃:nhɪpʰow'pʰɑ.ʌ]		3.00
2218	he's eating chicken	[ˌhijzijtɪŋ'tʃɪkən]	[hijˌijr̃ɪŋtʃɪkĩn]	[hijʔij:'ʃɪkn̩]	[hrʲˌʔirɪ'ʃʲœkin]	[hijˌʔijr̃ɪŋ'ʃɪkĩn]		3.00
2232	Ichobod	[ɪkə'bɑd]	[ɪgə'bɑ:d]	['ɪgəbɑ:d]	['ɪgəbɑ:d]	[ɪgə'bɑ:d]		3.00
2232	Ichobod	[ɪkə'bɑd]	[ɪgə'bɑ:d]	['ɪgəbɑ:d]	['ɪgəbɑ:d]	[ɪgə'bɑ:d]		3.00
2246	rabbits	['ɹæbɪts]	['wæbɪts]	['wæbɪts]	['wæbɪts]	['wæbɪts]		3.00
2254	they're not eating	[ðɛɹnɑt'ʔijtɪŋ]	['dijrnɑʔˌijdĩŋ]	[ˌðejnɑʔ'ijdɪŋ]	[ðeˌjnɑʔ'iːriŋ]	['ðijnɑʔˌijdĩŋ]		3.00
2262	purple	['pɜɹpəɬ]	['pʰɪrpʰəɬ]	['pʰʌpʰɔ]	['pʰəpoʷ]	['pʰʌpʰɔ]	3.00	3.00
2268	and the duckies	[ɛndðə'dʌkijz]	[ẽndə'dʌkʰijs]	[ənə'dʌkijz]	[ənə'dʌʔkiʲs]	[ʔẽnə'dʌkʰijs]	3.00	
2270	he's a turtle	[ˌhijzə'tɜɹtəɬ]	[ĩnə'tʰɔrdɬ]	[ɪnə'tʰɔɹdow]	[ijə'tʰɔjoʷh]	[ʔĩnə'tʰɔɹdow]	3.00	
2279	get	['gɛt]	['gɪtʰ]	['gɪt]	[gɯt]	['gɪtʰ]	3.00	
2280	everybody in	['ɛvɹijbɑdijʔɪn]	[ʌ'bajĩn]	['ʌbajˌɪn]	['ʌpaˌjen]	[ʔʌ'bajĩn]	2.00	
2281	and the rabbit	[ɛndðə'ɹæbɪt]	[ẽnðəˌwæ'bɪtʰ]	[ɛnə'ɹæ'bɛt]	[ɛnə'ɹæ'bɛkʰ]	[ʔẽnðəˌwæ'bɛtʰ]		3.00
2290	the turtle needs help	[ðəˌtɜɹtəɬnijdz'hɛɬp]	[dɪ'tʰɔrdənijdhɛlpˀ]	[dɪ'tʰʊdʌnijzˌhɛwpˀ]	[dɪ'tʰɔdʌniʲˌhɛʷpˀ]	[dɪ'tʰɔdənijzˌhɛɬpˀ]	3.00	3.00
2295	pickles	['pɪkəɬz]	['pʰɪkʰɬs]	['pʰɪkəɬs]	['pʰɪkʊɬs]	['pʰɪkʰəɬs]	3.00	3.00
2299	chicken	['tʃɪkən]	['tʃɪkʰẽn]	['tʃɛkən]	['tʲʰɪkenh]	['tʃɪkʰẽn]		3.00
2304	I'm just making his	[ajmˌdʒʌst'mejkɪŋhɪz]	[mˌ'dɪsmejkĩŋɪz]	[ˌumdɪs'mejkɪns]	['umdʌʦɪ'mɐ̯ʲkʰɪnʲus]	[ə̃m'dɪsmejkʰĩnəz]	3.00	3.00
2316	something spicy	[ˌsʌmθɪŋ'spajsij]	[ˌsʌ̃mpʰĩŋ'pʰajsij]	['sʌmpʰɪŋ'pʰʌjsij]	['sʌmɸɪŋ'pʰʌʲθiʲ]	[ˌsʌ̃mpʰĩŋ'pʰajsij]	3.00	3.00
2317	cappucino	[ˌkæpə'ʧijnow]	['kʰæpʰətʰijnow]	[ˌkʰæpɛ'kijnow]	[ˌkʰæpɛ'kɪnoʷ]	[ˌkʰæpʰə'kʰijnow]	3.00	3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
2317	cappucino	[ˌkæpəˈtʃijnow]	[ˈkʰæpʰətʰijnow]	[ˌkʰæpɛˈkijnow]	[ˌkʰæpɛˈkɪnoʷ]	[ˌkʰæpʰəˈkʰijnow]		3.00
2328	turtle	[ˈtɜɹtəɬ]	[ˈtʰɪrlduwd]	[ˈtʰʌduwd]	[ˈtʰʌʷrənd]	[ˈtʰʌɬduwd]	3.00	3.00
2332	a rabbit	[əˈɹæbɪt]	[əˈwæbɪ]	[əˈwæbɪt̚]	[ʔˈwæbɪ]	[əˈwæbɪʔ]		3.00
2342	cut	[ˈkʌt]	[ˈkʰʌtʰ]	[ˈkʰʌtʰ]	[kʰʌtʰ]	[ˈkʰʌtʰ]	3.00	
2368	apple	[ˈæpəɬ]	[ˈæbow]	[ˈæʔbow]	[ˈæpˀpoʷɬ]	[ˈʔæpˀbow]		2.00
2383	they're eating	[ˌðɛɹˈʔijtɪ̃ŋ]	[dɛˈijtɪ̃ŋ]	[dɛʔˈijdɪŋ]	[dɛʔˈirɪŋ]	[dɛˈʔijdɪ̃ŋ]	3.00	2.00
2395	this marker's not working	[ðɪsˌmɑɹkəɹɪznɑtˈwɜɹkɪŋ]	[dɪsˈmɑrkʰənɑʔˌwʌrkʰijn]	[dɪsˌmʌkʌnɑʔˈwʌkijn]	[dɪʔˌmɑkənʌʔˈwɔkin]	[dɪsˈmɑkʰənɑʔˌwʌkʰ̃ijn]	3.00	3.00
2395	this marker's not working	[ðɪsˌmɑɹkəɹɪznɑtˈwɜɹkɪŋ]	[dɪsˈmɑrkʰənɑʔˌwʌrkʰijn]	[dɪsˌmʌkʌnɑʔˈwʌkijn]	[dɪʔˌmɑkənʌʔˈwɔkin]	[dɪsˈmɑkʰənɑʔˌwʌkʰ̃ijn]		3.00
2398	apples	[ˈæpəɬz]	[ˈæpʰʊɬ]	[ˈæpʊɬ]	[ˈæfoɬ]	[ˈʔæpʰʌɬ]		3.00
2402	a cheapy	[əˈtʃijpij]	[əˈtʃijpʰij]	[ʌˈtʃijpij]	[ʔæˈʧipiː]	[ʔəˈtʃijbij]		0.00
2403	strawberries	[ˈstɹɑˌbɛɹɪijz]	[ˈtʰwɑːbɛijs]	[ˈtʃɹɑˌbɛjz]	[ˈʧɹɑbɛʲʦ]	[ˈtʰwɑːbejz]		3.00
2407	painting	[ˈpejntɪŋ]	[ˈpʰejntʰijn]	[ˈpejtʰijn]	[ˈpɛʲnˌtʰ̃ɪŋ]	[ˈpʰɛ̃jntʰ̃ijn]	3.00	3.00
2421	a wagon	[əˈwægɪn]	[əˈwɛgæ̃n]	[əˈwægɛn]	[əˈwæʲgʲen]	[əˈwejgɛ̃n]		3.00
2424	kangaroo	[ˌkæŋəˈɹuw]	[ˈkʰwɛ̃ŋgəuwː]	[ˌkwæŋgɛjˈuw]	[ˌkwæŋgiˈɹʲuʷ]	[ˈkʰwɛ̃ŋgəuw]		3.00
2427	peacock	[ˈpijkɑk]	[ˈpʰijkʰɑ]	[ˈpʰijkɑ]	[pʰiˈkɔʔ]	[ˈpʰijkʰɑ]	3.00	3.00
2436	you my baby	[juwmajˈbejbij]	[juwˌmajˈbejbij]	[juwmajʔːˈbejbij]	[juˌmaʲʔ ˈbeʲbiː]	[juwˌmajʔˈbejbij]	3.00	3.00
2441	the wacky witches	[ðəˌwækijˈwɪtʃəz]	[ðəˌwækʰijˈwɪtʃɛz]	[dəˌwækijˈwɪtʃəz]	[ðəˌwækiˈwɪʧedˀs]	[ðəˌwækʰijˈwɪtʃɛz]		3.00
2450	other baby	[ˈʌðəɹˌbejbij]	[ˈʌðəˌbejbij]	[ˈʌdəˌbejbij]	[ˈærəbeʲˌbi]	[ˈʔʌðəˌbejbij]	3.00	3.00
2455	a lot of people	[əˌlɑtʌvˈpijpəɬ]	[lɑrəˈpʰijpʰɬ]	[ˌɑlɑˈpʰijpʊɬ]	[ˌbɑlɑˈpʰipʊɬ]	[lɑrəˈpʰijpʰʌɬ]	3.00	3.00

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
2471	You open the door and see here	[juw,ʔowpɪnðə ˈdɔɹɛndsij,hɪɹ]	[juwˈowpʰɪ̃ndə,dɔr əsijhijr]	[juw,ʔowpəndə,do wæsijˈhijæ]	[juʔ,ɔʷpəndə,dowæ siˈheæ]	[juwˈʔowpʰɪ̃ndə,dɔ .əsijhija]	3.00	
2471	You open the door and see here	[juw,ʔowpɪnðə ˈdɔɹɛndsij,hɪɹ]	[juwˈowpʰɪ̃ndə,dɔr əsijhijr]	[juw,ʔowpəndə,do wæsijˈhijæ]	[juʔ,ɔʷpəndə,dowæ siˈheæ]	[juwˈʔowpʰɪ̃ndə,dɔ .əsijhija]		3.00
2478	that's a nice bottle	[ðætsəˈnajs,bɑ təɬ]	[dæsənajˈbɑdəɬ]	[ˌdæzænajsˈbɑdʊɬ]	[ˌdæsænaˈjsˈbɑrɔ̰ˌ]	[dæsənajəˈbɑdʌɬ]	3.00	3.00
2481	bacon	[ˈbejkən]	[ˈbejkʰɪ̃n]	[ˈbej,kɪn]	[ˈbeˈjkɪn]	[ˈbej,kʰɪ̃n]	3.00	3.00
2483	baby cat	[ˈbejbij,kæt]	[ˈbejbij,pʰætʰ]	[ˈbejbij,pʰæt]	[ˈbeˈjbi,kʰæt]	[ˈbejbij,pʰætʰ]	3.00	3.00
2483	baby cat	[ˈbejbij,kæt]	[ˈbejbij,pʰætʰ]	[ˈbejbij,pʰæt]	[ˈbeˈjbi,kʰæt]	[ˈbejbij,pʰætʰ]	3.00	
2487	a pickle	[əˈpɪkəɬ]	[əˈpʰɪkʰow]	[æˈpʰɪkʊɬ]	[æˈkʰɪkoɬ]	[əˈpʰɪkʰow]	3.00	3.00
2492	I want the wacky witches	[ajwantðə,wæ kijˈwɪttʃəz]	[ʌwɑ̃nðə,wɑkʰijˈw ɪt͡ʃəz]	[ˌwɑnt̚də,wækijˈw ɪt͡ʃəz]	[ˌwɑntə,wɔk̚kiˈwɪt̚ ʃed̚]	[ʌwɑ̃nðə,wɑkʰijˈwɪ t͡ʃəz]		3.00
2494	is this one happy?	[ɪz,ðɪswʌnˈhæ pij]	[ɪˈðɪswɑ̃n,hæpʰij]	[ɪˈdɪswʌn,hæ̃pij]	[ɪˈzɪswʌn,hæpi]	[ɪˈðɪswɑ̃ŋ,hæ̃pʰij]		3.00
2504	gum	[ˈgʌm]	[ˈgɑ̃m]	[ˈgʌm]	[kʌm]	[ˈgɑ̃m]	2.00	
2555	purple	[ˈpɜɹpəɬ]	[ˈpʰɔrpʰ̩ɬ]	[ˈpʰɔpʌɬ]	[ˈpʰaˈɹpʌɬ]	[ˈpʰɔpʰɔɬ]	3.00	3.00
2586	something else	[ˌsʌmθɪŋˈʔɛls]	[tʰɑ̃mpɪŋˈɛls]	[kʰʌmpəˈnɛɬts]	[kʰʌmgɪˈnɛɬs]	[ˌkʰɑ̃mhəˈnɛɬs]	3.00	
2615	puppet	[ˈpʌpət]	[ˈpʰʌpʰɪt̚]	[ˈpʰʌpʰɪt]	[ˈpʌpet̚]	[ˈpʰʌpʰɪt̚]	3.00	3.00
2889	O.K., they	[ˈowkej,ðej]	[kʰejˈðej]	[ˈkʰejðej]	[ˈkʰejðeˈj]	[kʰejˈðej]		3.00
2913	going, wanna eat	[gowɪŋ,wɑnəˈʔ ijt]	[ˈgowɪ̃ntʰij,wɑ̃nəˈi jt̚]	[gowɪnsij,wɑnəˈʔij t]	[ˈgowɪn hi ˌwɑnəˈʔit]	[ˈgowɪ̃nsij,wɑ̃.əˈʔij t̚]	3.00	

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Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
2984	get the keys, I'm coming in	[ˌgɛtðə‘kijzʔaj mˌkʌmɪŋ‘ʔɪn]	[‘gɪðətʰkʰijzajmˌkʰ ʌ̃mĩŋ‘ĩn]	[gɛdəʔ‘kʰijzajmkʰ ʌmɪnˌɪn]	[gɛd̚dəʔ‘tʰkʰizaʲm kʰʌmiˌnɪn]	[‘gɪðətʰəkʰijzajmˌk ʰʌ̃mĩ.‘ĩn]	3.00	
2984	get the keys, I'm coming in	[ˌgɛtðə‘kijzʔaj mˌkʌmɪŋ‘ʔɪn]	[‘gɪðətʰkʰijzajmˌkʰ ʌ̃mĩŋ‘ĩn]	[gɛdəʔ‘kʰijzajmkʰ ʌmɪnˌɪn]	[gɛd̚dəʔ‘tʰkʰizaʲm kʰʌmiˌnɪn]	[‘gɪðətʰəkʰijzajmˌk ʰʌ̃mĩ.‘ĩn]	3.00	
2984	get the keys, I'm coming in	[ˌgɛtðə‘kijzʔaj mˌkʌmɪŋ‘ʔɪn]	[‘gɪðətʰkʰijzajmˌkʰ ʌ̃mĩŋ‘ĩn]	[gɛdəʔ‘kʰijzajmkʰ ʌmɪnˌɪn]	[gɛd̚dəʔ‘tʰkʰizaʲm kʰʌmiˌnɪn]	[‘gɪðətʰəkʰijzajmˌk ʰʌ̃mĩ.‘ĩn]	3.00	
3034	that all done?	[ˌðætɑɫ‘dʌn]	[‘dæɑɫˌdʌ̃n]	[ˌgaʔɑɫ‘dʌn]	[ˌdæʔɑ‘lran]	[‘gaʔɑɫˌdʌ̃n]	3.00	
3038	cup of tea	[ˌkʌpʌv‘tij]	[‘kʰʌpʰˌtʰij]	[‘kʰʌpʰˌtʰij]	[‘kʰʌpʰˌtʰiʲ]	[‘kʰʌpʰˌtʰij]	3.00	
3038	cup of tea	[ˌkʌpʌv‘tij]	[‘kʰʌpʰˌtʰij]	[‘kʰʌpʰˌtʰij]	[‘kʰʌpʰˌtʰiʲ]	[‘kʰʌpʰˌtʰij]	3.00	
3092	Cathy, can you lift this up?	[ˌkæθijkænju wˌlɪftðɪ‘sʌp]	[‘kʰæθijːkə̃njuwːlɪ fdɪsˌʌpʰ]	[ˌkʰæθijkɪn‘lɪfdɪsˌʌ p]	[ˌkʰæθikɪnjː‘lɪfdɪˌzʌ p]	[‘kʰæθijkʰə̃nlɪfdɪˌz ʌpʰ]	3.00	
3092	Cathy, can you lift this up?	[ˌkæθijkænju wˌlɪftðɪ‘sʌp]	[‘kʰæθijːkə̃njuwːlɪ fdɪsˌʌpʰ]	[ˌkʰæθijkɪn‘lɪfdɪsˌʌ p]	[ˌkʰæθikɪnjː‘lɪfdɪˌzʌ p]	[‘kʰæθijkʰə̃nlɪfdɪˌz ʌpʰ]	3.00	
3168	curb fall	[‘kɜɹbfɑɫ]	[ˌkʰʊr‘fɑɫ]	[kʰʊb‘fɑɫ]	[kʰʊrʊb‘fɑɫ]	[kʰʊrəb‘fɑɫ]	3.00	
3221	put some more	[ˌpʊtsʌ‘mɔɹ]	[pʰəsʌ̃‘mɔrə]	[pəsə‘buwæ]	[pʊsə‘bʷua]	[pʰəsʌ̃‘bɔ.a]	3.00	
3436	get it	[‘gɛtɪt]	[‘gɪrɛt̚]	[‘gɛrɛt]	[ˌgɛ̠ː‘rɛ̠ʔ]	[‘gɪrɛʔ]	3.00	
3444	I can't cut it	[ajˌkænt‘kʌtɪt]	[kæ̃ʔ‘kʰʌrɪtʰ]	[ə̆kʰæ̃t‘kʰʌdɪt]	[kĩr‘kʰɑrit]	[kæ̃ʔ‘kʰʌrɪtʰ]	3.00	
3444	I can't cut it	[ajˌkænt‘kʌtɪt]	[kæ̃ʔ‘kʰʌrɪtʰ]	[ə̆kʰæ̃t‘kʰʌdɪt]	[kĩr‘kʰɑrit]	[kæ̃ʔ‘kʰʌrɪtʰ]	3.00	
3495	to call us	[tuw‘kɑɫʌs]	[‘kʰɑɫʌs]	[‘kʰowʌs]	[‘kɑlɑs]	[‘kʰɑwʌs]	3.00	
3530	coffee	[‘kɑfij]	[‘kʰɑfij]	[‘kʰɑvij]	[‘kʰɑfi]	[‘kʰɑfij]	3.00	

Appendix A - Ranking for Inter-transcriber Reliability

Rec #	Ortho.	Target	Transcriber 1	Transcriber 2	Transcriber 3	Validated Transcription	Score WI	Score WM
3587	cats	[ˈkæts]	[ˈkʰætʰ]	[ˈkʰæts]	[kætˀs]	[ˈkʰætʰ]	3.00	
3597	cats	[ˈkæts]	[ˈkʰæts]	[ˈkʰæts]	[kʰætˀθː]	[ˈkʰæts]	3.00	
3639	go	[ˈgow]	[ˈgow]	[ˈgow]	[kɔ̰]	[ˈgɔ]	2.00	
3640	stop	[ˈstɑp]	[ˈtʰɑpʰ]	[ˈtɑpˀ]	[tɔpˀ]	[ˈtʰɑpʰ]	3.00	
3642	stop	[ˈstɑp]	[ˈtʰɑpˀ]	[tɑpˀ]	[tɑpˀ]	[ˈtʰɑpˀ]	3.00	
3663	ok, lets keep this there	[owkej,lɛtskij p‘ðɪsðɛɹ]	[kʰejlɛsˈkʰijpdʌsˌðɛr]	[kʰejwəsˈkʰijpˈdɪθnɛ]	[ˈoʷəˈkʰitʊdˈðɛ]	[kʰejlɛsˈkʰijpdʌθˌðɛ]	3.00	3.00
3712	guy	[ˈgaj]	[ˈgajij]	[ˈgʌʔaj]	[qɑˈʕɑj]	[ˈgʌʔaj]	2.00	
3722	paintings	[ˈpejntɪŋz]	[ˈpʰejntʰijn]	[ˈpʰɛ̃jntʰijn]	[ˈpʰeʲntʰiŋ]	[ˈpʰɛ̃jntʰ̃ijn]	3.00	3.00
3819	Kathy met P.J.?	[ˌkæθijmɛtˈpij d͡ʒej]	[ˈkæðijmɛʊˌpʰijˈd͡ʒij]	[ˌkʰæθijmɛtˈpʰijd͡ʒij]	[ˈkʰæθiˌmɛɾoʷˈpʰiˌd͡ʒiː]	[ˈkʰæθijmɛ.əˌpʰijˈd͡ʒij]	3.00	
3819	Kathy met P.J.?	[ˌkæθijmɛtˈpij d͡ʒej]	[ˈkæðijmɛʊˌpʰijˈd͡ʒij]	[ˌkʰæθijmɛtˈpʰijd͡ʒij]	[ˈkʰæθiˌmɛɾoʷˈpʰiˌd͡ʒiː]	[ˈkʰæθijmɛ.əˌpʰijˈd͡ʒij]	3.00	
3828	to drink	[tuwˈdɹɪŋk]	[ˈtʰuwˌdwĩŋkʰ]	[tʰəˈdɥɪŋkʰ]	[keʲˈdwɪŋkʰ]	[kʰɛ̃ˈdwĩŋkʰ]	3.00	
							WI	WM
						3	404	277
						2	21	16
						1	3	2
						0	0	1
							428	296
						3 of 3	94.39%	93.58%
						2 of 3	99.30%	98.99%
							Total	724
								94.06%
								99.17%

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0005	papa	[ˈpʰɑpə]	[ˈpʰʌp̚pʰɑʔ]	105.00	Voiceless				
0048	apple	[ˈæp̚l̩]	[ˈpʰuw]	115.00	Voiceless				
0050	apple	[ˈæp̚l̩]	[ˈpʰɑ]	36.00	Voiceless				
0054	apple	[ˈæp̚l̩]	[ˈpʰɑʔ]	103.00	Voiceless				
0067	apple	[ˈæp̚l̩]	[ˈpʰʊʔʌ]	111.00	Voiceless				
0123	pig	[pʰɪg]	[ˈpʰej]	62.00	Voiceless				
0124	pig	[pʰɪg]	[ˈpʰej]	55.00	Voiceless				
0141	pillow	[ˈpʰɪɬoʷ]	[ˈɤ̃ʔ̚awˈpʰʊɬuw]	60.00	Voiceless				
0152	pen	[pʰɛn]	[m̩ˈpʰæ]	80.00	Voiceless				
0153	pen	[pʰɛn]	[ˈpʰæ]	56.00	Voiceless				
0186	apple	[ˈæp̚l̩]	[ˈpʰʌ]	66.00	Voiceless				
0216	pig	[pʰɪg]	[əˈpʰij]	99.00	Voiceless				
0224	spoon	[spʰuʷn]	[ˈpʰũːw]	73.00	Voiceless				
0235	spoon	[spʰuʷn]	[ˈpʰuw]	56.00	Voiceless				
0276	plate	[pʰleːt]	[ˈpʰæː]	105.00	Voiceless				
0282	pig	[pʰɪg]	[ˈpʰiːj]	80.00	Voiceless				
0289	plate	[pʰleːt]	[ɤ̃ˈpʰæː]	123.00	Voiceless				
0315	mama, I wanna poo	[ˌmɑməaʲwɑ nəˈpʰuʷ]	[ˈmɤ̃məˈʔajwʌn əhˈpʰʊ]	77.00	Voiceless				
0372	pig	[pʰɪg]	[ˈpʰiːj]	110.00	Voiceless				
0392	uh, push	[ʔʌˈpʰʊʃ]	[hɤ̃ʔˈpʰʊx]	67.00	Voiceless				
0471	peacock	[ˈpʰikɑk˞]	[pʰijˈkʰɑː]					24.00	Borderline
0473	uh, peacock	[ʌˈpʰikɑk˞]	[ɤ̃ʔɤ̃ʔɤ̃ʔəˌpʰijˈkʰɑ]	6.00	Voiced				
0486	pee	[pʰi̯]	[ˈpʰiːj]	26.00	Voiceless				
0512	bicycle	[ˈbaʲsɪɬ]	[ˈpʰowˌtʰʌ]	47.00	Voiceless				
0517	papa	[ˈpʰɑpɑ]	[ˈpʰɑpʰə]	64.00	Voiceless				
0533	...Cathy ... paper	[ˈkʰæθi...ˈpʰeʲpə˞]	[...ˈkʰæʃej...ˈpʰɑpʰɑ]	30.00	Voiceless				
0557	pig	[pʰɪg]	[ˈpʰij]	62.00	Voiceless				
0562	...up high	[ʌp˞haʲ]	[həˈpʰaj]	88.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0621	park	[pʰaɹkˀ]	[ə'pʰow]	94.00	Voiceless				
0657	park	[pʰaɹkˀ]	['pʰɑkʰ]	99.00	Voiceless				
0690	painting	['pʰeɪ̯ntɪŋ]	['pʰej̯t̪ʰij]	81.00	Voiceless				
0691	paint	[pʰeɪ̯ntˀ]	[ə̥pʰʊd'pʰejtʰ]	95.00	Voiceless	56.00	Voiceless		
0692	new page	['nuʷpʰeɪ̯dʒ]	[m̥'pʰɪd̥ʒ]	41.00	Voiceless				
0705	pea(?)	[pʰi̯ˀ]	['pʰij]	96.00	Voiceless				
0713	shovel(?)	['ʃʌv̥ɬ]	['pʰʊ̥hʌʔ]	92.00	Voiceless				
0719	fish	[fɪʃ]	['pʰijʃ]	56.00	Voiceless				
0791	piggy	['pʰɪgi]	['pʰɪgij]	93.00	Voiceless				
0827	painting	['pʰeɪ̯ntɪŋ]	['pʰej̯t̪ʃɪ̃ŋ]	66.00	Voiceless				
0831	painting	['pʰeɪ̯ntɪŋ]	[ɛ̃.aj'pʰejθɪ̃ŋ]	70.00	Voiceless				
0832	swing	[swɪŋ]	['pʰɛg]	44.00	Voiceless				
0854	pail	[pʰeɪ̯ɬ]	['pʰe̥ja]	23.00	Borderline				
0857	fish	[fɪʃ]	['pʰɪʃ]	54.00	Voiceless				
0868	aligator on bicycle	[ˌæɬigeɪ̯ɾə-ɑn' baɪ̯dsɪkɬ]	[m̥'ægɛlə?ɐ̃?ʊ̃n̥ pʰʌtʰɑ]	31.00	Voiceless				
0889	uh, page	[ʌ'pʰeɪ̯dʒ]	[ɐ̃'pʰejt̪s̪]	28.00	Voiceless				
0893	fridge	[fɹɪd̥ʒ]	['pʰɪ̃mpʰ]	32.00	Voiceless				
0896	spoon	[spʰuʷn]	['pʰõw]	34.00	Voiceless				
0906	that's a piggy	[ðætsə'pʰɪgi]	['tʰætʰḁpʰɪgij]			34.00	Voiceless		
0908	hen?	[hɛn]	['pʰɛ̃ʔ]	71.00	Voiceless				
0920	uh, paint	[ʌpʰeɪ̯ntˀ]	[ɐ̃jə'pʰejntʰ]	98.00	Voiceless				
0921	paint	[pʰeɪ̯ntˀ]	[ɐ̃'pʰejntʰɐ̃]	34.00	Voiceless				
0927	page	[pʰeɪ̯dʒ]	[ʔɐ̃'pʰejt̪ʃ]	26.00	Voiceless				
0950	peas	[pʰiz]	['pʰijʃ]	35.00	Voiceless				
0954	...paint	[pʰeɪ̯ntˀ]	[...'pʰɛ̃jntʰ]	59.00	Voiceless				
0963	pail	[pʰeɪ̯ɬ]	[ʔɐ̃'pʰejʌɬ]	84.00	Voiceless				
0967	blue and red and purple too	['bluːən'ɹɛdə n'pəɹpəltuː]	[ˌwuwɑ̃nə'wɛdʔ ɑ̃n'pʰɜpʰʌ̥tʰuwə]	42.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0971	pull that	[pʰʊɬðæt̚]	[ˈpʰʊɬəˈnəˈdætʰ]	80.00	Voiceless				
0974	airplane	[ˈɛɹpleʲn]	[ʔɐ̃mˈpʰẽjn]	62.00	Voiceless				
0979	paper	[ˈpʰeʲpɚ]	[ˈpʰejˌpʰʊ]	45.00	Voiceless				
0982	no, want page	[noʷwɑnʔˈpʰeʲdʒ]	[ˌnowˌˌwɐ̃ˈpʰejtʃ]	57.00	Voiceless				
0988	new page	[ˈnuʷˌpʰeʲdʒ]	[mˌˈpʰejtʃ]	76.00	Voiceless				
1000	pink	[pʰɪŋk̚]	[ˈpʰɪ̃ŋkʰ]	129.00	Voiceless				
1064	I wanna turn page	[aʲwɑnətʰɚn pʰeʲdʒ]	[ɐ̃ˈmɑ̃nˌtʰuːwpʰejd]					21.00	Borderline
1067	lot of pictures	[lɑɹəvˈpʰɪktʃɚz]	[əˈlɑʔaˈpʰɪ̃tʃʌkʰ]	61.00	Voiceless				
1068	lot of pictures...look a	[lɑɹəvpʰɪktʃɚz...lʊkə]	[lɑʔɑˈpʰɪʔɐ̃ˈʃuwdɛ̃nˈtʰɛˈlʊkʰʌˌtʰɛ]	20.00	Borderline				
1075	cat	[kʰæt̚]	[ˈpʰæt̚]	52.00	Voiceless				
1090	page	[pʰeʲdʒ]	[õmˈpʰejtʃ]	60.00	Voiceless				
1093	that's a purple	[ðætsəˈpʰɚpɫ]	[ˌʔætʰaˈpʰɜˌpʰʊ]	32.00	Voiceless				
1096	paint	[pʰeʲnt̚]	[ɛ̃nəˈpʰɛ̃jntʰ]	37.00	Voiceless				
1110	want page	[wɑnt̚pʰeʲdʒ]	[mˌˈpʰejtʃ]	35.00	Voiceless				
1123	peas	[pʰiz]	[ˈpʰijʃ]	56.00	Voiceless				
1136	putting that	[ˌpʰʊɾɪŋˈðæt̚]	[mˌpʰɪtʰɛ̃nˈdæd]			63.00	Voiceless		
1137	spoon cook	[ˈspʰuʷnˈkʰʊk]	[əˈpʰuwɛ̃nˈkʰʊkə]	114.00	Voiceless				
1149	that's a ... purple	[ðætsə...ˈpʰɚpɫ]	[ˌðætshɐ̃ˌdætʰɛnˈpʰɔpʰwʌ]	24.00	Borderline				
1161	purple...	[ˈpʰɚpɫ...]	[ˈpʰʊpʰʌʔ...]	63.00	Voiceless				
1173	cow	[kʰaʷ]	[ˈpʰaw]	117.00	Voiceless				
1188	fish	[fɪʃ]	[ˈpʰɪʃ]	98.00	Voiceless				
1189	peacock	[ˈpʰiˌkʰɑk̚]	[ˈpʰejˌkʰɑkʰ]	51.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1202	purple	[ˈpʰəˑpɫ]	[mˌˈpʰʌpʰɔ]	70.00	Voiceless				
1219	piggy too	[ˈpʰɪgitʰuʷ]	[əˈpʰɪgijˌtʰuw]	51.00	Voiceless				
1226	paint	[ˈpʰeɪnt˺]	[ˈpʰẽjn]	26.00	Voiceless				
1250	piggy	[ˈpʰɪgi]	[ˈpʰɪgijˌ]	19.00	Borderline				
1264	piggy come	[ˈpʰɪgitʰuʷ]	[ˌpʰɪgijˈkʰ ̃mna]			58.00	Voiceless		
1291	keys	[kʰiˌjz]	[ˈpʰijs]	90.00	Voiceless				
1301	piggy	[ˈpʰɪˌgi]	[ˈpʰɪgiːj]	42.00	Voiceless				
1305	plate	[pʰleɪt]	[ˈpʰejt˺]	92.00	Voiceless				
1306	spoon	[spʰuʷn]	[ˈpʰũw]	87.00	Voiceless				
1329	I want ... a popsicle	[aɪwɑnt˺...əˈpʰɑpsɪkɬ]	[ʌwãʔawãtʰɛdədtʰəʔɛðəʔɛnˈpʰɑˌkʰʌ]	91.00	Voiceless				
1331	want popsicle on my plate	[wɑnt˺ˈpʰɑpsɪkəlanmaɪˌpʰleɪtˌ]	[ãˌpʰɑkʰəʔĩmajˈpʰajtʰ]	82.00	Voiceless	18.00	Borderline		
1365	giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[ˌdʒ̀ajə̃ˈpʰijtʃ]	47.00	Voiceless				
1366	giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[ˌdajə̃ˈpʰij]	62.00	Voiceless				
1367	...giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[ˈajməˈdʒ̀ãjˌpʰiːj]			70.00	Voiceless		
1369	giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[ˌdajəˈpʰeːjs]	73.00	Voiceless				
1370	giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[dʒ̀ãjˈpʰiːjts]	82.00	Voiceless				
1372	giant peach	[dʒajn̥t˺pʰiˌjtʃ]	[ˌdajˈpʰiːj]	62.00	Voiceless				
1406	piggy, two piggy	[pʰɪgitʰuʷpʰɪgi]	[ˈpʰɪgijtʰuwˌpʰijgij]	86.00	Voiceless	54.00	Voiceless		
1432	there's a spoon	[ˈðɛɹzəˌspʰuʷn]	[ˈbɛzɛˌpʰuwŋ]			69.00	Voiceless		
1434	peacock	[ˈpʰiˌkʰɑk˺]	[ˈpʰijˌkʰɑkʰ]	13.00	Voiced				
1463	spoon	[spʰuʷn]	[ˈpʰũwə]	54.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1473	and spoon and knife	[ɛn'spʰuʷnən 'nʌʲf]	[ɐ̃'pʰuwn?ə?ɐ̃?' najf]	104.00	Voiceless				
1497	pigs	[pʰɪgz]	['pʰɪkʰ]	27.00	Voiceless				
1504	pig	[pʰɪg]	['pʰɪkʰ]	21.00	Borderline				
1507	that guy ... purple	[ðæt˺gaʲ...pʰə˗pɬ]	[dæ'gaj?ɛt˺?õn, pʰɜɹpʊ]			40.00	Voiceless		
1519	corn pie	[kʰɔɹnpʰiʲ]	[kʰɔ̃'pʰaj]	87.00	Voiceless				
1544	paint	[pʰeʲnt˺]	[ə'pʰẽjntʰ]	94.00	Voiceless				
1588	pig	[pʰɪg]	['pʰɪk˺]	95.00	Voiceless				
1606	pigs	[pʰɪgz]	['pʰɪk]	46.00	Voiceless				
1618	I have a pig	[aʲhævəpʰɪg]	[ʌ'hɛwə,pʰɪk]			40.00	Voiceless		
1637	put it on my hair	[ˌpʰʌɾɪɾɑnmaʲ 'hɛɹ]	[pʰʊdə?ɐ̃'ma,haw]					30.00	Voiceless
1690	pigs	[pʰɪgz]	['pʰɪks]	67.00	Voiceless				
1709	pillow	['pʰɪɬoʷ]	['pʰɪlow]	67.00	Voiceless				
1712	pillow	['pʰɪɬoʷ]	['pʰɪlow]	74.00	Voiceless				
1749	peas	[pʰɪʲz]	['pʰijdə]	115.00	Voiceless				
2078	potty	['pɑɾi]	['pʰɑdij]	74.00	Voiceless				
2330	pig	[pʰɪg]	['pʰɪg]	53.00	Voiceless				
2401	peas	[pʰiz]	['pʰijð]	62.00	Voiceless				
2425	penguins	['pʰɛŋgʷɪnz]	['pʰɛ̃ŋwĩns]	59.00	Voiceless				
2427	peacock	['pʰikɑk˺]	['pʰijkʰɑ]	70.00	Voiceless				
2555	purple	['pʰə˗pɬ]	['pʰɔpʰɔɬ]	24.00	Borderline				
2570	pink	[pʰɪŋk]	['pʰĩŋkʰ]	60.00	Voiceless				
2602	penguin	['pʰɛŋgʷɪn]	['pʰɛ̃ŋwĩn]	54.00	Voiceless				
2615	puppet	['pʰʌpət˺]	['pʰʌpʰɪt˺]	18.00	Borderline				
2673	Mog	[mɑg]	['pʰɑg]	58.00	Voiceless				
2705	spoon	[spuʷn]	['pʰuw]	33.00	Voiceless				
2734	Panda	['pʰændə]	['pʰæ̃nda]	28.00	Voiceless				
2781	purple	['pʰə˗pɬ]	['pʰʊbəɬ]	77.00	Voiceless				
2805	purple	['pʰə˗pɬ]	['pʰʊbʌɬ]	86.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
3094	pink	[pʰɪŋk]	[ˈpʰ̃ɪ̃ŋkʰ]	47.00	Voiceless				
3221	put some more	[pʰʊt̚səˈmɔɹ]	[pʰəsɐ̃ˈbɔ.a]					15.00	Borderline
3299	purple and blue	[ˌpəɹpələnˈbl uːˌ]	[ˌpʰɔpʰə.ɐ̃nˈwu wˌ]			56.00	Voiceless		
3325	pink	[pʰɪŋk]	[ˈpʰ̃ɪ̃ŋkʰ]	56.00	Voiceless				
3331	purple	[ˈpʰə˞pɬ]	[ˈpʰʊpəɬ]	66.00	Voiceless				
3681	people wear hats	[ˈpʰijpəɬwɛɹˌ hæts]	[ˈpʰijpʰʌʔwɛˌhæ t̚]	48.00	Voiceless				
3685	spill	[ˈspɪɬ]	[ˈpʰɪ.ʌɬ]	31.00	Voiceless				
3722	paintings	[ˈpʰeĩnt̃ɪ̃ŋz]	[ˈpʰẽjntʰ̃ijn]	16.00	Borderline				
			Voiceless		112		10		1
			Borderline		8		1		3
			Voiced		2		0		0

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0015	Peter	[ˈpʰiˌɹɚ]	[ˈbowɑʔ]	10.00	Voiced				
0023	Peter	[ˈpʰiˌɹɚ]	[ˈbʌˌbʊ.ɛʔ]	19.00	Borderline				
0027	Booboo	[ˈbuʷbuʷ]	[ˌbʊˈbʊː]			8.00	Voiced		
0043	Babar	[ˈbæbaɹ]	[ˈbæbʌʔ]	9.00	Voiced				
0045	Babar's dada	[ˌbəbaɹzˈdædæ]	[ˈbowˌdædæ]	8.00	Voiced				
0046	a book...cup	[ʌˈbʊkˀ...kʰʌpˀ]	[əˈbʊkˀ...kʰˌɪˈkʰʌpˀ]	2.00	Voiced				
0055	uh, ball	[ʌʔbɑɬ]	[ˌbɐ̃mˈbɑː]	10.00	Voiced				
0061	blue	[bluː]	[ˈbuw]	15.00	Borderline				
0072	moo	[muʷ]	[ˈbʊː]	9.00	Voiced				
0080	Peter	[ˈpʰiˌɹɚ]	[ˈbʊbʊ]	16.00	Borderline				
0082	Peter	[ˈpʰiˌɹɚ]	[bəˈwɛʔ]					4.00	Voiced
0093	book	[bʊkˀ]	[ˈbʌʔ]	3.00	Voiced				
0099	bib	[bɪb]	[ˈbɪʔ]	8.00	Voiced				
0115	baby	[ˈbeˌbi]	[bijʔˈbejˌbij]	9.00	Voiced			3.00	Voiced
0116	baby	[ˈbeˌbi]	[ˈbejbɪ]	13.00	Voiced				
0118	baby	[ˈbeˌbi]	[ˈbejbɪ]	6.00	Voiced				
0120	baby	[ˈbeˌbi]	[ˈbɛbij]	4.00	Voiced				
0166	book	[bʊkˀ]	[ˈbʌʔ]	7.00	Voiced				
0168	bear(?)	[bɛɹ]	[ˌkʰowˈbɑː]	3.00	Voiced				
0170	beans(?)	[biˌnz]	[owˈbij]	2.00	Voiced				
0175	bird	[bɚd]	[ˈbow]	15.00	Borderline				
0194	ball	[bɑɬ]	[ˈbɑ.əʔɐ̃]	17.00	Borderline				
0198	ball	[bɑɬ]	[ˈbɑː]	9.00	Voiced				
0213	boat	[boʷtˀ]	[ˈbow]	9.00	Voiced				
0220	sheep, moo	[ʃiˌpˀmuʷ]	[ˈʃijpʰˌbuw]			1.00	Voiced		
0225	bean	[biˌn]	[bejˈvij]					3.00	Voiced
0234	ball	[bɑɬ]	[ˈdɪˌbɑː]			3.00	Voiced		
0257	ball	[bɑɬ]	[ˈbʌ]	10.00	Voiced				
0274	brown(?)	[bɹaʷn]	[əˈbɑkˀ]	2.00	Voiced				
0284	oh, ball	[oʷbɑɬ]	[ˌowˈbɑ]	1.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0292	bean ... noodles	[biʲnz...nuʷdɬz]	[ˈbɪ̈juwəkʰaˌnuwnuw]	17.00	Borderline				
0293	bean	[biʲn]	[ˈbij]	10.00	Voiced				
0300	garbage truck	[ˈgɑɹbədʒˌtʃɹʌk]	[ˈbejtʃʌ]	2.00	Voiced				
0303	oh, garbage truck	[oʷˈgɑɹbədʒˌtʃɹʌk]	[ˌoːwbejˈʃæ]					2.00	Voiced
0335	oh, teddy bear	[oʷˈtʰɛdibɛɹ]	[owəˈdɛːwɛ]					5.00	Voiced
0336	bib	[bɪb]	[ˈbij]	5.00	Voiced				
0338	oh, pig	[oʷˈpʰɪg]	[ɔʔˈbij]	4.00	Voiced				
0343	ball	[bɑɬ]	[ˈbɑ]	8.00	Voiced				
0349	blue	[bluː]	[əˈbuwə]	4.00	Voiced				
0352	blue	[bluː]	[ˈbuw]	9.00	Voiced				
0355	blue	[bluː]	[ˈbuw]	13.00	Voiced				
0364	bath	[bæθ]	[ˈbæ]	13.00	Voiced				
0366	box(?)	[bɑks]	[ˈbɑ]	4.00	Voiced				
0383	oh, on the bed	[oʷˌɑnðəˈbɛd]	[uwʔˌɑ̃nəˈbæː]	6.00	Voiced				
0464	ball	[bɑɬ]	[ˈbɑ]	6.00	Voiced				
0467	garbage truck	[ˈgɑɹbədʒˌtʃɹʌk]	[bæˈtʃɛkʰ]					2.00	Voiced
0468	uh, dada	[ʌˈdædæ]	[bʊˈdæɾæ]					4.00	Voiced
0469	a big cow	[əbɪgkʰaʷ]	[ʌ.æ.ɛːˈbijˌkʰɑw]	9.00	Voiced				
0489	bath	[bæθ]	[...ˈbæ]	8.00	Voiced				
0494	boot	[buʷtˀ]	[ˈbuːwtʰ]	10.00	Voiced				
0505	balloon	[bəˈluʷn]	[dʌˈbaː]	9.00	Voiced				
0513	bicycle	[ˈbaʲsikɬ]	[ˌbɛʔjəˈpʰʊtʰʌ]			2.00	Voiced		
0529	ball	[bɑɬ]	[ˈbɑː]	3.00	Voiced				
0547	ball	[bɑɬ]	[ˈbɑ]	10.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0548	mama ... ball	[mɑmə...bɑɫ]	[nɛˈmāmā.... hɛkəˈbɑ]	5.00	Voiced				
0572	ball	[bɑɫ]	[ˈbɑ]	9.00	Voiced				
0573	ball	[bɑɫ]	[uwˈbɑː]	6.00	Voiced				
0574	Ernie Bert	[ɚnibɚt˺]	[ˈẽjmɪˌbʊ]			6.00	Voiced		
0605	boat	[boʷt˺]	[əˈbowtʰ]	1.00	Voiced				
0617	ball	[bɑɫ]	[ʌ̃ʔəˈba]	3.00	Voiced				
0624	boy	[boʲ]	[ˈbuwij]	11.00	Voiced				
0646	ball	[bɑɫ]	[luwˈbɑː]	4.00	Voiced				
0673	bird	[bɚd]	[ˈbʌ.æ]	15.00	Borderline				
0681	bird	[bɚd]	[m̩ˈbɑː]	9.00	Voiced				
0682	bird	[bɚd]	[ˈbɑː]	8.00	Voiced				
0693	I want blanket	[ˈaʲwɑnt˺ˌblæŋkɪt]	[ʌjwãˈbædij]	8.00	Voiced				
0695	want blanket	[wɑnt˺ˈblæŋkɪt]	[ʌ̃ʔˈbædiːj]	7.00	Voiced				
0710	boat	[boʷt˺]	[ˈbow]	6.00	Voiced				
0742	little ball	[lɪɾɬbɑɫ]	[ˌlɛˈbʌ]	4.00	Voiced				
0743	little ball	[lɪɾ̩ɬbɑɫ]	[ˈlɪˌbʌ̃]	5.00	Voiced				
0748	big tail	[bɪgtʰeɬ]	[bɪˈtʰejʌ]					3.00	Voiced
0778	um, brown	[əmˈbɪaʷn]	[ʌ̃mˈbawn]	2.00	Voiced				
0779	big tail	[bɪgtʰeɬ]	[ˈbɪgˈtʰeja]	8.00	Voiced				
0800	bird	[bɚd]	[ˈbʊ.ət]	4.00	Voiced				
0815	blue	[bluː]	[ˈbuw]	3.00	Voiced				
0850	rake	[ɹeʲk˺]	[ʌ̃ʔəˈbejkʰ]	6.00	Voiced				
0852	boat	[boʷt˺]	[ˈboːwtʰ]	12.00	Voiced				
0856	.....beach	[.....bitʃ]	[.....ˈbijtʃ]	4.00	Voiced				
0859	bird	[bɚd]	[ˈbɔ.ətʰ]	4.00	Voiced				
0867	elephant ... bicycle	[ɛɬəfənt...ˈbaʲsɪkɬ]	[ænəˈɛɬfẽ...ˈpʰʌtʰæ]	25.00	Voiceless				
0881	blue	[bluː]	[ˈbuw]	10.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0904	big tail	[bɪgtʰeɨ]	[bɪˈtʰejəɨ]					3.00	Voiced
0912	bird	[bə˞d]	[ˈbʌs]	12.00	Voiced				
0916	big tail	[bɪgtʰeɨ]	[bɪʔˈtʰejʌː]					4.00	Voiced
0917	that's a big slide	[ˈðætsəˈbɪgˈslaɪd]	[ˈdætʰəbɪˌɬajtʰ]					2.00	Voiced
0923	blue	[bluː]	[ˈbuwə]	10.00	Voiced				
0925	book	[bʊkˀ]	[ˈbʊkʰ]	17.00	Borderline				
0957	boat ... drive	[boʷtˀ...ʤɹaɪv]	[ˈbowtʰəʔɐ̃wɑ̃nədəˈdɹajv]	15.00	Borderline				
0972	that's a bird	[ðætsəˈbə˞d]	[n̥ˈdætʰəˈbʌ̃ntʰ]	3.00	Voiced				
0976	vacuum	[ˈvækjuʷm]	[ˈbækʰ͡fnɐ̃]	11.00	Voiced				
0997	...blue one	[ˈbluːwʌn]	[...ˈbuw.wɐ̃nə]	4.00	Voiced				
1001	box	[bɑks]	[ˈbɑ]	2.00	Voiced				
1003	boat	[boʷtˀ]	[ˈbowtʰ]	3.00	Voiced				
1004	?little bear	[lɪɾɬbɛɹ]	[ˌlɪˈbɛ.ə]	6.00	Voiced				
1006	doggie	[dɑgi]	[ˈbɪkʰˌdɑgij]	3.00	Voiced				
1014	...shoe, boot on	[ʃuʷbuʷɾɑn]	[ʃuwʔəˈbuwʔɑ̃n]	6.00	Voiced				
1020	hippo	[ˈhɪpoʷ]	[ˈbɐ̃mˌboːw]	3.00	Voiced				
1024	that's a big shoe	[ðætsəbɪgˈʃuʷ]	[ˌdætʰaʔɛ̃nˌbɪtʰijˈʃuwə]			13.00	Voiced		
1039	I'm crying in bed	[aɪmˌkʰɹajɪŋɪnˈbɛd]	[ɛ̃nɐ̃ˌmajuwˈkʰwɑ̃jnɑ̃ˈbɛtʰ]	4.00	Voiced				
1041	bath	[bæθ]	[ˈbætʰ]	10.00	Voiced				
1060	big tail	[bɪgtʰeɨ]	[bɪˈtʰejow]					5.00	Voiced
1083	boy	[boɪ]	[ˈbɔj]	4.00	Voiced				
1097	that's a blue and a purple	[ˌðætsəˈbluːændəˈpəɹpəl]	[əˈdætʰʌˌbuwɑ̃nəˈbɔpʰʌ]	10.00	Voiced	1.00	Voiced		
1098	...a cat, a boy	[əˈkʰærəˈboɪ]	[...əˈkʰætʰəʔɐ̃ˈbɔjʌ]	2.00	Voiced				
1100	...bed	[bɛd]	[...ˈbætʰ]	2.00	Voiced				
1102	...bib	[bɪb]	[ɐ̃ˌmɑ̃jˈbɪbə]	4.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1103	little baby	[lɪɾ̩beʲbi]	[ˌlejˈbijbij]	2.00	Voiced				
1106	baby	[ˈbeʲbi]	[ˈbejbij]	7.00	Voiced				
1152	...big tail	[bɪgtʰeɨ̞]	[bijˈtʰejow]					3.00	Voiced
1164	garbage	[ˈgaɹbɪdʒ]	[ɑ̃ˈbægəˈkʰɹow]	2.00	Voiced				
1180	ball	[bɑɬ]	[ˈboːw]	8.00	Voiced				
1182	boats	[boʷts]	[ˈbowtʰ]	7.00	Voiced				
1190	birds	[bə˞dz]	[ˈbʊdɪ]	10.00	Voiced				
1195	big tail too	[bɪgtʰeɨ̞tʰuʷ]	[əbɪˌtʰejəˈtʰuw]					5.00	Voiced
1199	brush	[bɹʌʃ]	[ɑ̃ˈbas]	4.00	Voiced				
1222	big eyes	[bɪgaʲz]	[bijˈʔaj]					5.00	Voiced
1223	big toes	[bɪgtʰoʷz]	[bɪʔˈtʰows]					4.00	Voiced
1230	mm, butter	[m̩ˈbʌɾə˞]	[m̩ˈbʌdæ]	4.00	Voiced				
1232	honey and butter too	[hʌnijənbʌɾə˞tʰuʷ]	[ˈhæ̃nijʔə̃ˌbʌ.aˈtʰuw]			6.00	Voiced		
1249	boats	[boʷts]	[ˈbowtʃ]	12.00	Voiced				
1256	boat	[boʷt̚]	[ˈbowtʰ]	11.00	Voiced				
1261	back...house	[bæk̚...haʷs]	[ˌbækʰəʔəˈbækʰəˈhaws]	3.00	Voiced	4.00	Voiced		
1334	no, the big one	[noʷðəbɪgwʌn]	[ˌnowdəˈbɛgwɛ̃n]	2.00	Voiced				
1377	bang	[bæŋ]	[ˈbæ̃ŋ]	6.00	Voiced				
1378	bang	[bæŋ]	[ˈbɛ̃ŋ]	12.00	Voiced				
1379	lady bang	[leʲdibæŋ]	[ˌnejˈbɛŋ]	3.00	Voiced				
1384	...baby some	[beʲbisʌm]	[ˈbejbijˌsɑ̃m]	3.00	Voiced				
1517	a bike	[əˈbaʲk̚]	[uwəˈbɛjkʰ]	5.00	Voiced				
1533	get bean	[gɛt̚ˈbiʲn]	[ˌgɛtˈbijn]	5.00	Voiced				
1535	where did bean go	[wɛɹdɪdbiʲngoʷ]	[əwəˈbɛŋˌgow]	4.00	Voiced				
1537	I wanna... Bean in blanket	[ˈaʲwɑnə...ˌbiːnɪnˈblæŋkɪt]	[ʌˈwɑ̃nəbĩŋdɪbwɛ̃ŋkʰɪtʰʔɛ̃nĩˌbɛ̃ŋkʰɛ̃nt̚]					3.00	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1546	walking ... Bean	[wɑɬkɪŋ...biʲn]	[ˈwɑkʰijnɑ̃ʔɑ:ˌbijn]			7.00	Voiced		
1549	a bum	[əˈbʌm]	[əˈbɑ̃m]	6.00	Voiced				
1553	bye	[baʲ]	[ˈbaj]	13.00	Voiced				
1584	beef hearts	[ˈbiʲfhaɹts]	[ˈbijˌhɑ.ət̚]	13.00	Voiced				
1617	no ball	[noʷbɑɬ]	[ˌnowˈbɑːɬ]	5.00	Voiced				
1654	baby chicks	[ˈbeʲbi̥ˌtʃɪks]	[ˌbejbijˈtʃɪks]			6.00	Voiced		
1662	boats	[boʷts]	[ˈbowtʰ]	9.00	Voiced				
1842	bear	[bɛɹ]	[ˈbɛʔɑ]	6.00	Voiced				
1877	be careful	[biˈkʰɛɹfi̥]	[bɪˈkʰɛfʌɬ]					4.00	Voiced
2022	bear	[bɛɹ]	[ˈbɛː]	13.00	Voiced				
2031	boats	[boʷts]	[ˈbʌwt]	5.00	Voiced				
2074	clock	[kʰlɑk]	[buwˈhɑ]					3.00	Voiced
2092	bugs	[bʌgz]	[ˈbʊdz]	6.00	Voiced				
2098	bus	[bʌs]	[ˈbɪs]	15.00	Borderline				
2156	blue	[blu:]	[bəˈjʊ]					3.00	Voiced
2211	butterfly	[ˈbʌɾəˌflaʲ]	[ˈbʌˌfwaj]	6.00	Voiced				
2358	bib	[bɪb]	[ˈbɛb]	9.00	Voiced				
2365	book	[bʊk̚]	[ˈbʊkʰ]	7.00	Voiced				
2448	baby	[ˈbeʲbi]	[ˈbejbij]	3.00	Voiced				
2460	B,what B for?	[biwʌʔbifɔɹ]	[bijˌʔɑ̃ˈbijfɔ.a]					2.00	Voiced
2481	bacon	[ˈbeʲkn̩]	[ˈbejˌkʰĩn]	10.00	Voiced				
2631	trucks	[tʃɹʌks]	[ˈbʌkʰ]	4.00	Voiced				
2635	bottle	[ˈbɑɾ̩]	[ˈbɑdəɬ]	7.00	Voiced				
2692	black	[blæk]	[bəˈwækʰ]					4.00	Voiced
2733	big ducks	[ˌbɪgˈdʌks]	[ˈbɪʔˈdʌks]	7.00	Voiced				
2752	for these	[fəˈðiz]	[bʌˈdij]					2.00	Voiced
2759	boats	[boʷts]	[ˈbowʔ]	8.00	Voiced				
2804	bother Dad	[bɑðəˈdæd]	[ˌbɑðʌˈdæd]			5.00	Voiced		
2969	brought the hat	[ˌbɹɑtðəˈhæt]	[ˌbɑtdaˈhæt̚]			6.00	Voiced		

Appendix B - VOT and Initial Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
3001	bubbles	[ˈbʌbɬz]	[ˈbʌbəɬ]	6.00	Voiced				
3111	baby	[ˈbeʲbi]	[ˈbejbij]	8.00	Voiced				
3330	brown	[bɹaʷn]	[ˈbãwn]	7.00	Voiced				
3384	bottle for a meal	[ˌbɑtəɬfɔɹəˈmijɬ]	[ˌbɑɬfʌˈmijəɬ]			7.00	Voiced		
3585	boats	[ˈbowts]	[ˈbowts]	5.00	Voiced				
3743	boats	[ˈbowts]	[ˈbowʔs]	2.00	Voiced				
3864	build something	[ˈbɹɬd̚ˌsʌmθɪŋ]	[ˈbɹɬd̚ˌsə̃mpʰĩŋ]	4.00	Voiced				
			Voiceless		1		0		
			Borderline		0		0		
			Voiced		122		14		23

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0053	toy	[tʰoʲ]	[ˈtʰɔʔ]	35.00	Voiceless				
0063	toe	[tʰoʷ]	[ˈtʰʌ]	89.00	Voiceless				
0064	toe	[tʰoʷ]	[ˈtʰuw]	37.00	Voiceless				
0066	toy	[tʰoʲ]	[ˈtʰʊʔ]	73.00	Voiceless				
0071	toy	[tʰoʲ]	[ˈtʰʌw]	53.00	Voiceless				
0074	keys	[kʰiʲz]	[n̩ˈtʰiːj]	137.00	Voiceless				
0087	keys	[kʰiʲz]	[ˈtʰij]	45.00	Voiceless				
0106	cat	[kʰæt̚]	[tʰəˈkʰæt̚]					41.00	Voiceless
0107	cat	[kʰæt̚]	[...ˈtʰɛ̃]	74.00	Voiceless				
0145	cat	[kʰæt̚]	[n̩ˈtʰɛ]	53.00	Voiceless				
0147	tail	[tʰeɨ̯]	[ˈtʰɛlij]	52.00	Voiceless				
0149	tail	[tʰeɨ̯]	[ɵ̃ˈtʰɛlij]	24.00	Borderline				
0158	cookie	[ˈkʰʊki]	[huwəˈtʰejkʰɪʔ]	56.00	Voiceless				
0159	oh, cookie	[oʷkʰʊki]	[ˈowəˌtʰejkʰɛ]	77.00	Voiceless				
0160	uh, chair	[ʌʔˈtʃɛɹ]	[ʊˈtʰɑ]	47.00	Voiceless				
0177	cookie	[ˈkʰʊki]	[hɪmojˈtʰejkʰɪʔ]	55.00	Voiceless				
0187	turtle	[ˈtʰəˠɾ̩]	[ˈtʰɛ̃]	45.00	Voiceless				
0188	turtle	[ˈtʰəˠɾ̩]	[ˈtʰɜ̃ːtʰɛ̃]	59.00	Voiceless				
0231	toy	[tʰoʲ]	[ˈtʰʊej]	63.00	Voiceless				
0247	cat	[kʰæt̚]	[ˈtʰɛː]	71.00	Voiceless				
0261	toys	[tʰoʲz]	[ˈtʰɔj.ij]	39.00	Voiceless				
0273	turtle	[ˈtʰəˠɾ̩]	[ˈtʰɜˌtʰuw]	42.00	Voiceless				
0325	oh, cat	[oʷkʰæt̚]	[ʊwəˈtʰæ]	83.00	Voiceless				
0384	two, three, go	[ˌtʰuʷˌθɹiˈgoʷ]	[ˌtʰuːwˌfwajˈgoːw]			33.00	Voiceless		
0385	two,two, five	[ˌtʰuʷ... ˈtʰuʷˌfaʲv]	[ˌtʃuːwˈtʰuːwˌfaːj]	57.00	Voiceless				
0394	two, five, three	[ˌtʰuʷˌfaʲv,θɹiʲ]	[ˌtʰuwˈfaːjˌhɔwij]			153.00	Voiceless		
0401	two, five, go	[ˌtʰuʷˌfaʲvˈgoʷ]	[ˌtʰuːwˌfwaːjˈgɑʔ]			144.00	Voiceless		

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0403	two, three, go	[ˌtʰuʷˌθɹiˈgoʷ]	[ˌtʰuːwˌhwaːjˈgoːw]			115.00	Voiceless		
0404	two, three, go	[ˌtʰuʷˌθɹiˈgoʷ]	[ˌtʰuːwˌfwaːjˈgoːw]			31.00	Voiceless		
0408	two, three, go	[ˌtʰuʷˌθɹiˈgoʷ]	[ˌtʰuːwˌlaːjˈgoːw]			42.00	Voiceless		
0411	turtle	[ˈtʰɚɾ̩]	[ˈtʰɪtʰʌ]	34.00	Voiceless				
0416	cat	[kʰætˀ]	[ˈtʰæʔ]	90.00	Voiceless				
0446	potato head	[pəˈtʰeɪɾoʷhɛd]	[ˈtʰejˌhɑɹʔ]	52.00	Voiceless				
0456	mama ... toy	[mɑmɑ...tʰoɪ̯]	[ˈmʌ̃mɑ...ˈtʰɔj]	90.00	Voiceless				
0459	tail	[tʰeɪ̯]	[ˈtʰejʌ]	61.00	Voiceless				
0461	turtle	[ˈtʰɚɾ̩]	[ˈtʰʊtʰʌ]	76.00	Voiceless				
0482	turtle	[ˈtʰɚɾ̩]	[ˈtʰʊˌsʊ]	42.00	Voiceless				
0495	tail	[tʰeɪ̯]	[ˈtʰijæ]	45.00	Voiceless				
0496	cat tail	[ˈkʰætˀˌtʰeɪ̯]	[ˈkʰæʔˌtʰijʌ]			61.00	Voiceless		
0515	telephone	[ˈtʰɛɬəfoʷn]	[ˈtʰɑhow]	100.00	Voiceless				
0543	tail	[tʰeɪ̯]	[nˌˈtʰeːjʌ]	93.00	Voiceless				
0544	cat...tail	[kʰætˀ...tʰeɪ̯]	[ʊˌkʰætʰəʔəˈtʰiːjʌ]	64.00	Voiceless				
0550	duck tail	[ˈdʌkˀˌtʰeɪ̯]	[ɪˌdʌkˀˈtʰejʌ]	91.00	Voiceless				
0608	tail	[tʰeɪ̯]	[ˈtʰeːjə]	41.00	Voiceless				
0633	...tail	[...tʰeɪ̯]	[ʊnˈtʰejʌ]	63.00	Voiceless				
0634	it's a tail	[ɪtsəˈtʰeɪ̯]	[ɪsəˈtʰejʌ]	77.00	Voiceless				
0640	dada...tail	[dædæ...tʰeɪ̯]	[ˌdædaʔɪnˈtʰeja]	65.00	Voiceless				
0656	rabbit...tail	[ˈɹæbɪtˀ...tʰeɪ̯]	[nˌˈwæ.əˌĩnˌtʰejə]	83.00	Voiceless				
0670	on top	[ɑntʰɑpˀ]	[ɛ̃nˈʔʌpˀˈtʰɑpʰ]	83.00	Voiceless				
0676	toast	[tʰoʷstˀ]	[ˈtʰow]	86.00	Voiceless				
0684	treehouse	[ˈtɹiːhaʷs]	[ˈtʰijˌhʌw]	77.00	Voiceless				
0700	teddybear	[ˈtʰɛdibɛɹ]	[ˈtʰejˌbʌʔ]	68.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0722	phone(?)	[foʷn]	[ˈtʰɑ]	441.00	Voiceless				
0724	I want sofa	[aʲwɑnʔˈsoʷfɑ]	[owˈtʰuwva]	50.00	Voiceless				
0738	toy	[tʰoʲ]	[dəˈʔowtʰow,tʰɔj]			56.00	Voiceless		
0740	...toy	[...tʰoʲ]	[ɐ̃ʔˈtʰɔj]			27.00	Voiceless		
0744	candle	[ˈkʰændl̩]	[ˈtʰæ̃nʌ]	40.00	Voiceless				
0745	candle	[ˈkʰændl̩]	[ˈtʰæ̃n.na]	51.00	Voiceless				
0748	big tail	[bɪgtʰeɪl̩]	[bɪˈtʰejʌ]	62.00	Voiceless				
0779	big tail	[bɪgtʰeɪl̩]	[ˈbɪgˈtʰeja]	39.00	Voiceless				
0787	mm, toast	[mːˈtʰoʷstˀ]	[ənˈtʰowtʰ]	36.00	Voiceless				
0788	toast	[tʰoʷstˀ]	[ˈtʰows]	78.00	Voiceless				
0809	...teddy bear	[...ˈtʰɛdibɛɹ]	[ˈnowəˈtʰej,bɛ]	65.00	Voiceless				
0820	cat hair ... cat	[kʰætˀhɛɹ...kʰætˀ]	[ɐ̃ˈtʰæhjɔ...ˈkʰætˀ]	72.00	Voiceless				
0825	one, two	[wʌntʰuʷ]	[ˌwɪnˈtʰuːw]	62.00	Voiceless				
0841	guitar	[gɪˈtaɹ]	[ˈtʰaː]	77.00	Voiceless				
0865	telephone	[ˈtʰəɬəfoʷn]	[ˈtʰʌˌfwõːw]	31.00	Voiceless				
0873	teddybear(?)	[ˈtʰɛdibɛɹ]	[əˈtʰɛˌbɑː]	19.00	Borderline				
0879	two	[tʰuʷ]	[ˈtʰuwə]	103.00	Voiceless				
0894	toast	[tʰoʷstˀ]	[ˈtʰows]	85.00	Voiceless				
0895	toaster	[ˈtoʷsɾəˠ]	[...ˈtʰows.sij]	55.00	Voiceless				
0903	that's a cow	[ðætsəkʰaʷ]	[tʰɐ̃tʰəʔʌˈkʰɑwa]					19.00	Borderline
0904	big tail	[bɪgtʰeɪl̩]	[bɪˈtʰejəɬ]	40.00	Voiceless				
0916	big tail	[bɪgtʰeɪl̩]	[bɪʔˈtʰejʌː]	62.00	Voiceless				
0919	...mommy's on the swing too	[ˈmamizɑnðəswɪŋˈtʰuʷ]	[...mɐ̃mijʌvəˌfwĩŋəˈtʰuwə]	39.00	Voiceless				
0928	...tiny stairs	[ˈtʰaʲniʲˈstʰɛɹz]	[....ˈtʰãjˈtʰɛjə]	60.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0928	...tiny stairs	[ˈtʰaɹniɹˈstʰɛɹz]	[....ˈtʰãjˈtʰɛjə]	65.00	Voiceless				
0930	tiny stairs	[ˈtʰaɹniɹˈstʰɛɹz]	[ˈtʰajn̩tʰɛ]	61.00	Voiceless	75.00	Voiceless		
0967	blue and red and purple too	[ˈbluːənˈɹɛdənˈpəɹpəltuː]	[ˌwuwɑ̃nəˈwɛdʔɑ̃nˈpʰɜpʰʌˌtʰuwə]			63.00	Voiceless		
0985	...TV	[tʰiˈviɹ]	[...ˈtʰijˈvij]	65.00	Voiceless				
0998	...two balloons	[ˌtʰuʷbəˈluʷnz]	[ˈtʰuwɑ̃næˈbuw.wɑ̃nə]	56.00	Voiceless				
1013	...tiny one like it ice cream	[ˌtʰaɹniːwʌnlaɹkɪˈɾaɹskɹiːm]	[...tʰajnijwɑ̃ːʔəˌlajkʰɪθʔænəˈejkʰij]	31.00	Voiceless				
1032	tiny dog	[tʰaɹnidɑg]	[ˈtʰajnijˌdɑkʰ]	39.00	Voiceless				
1042	hippo ... towel ... toys	[ˈhɪpoʷ...ˈtʰæwɬ...tʰoɹz]	[əˈθĩmbow...ˈtʰʌwa...ˈtʰɔjs]	37.00	Voiceless				
1042	hippo ... towel ... toys	[ˈhɪpoʷ...ˈtʰæwɬ...tʰoɹz]	[əˈθĩmbow...ˈtʰʌwa...ˈtʰɔjs]	51.00	Voiceless				
1049	toast	[tʰoʷstˀ]	[tũˈtʰʌws]	68.00	Voiceless				
1050	toast	[ˈtʰoʷst]	[ʔtũˈtʰowəʃ]	123.00	Voiceless				
1051	mine toast too	[maɹntʰoʷstʰuʷ]	[ˈmajˈtʰɔjsˌtʰuːw]	61.00	Voiceless				
1052	and tea	[ænˈtʰi]	[n̩ˈtʰeːj]	67.00	Voiceless				
1063	that's a tiny one	[ðætsətʰaɹniwʌn]	[dætʰəˈtʰajnijˌwɑ̃n]	17.00	Borderline				
1080	two	[tʰuʷ]	[ˈtʰuwa]	146.00	Voiceless				
1099	tape	[tʰeɹpˀ]	[ˈtʰeːj]	67.00	Voiceless				
1107	diaper	[ˈdaɹpəˑ]	[ˈtʰɛpɛʔ]	73.00	Voiceless				
1134	cheese and ice cream too	[ˌtʃiːzənˈaɹskɹiːmˈtʰuː]	[ˌtʃijɜ̃ˈʔɛkʰijʔijˈtʰuwə]	78.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1143	I want blow	[ˈaɪwɑnt˺ˌblow˺]	[ɐ̃ˈwɑ̃ːbow]	25.00	Voiceless				
1144	two	[tʰuʷ]	[ˈtʰuwɛ̃nə]	29.00	Voiceless				
1160	turtle	[ˈtʰɚɾɬ]	[ˈtʰʊdʌ]	95.00	Voiceless				
1170	two	[tʰuʷ]	[ˈtʰuw]	93.00	Voiceless				
1171	two	[tʰuʷ]	[ˈtʰuw]	96.00	Voiceless				
1184	two	[tʰuʷ]	[ˈtʰuːw]	107.00	Voiceless				
1195	big tail too	[bɪgtʰeɪɬtʰuʷ]	[əbɪˌtʰejəˈtʰuw]	60.00	Voiceless	70.00	Voiceless		
1196	whiskers	[wɪskɚz]	[ʔɪk˺ˈtʰɛ]	37.00	Voiceless				
1206	cat too	[kʰæt˺tʰuʷ]	[əˌkʰæˈtʰuw]	70.00	Voiceless				
1210	...duck too	[dʌk˺tʰuʷ]	[ʌwɐ̃ˈdɪk˺ˌtʰuw]			43.00	Voiceless		
1211	apple too	[ˈæpɬtʰuʷ]	[ˈæbʊˌtʰuw]			66.00	Voiceless		
1214	turtle too	[ˈtʰɚɾɬtʰuʷ]	[...ˈtʰʌˈtʰʌˈtʰɛ]	28.00	Voiceless				
1219	piggy too	[ˈpʰɪgiɪtʰuʷ]	[əˈpʰɪgijˌtʰuw]			64.00	Voiceless		
1223	big toes	[bɪgtʰoʷz]	[bɪʔˈtʰows]	30.00	Voiceless				
1229	toast	[tʰoʷst˺]	[ˈtʰowəʂ]	74.00	Voiceless				
1231	want toast mommy	[wɑnʔtʰoʷst˺ mɑmi]	[ɐ̃ˈtʰowtʰəˈmaj]	44.00	Voiceless				
1239	mm, potato	[mmpəˈtʰeɪɾoʷ]	[m̩ˈtʰejdow]	61.00	Voiceless				
1245	guitar	[giˈtʰaɪ]	[ˈtʰɑː]	45.00	Voiceless				
1257	my working on a tie-dye	[maɪwə˞kɪŋɑnəˈtʰaɪdaɪ]	[ˌmɐ̃jwɜkʰʲijnɐ̃nɜ̃ˈtʰajdaj]	47.00	Voiceless				
1275	want toy	[wɑntʰoɪ]	[ɤ̆wɐ̃ˈtʰɔjz]	105.00	Voiceless				
1276	mama take it	[mɑmɑtʰeɪkɪt˺]	[ˌmɐ̃mɑˈtʰejkʰɛd]	52.00	Voiceless				
1278	two ducks	[tʰuʷˈdʌks]	[ˈtʰuwˌdækʰ]	44.00	Voiceless				
1282	two	[tʰuʷ]	[ˈtʰuw]	116.00	Voiceless				
1284	two horse	[tʰuʷhɔɹs]	[ˈtʰuwˌfɔj.ɪs]	50.00	Voiceless				
1294	a tiny one...	[əˈtʰeɪnɪwʌn]	[əˈtʰænijwĩn]	53.00	Voiceless				
1299	two brush	[ˈtuːbɹʌʃ]	[ˈtʰuwbwɛːˌʃtʰ]	113.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1302	one two	[wʌntʰuʷ]	[hɐ̃n‘tʰow]	67.00	Voiceless				
1312	it's mama toast	[ɪts mɑmɑmtʰoʷs t̚]	[ɪʃʔɪʃɑˌmɑma.ə‘tʰows]	70.00	Voiceless				
1345	potato	[pə‘tʰeɪdoʷ]	[‘tʰejdow]	71.00	Voiceless				
1352	toast	[tʰoʷst̚]	[ə‘tʰows]	52.00	Voiceless				
1353	toast	[‘tʰoʷst̚]	[aj‘tʰows]	142.00	Voiceless				
1356	duck some too	[dʌksʌmtʰuʷ]	[n̩‘dæksɐ̃mˌtʰuw]			61.00	Voiceless		
1401	two cats	[tʰuʷkʰæts]	[‘tʰuˌkʰæs]	75.00	Voiceless				
1402	another cat too	[ənʌðəˑkʰætʰ uʷ]	[ə‘nɐ̃nəkʰæ‘tʰuw]	106.00	Voiceless				
1405	no my take knife	[noʷmaɪtʰeɪk naɪf]	[now‘majətʰɛkʰˌnejf]					21.00	Borderline
1419	stand up	[stʰæn‘dʌp]	[uw‘tʰæ̃mʌpʰ]	38.00	Voiceless				
1420	teeth	[tʰiˌɪθ]	[‘tʰij]	74.00	Voiceless				
1442	toast	[‘tʰoʷst̚]	[‘tʰows]	83.00	Voiceless				
1445	kids like toast	[kʰɪdzlaˌɪktʰoʷst̚]	[kʰɪd‘lajkˌtʰows]			29.00	Voiceless		
1450	potato	[pə‘tʰeɪdoʷ]	[ənʊ‘tʰeːjdoːw]			84.00	Voiceless		
1451	...steaming	[ˈstiˌɪmɪŋ]	[‘tʰij‘mijnə]	60.00	Voiceless				
1460	potato	[pətʰeɪdoʷ]	[‘tʰejdow]	53.00	Voiceless				
1468	toys	[tʰoɪz]	[‘tʰɔjs]	66.00	Voiceless				
1498	two	[tʰuʷ]	[‘tʰuw]	113.00	Voiceless				
1503	two hearts	[tʰuʷhaɹts]	[‘tʰuwˌhɑ.ɛt̚]	87.00	Voiceless				
1508	one two three five	[wʌntʰuʷθɹifaɪv]	[də‘wɐ̃nˌtʰuwfwijfjætʰ]			87.00	Voiceless		
1556	two rabbits	[tʰuʷ‘ɹæbɪts]	[ˌtʰuw‘wæwɛts]			36.00	Voiceless		
1586	Cathy ... too	[kʰæθi...tʰuʷ]	[ˌkʰæʔij...‘tʰuw]	87.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1601	one, two, three	[wʌnthuwθɹi]	[ˈwʌ̃nˈthuwˈfwij]	92.00	Voiceless				
1638	I have a big knot	[ajhævəbɪgnɑtˀ]	[thaˈbɪʔˌnɑth]					48.00	Voiceless
1696	tea	[thij]	[ˈthija]	97.00	Voiceless				
1704	telephone	[ˈthɛɬəfowˌn]	[thɛləˈfɛwn]					15.00	Borderline
1897	too high	[thuwˈhaj]	[ˈthuwhaj]	102.00	Voiceless				
1898	too high	[thuwˈhaj]	[thuwˈhaj]					43.00	Voiceless
1988	two	[thuw]	[ˈthuw]	112.00	Voiceless				
2329	it's a rabbit	[ɪtsəˈɹæbɪtˀ]	[ˈthuw.wæbɪtˀ]	34.00	Voiceless				
2366	two books	[ˈthuwbʊks]	[thuwˈbʊks]					63.00	Voiceless
2516	take it off	[ˌthejkɪˈrɑf]	[ˌthejkhɪˈdɑf]			39.00	Voiceless		
2605	tiger	[ˈthajgɚ]	[ˈthajgə]	37.00	Voiceless				
2677	two names	[thuwnejmz]	[ˈthuw,nejm]	38.00	Voiceless				
2707	turtle	[ˈthəɾɬ]	[ˈthʊɬɹuw]	82.00	Voiceless				
2749	to the train	[thuðəˈʧɹejn]	[thuwðəˈtwejn]					63.00	Voiceless
2751	those guys	[ˈðowgajz]	[ˈthow,gaj]	32.00	Voiceless				
3072	these guys gotta	[ˈðizgajzgɑrə]	[dɪˈgaj,gɑrə]	112.00	Voiceless				
3361	two cookies	[ˈtuw,kʊkijz]	[thuwˈkhʊkhijs]					56.00	Voiceless
3558	turn it	[ˈtɜɹnɪt]	[ˈthɜnij]	52.00	Voiceless				
3569	turn the page	[ˌtɜɹnðəˈpejdʒ]	[ˌthɜnˈphejph]			50.00	Voiceless		
3640	stop	[ˈstɑp]	[ˈthɑph]	22.00	Borderline				
3642	stop	[ˈstɑp]	[ˈthɑpˀ]	16.00	Borderline				
3785	tail	[ˈtejɬ]	[ˈthejʌɬ]	59.00	Voiceless				
			Voiceless		130		22		6
			Borderline		5		0		3
			Voiced		0		0		0

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0004	dada	[ˈdædæ]	[ˈdɛdæʔ]	1.00	Voiced				
0019	dada	[ˈdædæ]	[ʌˈdædɛ]	7.00	Voiced				
0020	dada	[ˈdædæ]	[ʌˈdædæ]	15.00	Borderline				
0024	dada	[ˈdædæ]	[ˈdæˌdæ]	8.00	Voiced				
0025	dada	[ˈdædæ]	[ˈdæˌdɛ]	6.00	Voiced				
0037	Joe (?)	[dʒoʷ]	[əˈdow]	5.00	Voiced				
0038	Joe (?)	[dʒoʷ]	[əˈdow]	11.00	Voiced				
0039	Joe	[dʒoʷ]	[ˈdɜʔ]	9.00	Voiced				
0041	Joe	[dʒoʷ]	[ˈdow]	9.00	Voiced				
0045	Babar's dada	[ˌbəbaɹzˈdædæ]	[ˈbowˌdædæ]			6.00	Voiced		
0052	duck	[dʌk̚]	[ˈdæʔ]	8.00	Voiced				
0056	dada	[ˈdædæ]	[ˈdædɑ]	4.00	Voiced				
0057	dada	[ˈdædæ]	[ˈdɛdæ]	7.00	Voiced				
0069	dada	[ˈdædæ]	[ˈdæˌdæ]	5.00	Voiced				
0070	dada	[ˈdædæ]	[ˈdædʌ]	6.00	Voiced				
0084	dada	[ˈdædæ]	[ˈdɛdæ]	13.00	Voiced				
0090	dada	[ˈdædæ]	[dʌˈdæ]					2.00	Voiced
0105	dish	[dɪʃ]	[ˈdij]	4.00	Voiced				
0113	dada	[ˈdædæ]	[ˈdæˌdɛ]	7.00	Voiced				
0131	dada	[ˈdædæ]	[ʌ̟ˈdædɛ]	3.00	Voiced				
0132	dada	[dædæ]	[dæˈdæ]					2.00	Voiced
0134	dada	[dædæ]	[ˈdædɛ]	9.00	Voiced				
0136	dada cookie	[dædæˈkʰʊki]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	5.00	Voiced				
0140	dada	[dædæ]	[ˈdawdʒɑ]	8.00	Voiced				
0156	dada	[dædæ]	[ˈdɛdæ]	7.00	Voiced				
0200	duck	[dʌk̚]	[ˈdʌː]	10.00	Voiced				
0214	dada	[dædæ]	[n̩ˈdɛdɛ]	2.00	Voiced				
0298	duck	[dʌk̚]	[ˈdæ]	5.00	Voiced				
0308	Peter	[ˈpiɾəˑ]	[ˈdʌdæ]	7.00	Voiced				
0438	d, dada	[didædæ]	[ˌɛʔowˈdæɾæ]	4.00	Voiced				
0458	dada	[ˈdædæ]	[ˈdædæ]	7.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0463	duck	[dʌk˺]	[ˈdʌkʰ]	9.00	Voiced				
0468	uh, dada	[ʌˈdædæ]	[bʊˈdæræ]	6.00	Voiced				
0484	dog	[dɑg]	[ˈdɑːkʰ]	6.00	Voiced				
0506	dada	[ˈdædæ]	[ˈdædæ]	10.00	Voiced				
0523	um, uh, dada	[ʌmʌˈdædæ]	[m̩ʔõnˈdædæ]	14.00	Voiced				
0531	dada	[ˈdædæ]	[ˈdɛˌlø]	9.00	Voiced				
0538	dada	[ˈdædæ]	[dɛˈdæ]					5.00	Voiced
0541	dada	[ˈdædæ]	[ˌdɛˈda]			5.00	Voiced		
0554	uh, dog	[ʌdɑg]	[ãnˈdɑ]	3.00	Voiced				
0560	dog	[dɑg]	[ˈdɑkʰ]	11.00	Voiced				
0567	dog	[dɑg]	[ˈdɑ]	11.00	Voiced				
0636	mama	[mɑmə]	[dætˈˈmʌ̃mʌ̃]					7.00	Voiced
0668	dada	[dædæ]	[ũwˈdɛdɛ]	5.00	Voiced				
0669	dada	[dædæ]	[ˈdædæ]	9.00	Voiced				
0754	duck, a tail	[dʌkəthe˞ɬ]	[ˈdʌkʰʔɛ̃ˌtʰejɑ]	5.00	Voiced				
0771	duck	[dʌk˺]	[n̩ˈdɛkʰ]	5.00	Voiced				
0783	oh, dog	[oʷdɑg]	[ˈowˌdɑkʰ]			13.00	Voiced		
0813	that	[ðæt˺]	[ʌ̃wəˈdætʰ]	8.00	Voiced				
0835	a slide... wee, down	[əˈslaɪd...ˈwiːdaʷn]	[əˈslajdãdəˈwiːjˈdɑwn]	5.00	Voiced				
0839	dance	[dæns]	[ˈdɛ̃ntʃ]	10.00	Voiced				
0883	that's a dog	[ðætsədɑg]	[ˈdædəˈdɑgij]	3.00	Voiced				
0883	that's a dog	[ðætsədɑg]	[ˈdædəˈdɑgij]	5.00	Voiced				
0888	dogs	[dɑgz]	[ˈdɑkʰ]	6.00	Voiced				
0891	uh, that's a ??	[ʌðætsə]	[ʌ̃ːʔə̃nˈdætʰə]	2.00	Voiced				
0892	juice	[dʒuʷs]	[ˈduwʂ]	3.00	Voiced				
0907	duck	[dʌk˺]	[...ˈdʌtʰ]	7.00	Voiced				
0909	that's a dog	[ðætsədɑg]	[ˌdætʰʌ̃ʔəˈdɑkʰ]	6.00	Voiced	6.00	Voiced		
0910	that horsie	[ðætˈhɔɹsi]	[dæʔˈhɔʂij]					5.00	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0911	that, who's that	[ðæthuʷzðæt˺]	[ˈdɛstʰʌʔɐ̃ˈdæð]	8.00	Voiced				
0914	duck	[dʌk]	[ˈdʌkʰ]	9.00	Voiced				
0915	daddy duck	[dædidʌk˺]	[dæθajnõmˈdʌgej]	11.00	Voiced			6.00	Voiced
0917	that's a big slide	[ˈðætsəˈbɪgˈslaɪd]	[ˈdætʰəbɪˌɬajtʰ]	6.00	Voiced				
0922	?dog	[dɑg]	[ɐ̃ˈdætʰ]	4.00	Voiced				
0931	dance	[dænʃ]	[ɐ̃nˈdajs]	2.00	Voiced				
0932	what's that	[wʌtsðæt˺]	[ʔuwnˈdæt˺]	9.00	Voiced				
0933	that's an elephant	[ðætsənˈɛɬəfənt˺]	[ˈdæˌdaʔɑʔɛ̃fĩhɛ̃ˌpʰɛ̃]	4.00	Voiced				
0935	what's that	[wʌtsðæt˺]	[ʔɐ̃ˈdætʰ]	2.00	Voiced				
0937	cat	[kʰæt˺]	[ˈkʰætʰaʷduwijɛn]					2.00	Voiced
0938	dog	[dɑg]	[ˈdɑkʰ]	5.00	Voiced				
0941	grass	[gɹæs]	[n̩ˈdæs]	2.00	Voiced				
0948	...that's a...	[ðætsəˌ]	[m̩ˌdæsəʔəˈbɑɬ]	3.00	Voiced				
0949	that's a carrot	[ðætsəˈkʰɛɹət]	[ˌdæsɨˈkʰɛɹæ]			11.00	Voiced		
0951	what's that	[wʌtsðæt˺]	[n̩ˈdætʰ]	4.00	Voiced				
0952	what's that	[wʌtsðæt˺]	[n̩ˈdætʰ]	3.00	Voiced				
0953	this one	[ðɪswʌn]	[ˈdɛsˌ∑ɐ̃n]	9.00	Voiced				
0962	that's a hippo	[ðætsəhɪpoʷ]	[dæsaˈbɐ̃m̩bow]					8.00	Voiced
0966	what's that	[wʌtsðæt˺]	[ɐ̃ˈdætʰ]	4.00	Voiced				
0971	pull that	[pʰʊɬðæt˺]	[ˈpʰʊɬɛ̃nəˈdætʰ]	7.00	Voiced				
0972	that's a bird	[ðætsəˈbɚd]	[n̩ˈdætʰəˈbɐ̃ntʰ]	3.00	Voiced				
0977	dog	[dɑg]	[ˈdɑkʰ]	8.00	Voiced				
1006	doggie	[dɑgi]	[ˈbɪkʰˌdɑgij]			3.00	Voiced		
1010	eating that	[ˌiɾɪŋˈdæt˺]	[ɛ̃nəˌʔejd̪ĩŋɛ̃ʔəˈdætʰ]	4.00	Voiced				
1011	eating that	[ˌiɾɪŋˈðæt˺]	[ʔɛ̃ˌʔejd̪ĩjnəˈdætʰ]	7.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1024	that's a big shoe	[ðætsəbɪg'ʃuʷ]	[ˌdætʰaʔɛ̃nˌbɪtʰij'ʃu wə]			4.00	Voiced		
1030	and dog	[æn'dɑg]	[ʔə̃ʔʌ̃n'dɑkʰ]	2.00	Voiced				
1031	that's a dog	[ðætsədɑg]	[ʌ̃'dætʰɪˌdɑkʰ]	8.00	Voiced	3.00	Voiced		
1032	tiny dog	[tʰaɹnidɑg]	['tʰajnijˌdɑkʰ]			2.00	Voiced		
1059	duck	[dʌk˺]	['dʌkʰ]	11.00	Voiced				
1062	...that's a daddy one	[ðætsədædiwʌn]	[...dædə'dædijˌwʌ̃n]	5.00	Voiced			3.00	Voiced
1063	that's a tiny one	[ðætsətʰaɹniwʌn]	[dætʰə'tʰajnijˌwʌ̃n]					16.00	Borderline
1076	dancing	['dænsɪŋ]	['dæ̃ʃijnə]	4.00	Voiced				
1077	...cat	[kʰæt˺]	[ˌdæzə'kʰætʰ]			9.00	Voiced		
1084	that's a man	[ðætsəmæn]	[dætʰaṃ'mæ̃n]					41.00	Voiceless
1088	a dog	[ə'dɑg]	[nʌ̃'dɑkʰ]	5.00	Voiced				
1089	dog	[dɑg]	['dɑkʰ]	9.00	Voiced				
1097	that's a blue and a purple	[ˌðætsə'bluːændə'pəɹpəl]	[ə'dætʰʌˌbuwə̃nə'bɔpʰʌ]	3.00	Voiced				
1105	...what's that	[wʌtðæt˺]	[...ow'dætʰ]	7.00	Voiced				
1109	high chair	['haɹtʃɛɹ]	[ən'dætʰɪˌdɛ.ə]	5.00	Voiced	11.00	Voiced		
1112	uh, that	[ʌðæt˺]	[ṇ'dætʰ]	4.00	Voiced				
1113	that's a fish	[ðætsəfɪʃ]	[ˌdæzʔʌ̃ṇ'fɪʃ]			9.00	Voiced		
1114	that's meat	[ðætsmit˺]	[ˌdæzə'mijtʰ]			4.00	Voiced		
1116	that	[ðæt˺]	[ṇ'dætʰ]	2.00	Voiced				
1120	that	[ðæt˺]	[ʌ̃n'dæt˺]	4.00	Voiced				
1122	that is a red ???	[ðærɪzəˌɹɛd....]	[ˌdæʔɪʔəˌwɛd'ʃɹ.uw]			6.00	Voiced		
1126	that	[ðæt˺]	[ʌ̃n'dæ]	4.00	Voiced				
1127	that	[ðæt˺]	[ʌ̃n'dætʰ]	2.00	Voiced				
1128	that's a ???	[ðætsə]	[ʌ̃ˌdætʰɛ'næ̃.æ̃ʔ]	5.00	Voiced				
1132	that	[ðæt˺]	[ṇ'dæ]	2.00	Voiced				
1136	putting that	[ˌpʰʊɾɪŋ'ðæt˺]	[mˌpʰɪtʰɛ̃n'dæd]	9.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1150	that's a blue one	[ˌðætsəˈblu:wʌn]	[ˌdætʰəˈbuwɐ̃n]			7.00	Voiced		
1158	duck	[dʌk̚]	[ˈdakʰ]	5.00	Voiced				
1177	dog	[dɑg]	[əˈdɑkʰ]	10.00	Voiced				
1178	dog	[dɑg]	[ˈdakʰ]	3.00	Voiced				
1183	what that	[wʌʔðæt̚]	[owˈdætʰ]	2.00	Voiced				
1210	...duck too	[dʌk̚tʰuʷ]	[ʌwɐ̃ˈdɪk̚ˌtʰuw]	3.00	Voiced				
1235	mama that	[ˌmɑməˈðæt̚]	[mɑ̃.ɐ̃ˈdætʰ]	2.00	Voiced				
1280	ducks	[dʌks]	[ˈdʌt̚]	6.00	Voiced				
1322	...dinner, want dinner	[dɪnɚwɑntdɪnɚ]	[wɛ̃ntʰd̃ĩnʌˌwɑ̃ˈd̃ĩnʌ]	4.00	Voiced				
1323	cutting cutting that knife	[kʰʌɾɪŋkʰʌɾɪŋðætnaʲf]	[ajkʰʌtʰɪdˈkʰʌtʰn̄ˈdætʰənajf]	5.00	Voiced				
1346	...cook a duck	[ˌkʰʊkəˈdʌk]	[ˌkʰʊkʰəˈdækʰ]	5.00	Voiced				
1356	duck some too	[dʌksʌmtʰuʷ]	[n̩ˈdæksɐ̃mˌtʰuw]	3.00	Voiced				
1366	giant peach	[dʒajn̩t̚pʰi˕ɪtʃ]	[ˌdajɜ̃ˈpʰij]			5.00	Voiced		
1369	giant peach	[dʒajn̩t̚pʰi˕ɪtʃ]	[ˌdajəˈpʰe:js]			6.00	Voiced		
1372	giant peach	[dʒajn̩t̚pʰi˕ɪtʃ]	[ˌdajˈpʰi:j]			3.00	Voiced		
1389	doggie, mom read that	[dɑgimɑmɹɛdðæt]	[ˌdɑgijəˈmɑ̃.ɹij̩dæ]			5.00	Voiced		
1409	doggie	[ˈdɑgi]	[ˈdɑgij]	9.00	Voiced				
1429	...sit down	[sɪtdaʷn]	[ɐ̃wɑ̃ntʰɪ.ʃ.sɪˌdawn]			10.00	Voiced		
1448	doggies	[ˈdɑgiz]	[ˈdɑgija]	10.00	Voiced				
1511	...somebody coming sit down	[sʌmbʌdikʰʌmɪŋsɪʔdaʷn]	[ˈmɑ̃mijʔɛʔæ̃ndəˌsɐ̃mbʌ.ijˈkʰɐ̃mijnæ̃nʃij̩ˈdawn]	6.00	Voiced				
1527	uh, dad	[ʌdæd]	[ɐ̃ˈdædə̆]	4.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1550	that's a bum too	[ðætsəbʌmtʰuʷ]	[ˈdæzəˌbɐ̃mˈtʰuw]	9.00	Voiced				
1551	that bum	[ðætˀbʌm]	[ˈdæˌbɐ̃m]	7.00	Voiced				
1554	duck	[dʌkˀ]	[ˈdʌkʰ]	4.00	Voiced				
1587	that heart too	[ðæʔhaɹtˀtʰuʷ]	[ˌdæhɑˈtʰuw]			5.00	Voiced		
1589	duck	[dʌkˀ]	[ˈlʊkʰəwɑˌdɛ]			6.00	Voiced		
1591	ducks	[dʌks]	[ˈdʌks]	11.00	Voiced				
1595	duck	[dʌkˀ]	[ˈdʌtʰ]	11.00	Voiced				
1596	duck swim back	[ˈdʌkˀswɪmˈbækˀ]	[ˌdʌkswejˈbækˀ]			5.00	Voiced		
1600	that's a horse	[ðætsəˈhɔɹs]	[ˈdætʰəˌhɔ.ɛ]	11.00	Voiced				
1614	that's for Cathy	[ðætsfəˈkʰæθi]	[ˈdætʰəˌkʰæː]	6.00	Voiced				
1664	that guy driving a	[ˈðætˀgaʲˌʤɹaʲvɪŋə]	[dæˈgajˌdwajvijnʌʔ]					6.00	Voiced
1666	that drives	[ðætˀˈʤɹaʲvz]	[dæˈdwajv]					7.00	Voiced
1698	this has tea?	[ðɪshæstʰi]	[ˈdɪshʌzˌtʰij]	8.00	Voiced				
1724	that's the ground	[ðætsðəˈgɹaʷnd]	[ˈdæzəˌgawn]	7.00	Voiced				
1761	that's all my toys	[ðætsɑɬmaʲtʰoʲz]	[ˈdætsɑˈmajˌtʰɔjs]	6.00	Voiced				
1771	daddy	[ˈdædi]	[ˈdædij]	11.00	Voiced				
1775	dancing	[ˈdænsɪŋ]	[ˈdæ̃ntʰ͡ʰɪŋ]	4.00	Voiced				
1818	these guys	[ðizgaʲz]	[ˌdijˈgajs]			8.00	Voiced		
1820	these guys	[ðizgaʲz]	[ˈdijgaj]	4.00	Voiced				
1828	daddy, I want	[dædijaʲwɑntˀ]	[ˈdædijˌʔʌwɐ̃]	6.00	Voiced				
1833	this?	[ðɪs]	[ˈdɪs]	9.00	Voiced				
1847	dots	[dɑts]	[ˈdɑts]	8.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1906	this way	[ˈðiswe^{j}]	[ˈdɪθˌwej]	9.00	Voiced				
1925	eating corn	[iɾɪŋkʰɔɹn]	[dijðəˈklɔwən]					3.00	Voiced
1937	the white one	[ðəˈwa^{j}twʌn]	[dəˈwajfˌwɐ̃n]					5.00	Voiced
1939	this guy	[ðɪsga^{j}]	[ˈdɪsˌgaj]	8.00	Voiced				
1940	that one is not me	[ˌðæʔwʌnɪzˌnɑʔˈmi^{j}]	[ˌdæʔwɐ̃nɪˌnaʔˈmɪ̃jn]			6.00	Voiced		
1942	this guy	[ðɪsga^{j}]	[ˈdɪsˌgaj]	9.00	Voiced				
1944	this rabbit	[ðɪsˈɹæbɪt̚]	[ˈdɪsˌɹæbɪtʰ]	9.00	Voiced				
1985	this guy	[ˈðɪsˌga^{j}]	[ˈdɪsˌgaj]	9.00	Voiced				
2029	the little one is swimming	[ðəˈlɪɾɬwʌnɪzˈswɪmɪŋ]	[dəˈlɪɬwɐ̃nˌswɪ̃mɪ̃ŋ]					5.00	Voiced
2080	this big book	[ðɪsbɪgbʊk̚]	[ˈdɪθbɪgˌbʊkʰ]	8.00	Voiced				
2083	down there	[da^{w}nˈðɛɹ]	[dawˈnɛː]					5.00	Voiced
2085	don't move	[do^{w}nt̚ˈmu^{w}v]	[dõwt̚ˈmjuwv]					6.00	Voiced
2091	doggies	[ˈdɑgiz]	[ˈdɑgij]	10.00	Voiced				
2094	doggie	[ˈdɑgi]	[ˈdɑgij]	8.00	Voiced				
2117	this man	[ˈðɪsmæn]	[ˈdɪθˌmæːn]	7.00	Voiced				
2118	that man	[ˈðæt̚mæn]	[ˈdɑʔˌmæːn]	6.00	Voiced				
2122	duck	[dʌk̚]	[ˈdʌkʰ]	5.00	Voiced				
2178	ducks	[dʌks]	[ˈdʌʔs]	10.00	Voiced				
2260	dark out	[ˈdaɹka^{w}t̚]	[ˈdɑɹˌkʰawtʰ]	10.00	Voiced				
2273	the horse don't swim	[ðəˈhɔɹsdo^{w}nt̚ˈswɪm]	[dəˈhɔləˌfwɪ̃m]					5.00	Voiced
2274	this is the ground	[ˌðɪsɪzðəˈgɹa^{w}nd]	[ˌdɪzəˈgwawnt̬]			4.00	Voiced		
2290	the turtle needs help	[ðətʰəˈɾɬnidsheɬp̚]	[dɪˈtʰɔdənijzˌheɬp̚]					7.00	Voiced
2309	don't drip it	[ˌdo^{w}nt̚ʤɹɪpɪt̚]	[ˈdownˌdɹɛpʰɪtʰ]	10.00	Voiced				
2340	the cat got a tail	[ðəkʰæt̚gɑɾətʰeɬ]	[dəˈkʰægɑðəˌtʰejəɬ]					3.00	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
2348	this guy yellow	[ˈðɪsgaʲˌjɛɬoʷ]	[ˈdɪsgajˌlɛɥow]	3.00	Voiced				
2375	this yours	[ðɪsjɔɹz]	[ˈdɪsɔwas]	9.00	Voiced				
2378	that sock	[ðæʔsɑkˀ]	[ˈdæsɑkʰ]	9.00	Voiced				
2387	this guy needs this	[ˌðɪsgaʲnidsˈðɪs]	[ˌdɪsgajnijˈdɪs]			7.00	Voiced		
2391	the little duck	[ðəlɪɾɬdʌk]	[dəˌlɪ.əˈdʌkʰ]					6.00	Voiced
2396	this one	[ˈðɪswʌn]	[ˈdɪswɐ̃n]	6.00	Voiced				
2405	dogs	[dɑgz]	[ˈdɑkˀ]	7.00	Voiced				
2451	the other baby	[ðəˈjʌðəˌbeʲbi]	[dəˈʔʌðəˌbejbij]					6.00	Voiced
2457	D for Dada	[difəˑdædæ]	[dijfaˈdærɑ]					5.00	Voiced
2477	don't like it	[doʷnʔˈlaʲkɪtˀ]	[ˈdõwʔˌlajkˀdɪtʰ]	8.00	Voiced				
2482	those guys	[ˈðoʷzˌgaʲz]	[ˈdowsˌgajtʰ]	7.00	Voiced				
2510	this Mowgli's gum	[ðɪsˌmoʷgɬɪzˈgʌm]	[ˈdɪsmowgijˌgɐ̃m]	5.00	Voiced				
2517	just getting more gum	[dʒəsgɛɾɪŋˈmɔɹgʌm]	[ˌdʌsgɛdĩŋˈmɔɹgɐ̃m]			8.00	Voiced		
2526	turtle	[ˈtʰəˑɾɬ]	[ˈdɔdɑ]	8.00	Voiced				
2574	them animals	[ðɛmˈmɑnəmˌɬz]	[dɛ̃mˈʔæ̃nəwʌɬs]					5.00	Voiced
2620	doggies	[ˈdɑgiz]	[ˈdɑgijs]	6.00	Voiced				
2640	don't like it	[doʷnʔˈlaʲkɪtˀ]	[dõwʔˈlajgɛtˀ]					7.00	Voiced
2644	the bowl	[ðəˈboʷɬ]	[dəˈbowʌɬ]					4.00	Voiced
2711	Is that you bib?	[ɪsðætˀjuʷbɪb]	[ˈdæjɔˌbɐpʰ]	8.00	Voiced				
2722	there's keys	[ðɛɹsˈkʰiz]	[dɪsˈkʰij]					5.00	Voiced
2738	they're running away	[ðɛɹʌnɪŋəˈweʲ]	[dɛwɐ̃nĩjəˈwej]					6.00	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
2739	there's his hat	[ðɛɹzhɪz'hæt̚]	[dɛshɪz'hæːʔ]					3.00	Voiced
2740	these guys	['ðizgaɪz]	['dij͡gaj]	14.00	Voiced				
2741	that	[ðæt̚]	['dɛ]	5.00	Voiced				
2742	do you like these?	[duʷjuʷlaɪk'ðɪz]	['duwjuwlajk̚'dijð]	7.00	Voiced				
2744	dog	[dɑg]	['dɑj]	9.00	Voiced				
2747	that guy	[ðæt̚gaɪ]	['dæʔ͡gaj]	9.00	Voiced				
2787	she got mad on this page?	[ʃɪgɑt̚͡madɑn'ðɪspeɪdʒ]	[dʊnɑt̚'mædɑ̃n͡ðɪθ'pʰejt͡ʃ]					3.00	Voiced
2807	they're boys	[ðɛɹboɪz]	['dæ͡bɔjz]	8.00	Voiced				
2808	that guy	[ðæt̚gaɪ]	['dæʔ͡gaj]	8.00	Voiced				
2819	those guys	[ðoʷzgaɪz]	[͡dows'gaj]			5.00	Voiced		
2833	they got soup	[ðeɪgɑʔ'suʷp̚]	[dejgɑt̚'suwpʰ]					3.00	Voiced
2844	they like pickles	[ðeɪlaɪk'pʰɪkɬz]	[dɛ͡lajk̚'pʰɪkʰəɬ]					5.00	Voiced
2846	that spoon	[ðæt̚'spuʷn]	['dæt̚͡pʰuwn]	11.00	Voiced				
2860	there's a knife for the big one	[ðɛɹzənaɪfə-ðə'bɪgwʌn]	[dɪzə'naj͡fɔ.ə'bɪg'wɐ̃n]					3.00	Voiced
2951	these guys	['ðizgaɪz]	['dij͡gajs]	9.00	Voiced				
2971	?? just wanna go see a monster	[...dʒʊs͡wɑnəgoʷ͡sijə'mɑn͡stə-]	['dæwɐ̃n͡dʒʊswɐ̃.əgowsijə'mɐ̃θtʰɑ]	8.00	Voiced				
2976	don't find the horses	[͡donʔfaɪnðə'hɔɹsəs]	['dõw͡fɐ̃jndə'hɔ.əsɛz]	3.00	Voiced				
2997	that's a	['ðætsə]	['dæsə]	6.00	Voiced				
3000	that, I'm gonna blow	['ðætaɪmgənə'bloʷ]	['dæʔajŋgɐ̃͡bwow]	10.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
3016	the wind's coming in	[ðəˈwɪndskʰʌmɪˌŋɪn]	[dəˈwĩnkʰɤ̃mĩˌŋĩn]					3.00	Voiced
3023	that and that	[ðætˆˌnðætˆ]	[ˈdæʔləˌðætʰ]	11.00	Voiced				
3051	that a apple	[ˌðærnˈˌæpɬ]	[ˈdæʔæpʰuw]	3.00	Voiced				
3061	that red	[ðætˆˈˌɹɛd]	[ˈdæʔɹɛd]	6.00	Voiced				
3065	this blue	[ðɪsˈbluː]	[ˈdɪθˌbluw]	8.00	Voiced				
3070	they really like each other	[ðeʲˌɹɪliˈlaʲkiˌtʃʌðəˑ]	[dejɹəlijˈlajkˆdəˌtʃʌðə]					5.00	Voiced
3071	do it	[]	[ˈduwɪtʰ]	10.00	Voiced				
3072	these guys gotta	[ˈðizgaʲzgɑɾə]	[dɪˈgajˌgɑɾə]					5.00	Voiced
3076	this are kissing each other	[ˌðɪsəˑˈkʰɪsɪŋiˌtʃʌðəˑ]	[ˈdɪzəɹˌkʰɪsĩnˈtʃʌðə]	8.00	Voiced				
3077	they're kissing each other	[ðɛɹˈkʰɪsɪŋiˌtʃʌðəˑ]	[dɛˈkʰɪsĩnəˌtʃʌʤa]					4.00	Voiced
3080	this	[ðɪs]	[ˈdɪθ]	5.00	Voiced				
3081	this guy's still laughing	[ˈðɪsˈgajzstʰɪɬˈˈlæfɪŋ]	[ˈdɪgajˌθɪɬlæfĩj]	10.00	Voiced				
3097	duck	[dʌkˆ]	[ˈdʌkˆ]	2.00	Voiced				
3114	there's the spoon	[ˈðɛɹzðəˈspʰuwn]	[dəθdəˈpʰuːwn]					4.00	Voiced
3191	daddy gonna go that house	[ˌdædigənəgoˌðætˆhaʷs]	[ˈdæɾijgowĩgowˌðædˈhaws]	8.00	Voiced				
3225	Daddy	[ˈdædi]	[ˈdæɾij]	7.00	Voiced				
3263	this a big	[ˈðɪsəˌbɪg]	[ˈdɪsəˌbij]	9.00	Voiced				
3329	this is red	[ˈðɪsɪzˌɹɛd]	[ˈdɪsəˌwɛd]	7.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
3340	he just ate some	[hidʒʌsteˈtsəm]	[ˈdɪsʔejtˌθɤ̃m]	11.00	Voiced				
3350	dogs	[dɑgz]	[ˈdɑg]	6.00	Voiced				
3356	dogs can't	[ˈdɑgskænt]	[ˈdʌkskʰæ̃ʔ]	10.00	Voiced				
3412	ducks	[ˈdʌks]	[ˈdʌkˀ]	13.00	Voiced				
3413	this is orange	[ðɪsɪˈzɔɹɪndʒ]	[ˈdɪθɪˌðɔ.ɤ̃ndʒ]	11.00	Voiced				
3415	this is yellow	[ðɪsɪzˈjɛlow]	[dɪsəˈjɛlə]					4.00	Voiced
3418	this white	[ðɪsˈwajt]	[ˈdɪsˌwajtʰ]	12.00	Voiced				
3426	there's a horse	[ðɛɹsəˈhɔɹs]	[ˌdɛɹzəˈhɔ.ə]			7.00	Voiced		
3431	do that	[duwˈðæt]	[duwˈðætʰ]					3.00	Voiced
3435	this blue	[ðɪsˈbluw]	[ˌdɪsˈbwuw]			5.00	Voiced		
3437	there it is	[ˈðɛɹɪtɪz]	[ˈdɛɹɪɾɪz]	13.00	Voiced				
3482	do you wanna back?	[duwjuwˌwɑnəˈbæk]	[djuwɤ̃nɪˈbækʰ]					5.00	Voiced
3571	there	[ˈðɛɹ]	[ˈdɛ]	4.00	Voiced				
3582	there it is	[ˈðɛɹɪtɪz]	[ˈdɛɹəɪð]	7.00	Voiced				
3653	don't wear your other one	[downtwɛɹjɔɹˈʔʌðəɹˌwʌn]	[ˈdõwʔwɛjəˈʔɛðʌˌwɤ̃n]	10.00	Voiced				
3679	don't wear hat	[ˌdowntwɛɹˈhæt]	[ˌdõwʔwɛˈhæːtˀ]			7.00	Voiced		
3706	That's his mom?	[ðætshɪzˈmɑm]	[ˈdæθhɪˌmɤ̃m]	7.00	Voiced				
3715	little piggy	[ˌlɪtəɬˈpɪgij]	[dɪɬˈpʰɪgij]					3.00	Voiced
3759	dog	[ˈdɑg]	[ˈdɑg]	7.00	Voiced				
3767	the dirt fell down	[ðəˈdɜɹtfɛɬˌdawn]	[dəˈdøʔˌfɛɬdɤ̃wn]					3.00	Voiced
3860	this thing like this	[ðɪsˌθɪŋlajkˈðɪs]	[ˈdɪsˌθĩŋlĩŋˈðɪθ]	8.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
			Voiceless		0		0		1
			Borderline		1		0		1
			Voiced		184		32		42

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0001	cup	[]	[ˈkʰʌʔ]	90.00	Voiceless				
0030	Keesha	[ˈkʰiʲʃə]	[ˈkʰijʃɪ]	94.00	Voiceless				
0046	a book...cup	[ʌˈbʊkˀ...kʰʌpˀ]	[əˈbʊkˀ...kʰ̚ˈkʰʌpˀ]	122.00	Voiceless				
0047	apple	[ˈæp̚t̚]	[ˈkʰuw]	102.00	Voiceless				
0058	car	[kʰaɹ]	[ˈkʰʌw]	104.00	Voiceless				
0059	colour	[ˈkʰʊləˠ]	[ˈkʰʌwjæʔ]	105.00	Voiceless				
0060	colour	[ˈkʰʌləˠ]	[ˈkʰʌlə]	133.00	Voiceless				
0073	cat	[kʰætˀ]	[ˈkʰæʔ]	51.00	Voiceless				
0079	keys	[kʰiʲz]	[ˈkʰij]	141.00	Voiceless				
0081	keys	[kʰiʲz]	[ˈkʰij]	138.00	Voiceless				
0083	keys	[kʰiʲz]	[ˈkʰijʔ]	168.00	Voiceless				
0108	cat	[kʰætˀ]	[ˈkʰæ]	65.00	Voiceless				
0114	Keesha	[ˈkʰiʲʃɑ]	[ˈkʰijʃɪ]	120.00	Voiceless				
0127	keys	[kʰiʲz]	[əˈkʰɪʔ]	153.00	Voiceless				
0136	dada cookie	[dædæˈkʰʊki]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	59.00	Voiceless				
0162	cat	[kʰætˀ]	[ˈkʰæʔ]	49.00	Voiceless				
0163	cat	[kʰætˀ]	[əˈkʰɛ]	54.00	Voiceless				
0168	bear(?)	[bɛɹ]	[ˌkʰowˈbɑː]			60.00	Voiceless		
0178	cookie	[ˈkʰʊki]	[ˈkʰɪˈkʰɪ]	73.00	Voiceless				
0183	colour	[ˈkʰʊɬəˠ]	[ĩŋˈkʰʌlʊ]	85.00	Voiceless				
0204	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈzɛwˌkʰɛ]			45.00	Voiceless		
0209	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈlajˌkʰɛ̃]			54.00	Voiceless		
0260	shoe	[ʃuʷ]	[kʰəˈʒuw]	82.00	Voiceless				
0304	...key, key	[...kʰiʲkʰi]	[.....ˈkʰijˌkʰij]	94.00	Voiceless	192.00	Voiceless		
0321	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈlʊˌkʰæ]			35.00	Voiceless		
0323	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈlijˌkʰæ̃]			24.00	Borderline		
0324	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈlɛˌkʰæ]			33.00	Voiceless		
0327	cat	[kʰætˀ]	[ˈkʰæʔ]	53.00	Voiceless				
0330	lion king	[ˈlaʲn̩ˌkʰɪŋ]	[ˈlʊˌkʰɛʔ]			67.00	Voiceless		

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0332	heart	[haɹt͡]	[ow'kʰɑ]	83.00	Voiceless				
0334	lion king	['laɪn̩kʰɪŋ]	['lʊ̃kʰɛʔ]			49.00	Voiceless		
0351	keys	[kʰiɪz]	['kʰij]	47.00	Voiceless				
0363	towel	['tʰawɬ]	['kʰɑ̃məwɪ]	107.00	Voiceless				
0421	lion king	['laɪn̩kʰɪŋ]	[ə'lawkʰɛ]					90.00	Voiceless
0422	lion king	['laɪn̩kʰɪŋ]	[ə'lajkʰɛ]					72.00	Voiceless
0423	lion king	['laɪn̩kʰɪŋ]	['laj̃kʰæ]			39.00	Voiceless		
0424	uh, car	[ʌʔkʰaɹ]	[ʌ̃ʔʌʔej'kʰɑ:]	77.00	Voiceless				
0425	car	[kʰaɹ]	['kʰɑ:]	111.00	Voiceless				
0426	car	[kʰaɹ]	[uw'kʰɑ]	103.00	Voiceless				
0427	oh, car	[oʷkʰaɹ]	[ow'kʰɑ]	55.00	Voiceless				
0428	lion king	['laɪn̩'kʰɪŋ]	['lɛkʰɛ]					44.00	Voiceless
0430	lion king	['laɪn̩kʰiŋ]	['lajkʰɛ]					61.00	Voiceless
0432	car	[kʰaɹ]	['kʰʌ:]	53.00	Voiceless				
0433	lion king	['laɪn̩kʰɪŋ]	['lajkʰɛ]					77.00	Voiceless
0462	uh, cow	[ʌkʰaʷ]	[ʊ̃ʔʌ̃m'kʰaw]	12.00	Voiced				
0469	a big cow	[əbɪgkʰaʷ]	[ʌ.æ.ɛ:'bij̃kʰɑw]			64.00	Voiceless		
0474	uh, cow	[ʌkʰaʷ]	[ʌ̃ʔə'kʰɑ:w]	58.00	Voiceless				
0476	cat	['kʰæt͡]	['kʰɑtʰ]	59.00	Voiceless				
0478	cow	[kʰaʷ]	['kʰɑ:w]	78.00	Voiceless				
0481	uh, tractor(?)	[ʌ'ɹæktɚ]	[ə̃n.nʊ.ə'kʰijm]	40.00	Voiceless				
0490	cookie	['kʰʊki]	['kʰɪ'kʰij]	91.00	Voiceless				
0496	cat tail	['kʰæt͡ˌtʰeɪɬ]	['kʰæʔˌtʰijʌ]	66.00	Voiceless				
0499	uh, key	[ʌ'kʰi]	['ʌ̃ʔəˌkʰij]	53.00	Voiceless				
0500	candle	['kʰændɬ]	['kʰæ:da:]	82.00	Voiceless				
0501	cookie	['kʰʊki]	['kʰɪkʰij]	76.00	Voiceless				
0504	cookie	['kʰʊki]	['kʰijˌkʰij]	49.00	Voiceless				
0526	car	[kʰaɹ]	['kʰɑ:]	118.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0533	...Cathy ... paper	[ˈkʰæθi...ˈpʰeˌpəˑ]	[...ˈkʰæʃej...ˈpʰɑ pʰɑ]	31.00	Voiceless				
0534	Cathy	[ˈkʰæθi]	[...əˈkʰæθa]	67.00	Voiceless				
0551	keys	[kʰiˌiˌz]	[hãˈkij]	106.00	Voiceless				
0558	cat	[kʰæt˺]	[ˈkʰæt˺]	94.00	Voiceless				
0561	cat	[kʰæt˺]	[ˈkʰætʰ]	54.00	Voiceless				
0630	make castle	[meˌik˺ˈkʰæsˌɬˌ]	[ʊwɑ̃ˌmejkʰʔɑ̃ˈkʰæʃuw]	85.00	Voiceless				
0635	cow	[kʰaʷ]	[ˈkʰɑw]	136.00	Voiceless				
0639	cat...tail	[kʰæt...ˈtʰeˌiˌɬ]	[ˈkʰæʔkʰə̯ʔəˌtʰejə]	45.00	Voiceless				
0677	cow	[kʰaʷ]	[ˈkʰɑw]	123.00	Voiceless				
0678	tractor	[ˈɹæktəˑ]	[ˈkʰætʃˌɻɑ]	67.00	Voiceless				
0680	cat	[kʰæt˺]	[ˈkʰæ]	44.00	Voiceless				
0706	carrot	[ˈkʰɛɹət]	[ˈkʰɛɹɪʔ]	53.00	Voiceless				
0712	a castle	[əˈkʰæsˌɬ]	[ʊˈkʰæʃjuw]	30.00	Voiceless				
0729	cake	[kʰeˌik˺]	[ˈkʰejkʰ]	63.00	Voiceless				
0734	kip, cup	[kʰɪpkʰʌp˺]	[ˈkʰɪpʰˌkʰʌpʰ]	87.00	Voiceless	55.00	Voiceless		
0737	...cookie	[...ˈkʰʊki]	[...ˈkʰijkʰij]	96.00	Voiceless				
0746	cat	[kʰæt˺]	[ˈkʰæ]	73.00	Voiceless				
0767	moo-cow	[ˈmuʷkʰaʷ]	[nəˈmuwˌkʰʌw]			72.00	Voiceless		
0769	cow	[kʰaʷ]	[ˈkʰɑw]	142.00	Voiceless				
0790	a cow	[əˈkʰaʷ]	[əˈkʰɑːwə]	119.00	Voiceless				
0792	cat	[kʰæt˺]	[ˈkʰætʰ]	81.00	Voiceless				
0805	squeeze	[skwiz]	[ˈkʰeːjv]	138.00	Voiceless				
0822	Cathy	[ˈkʰæθi]	[uwˈkʰæˌi̯ij]	48.00	Voiceless				
0837	clock	[kʰlɑk]	[ˈkʰɑkʰ]	106.00	Voiceless				
0874	cake	[kʰeˌik˺]	[ˈkʰejkʰ]	122.00	Voiceless				
0876	cup	[kʰʌp˺]	[ˈkʰʌˌpʰʌ]	65.00	Voiceless				
0902	cook	[kʊk˺]	[ˈkʰʊkʰ]	91.00	Voiceless				
0903	that's a cow	[ðætsəkʰaʷ]	[tʰɑ̃tʰəʔʌˈkʰɑwa]	76.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0905	cat	[kʰæt̚]	[ˈkʰætʰ]	91.00	Voiceless				
0926	clock	[kʰlɑk]	[ˈkʰɑkʰ]	69.00	Voiceless				
0934	crocodile	[ˈkʰɹɑkʰəˌdaʲəl]	[ˈkʰɑkʰəˌdajvə]	61.00	Voiceless				
0937	cat	[kʰæt̚]	[ˈkʰætʰaˠduwijɛn]	58.00	Voiceless				
0949	that's a carrot	[ðætsəˈkʰɛɹət]	[ˌdæsɨˈkʰɛɹæ]	94.00	Voiceless				
0969	kite	[kʰaʲt̚]	[ˈkʰajtʰ]	86.00	Voiceless				
0990	candle	[ˈkʰændl̩]	[ˈkʰæ̃ˌnõw]	23.00	Borderline				
0991	eating cookie	[iɾɪŋkʰʊki]	[ʔajʔə̃ˈejtʰĩʔəˈkʰijkʰij]	23.00	Borderline				
0993	cookie	[kʰʌki]	[əˈkʰɪˌkʰijs]	87.00	Voiceless				
1021	going ... car	[goʷɪŋ...kʰaɹ]	[ˌgowijnawʔəpʰɑ̰ʔʌʔəˈkʰɑ]	95.00	Voiceless				
1025	going in the car	[goʷɪŋɪnðəkʰaɹ]	[əˈgowɐ̃nĩŋnʊʔɐ̃:...ˈkʰɑ:]	84.00	Voiceless				
1035	I like cookies	[aʲlaʲkˈˈkʰʌkiz]	[ˌlalajˈkʰɪʔkʰijs]	32.00	Voiceless				
1048	cutting knife	[ˈkʰʌɾɪŋnaʲf]	[ˈkʰʌtʰəˈnajfwɪf]	77.00	Voiceless				
1073	oh cat, hi cat	[oʷkʰæt̚haʲkʰæt̚]	[õˈkʰætʰɐ̃ˈhajˌkʰæʔtʰ]	34.00	Voiceless	32.00	Voiceless		
1074	cat	[kʰæt̚]	[ˈkʰʌtʰ]	45.00	Voiceless				
1077	...cat	[kʰæt̚]	[ˌdæzəˈkʰætʰ]	36.00	Voiceless				
1078	call phone	[kʰɑɬfoʷn]	[əˌkʰɑɬˈɸownə]			89.00	Voiceless		
1085	cat	[kʰæt̚]	[ˈkʰæt̚]	46.00	Voiceless				
1086	couch	[kʰaʷtʃ]	[mˌˈpʰɐ̃ntʃ]	24.00	Borderline				
1091	colour, colouring	[ˌkʰʌləˑˈkʰʌləˑɹɪŋ]	[ˈkʰʌlɑʔɐ̃ʔəˈkʰʌlʌĩˌnɛ̃]	51.00	Voiceless				
1091	colour, colouring	[ˌkʰʌləˑˈkʰʌləˑɹɪŋ]	[ˈkʰʌlɑʔɐ̃ʔəˈkʰʌlʌĩˌnɛ̃]	67.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1098	...a cat, a boy	[ə'kʰærə'boʲ]	[...ə'kʰætʰəʔɐ̃'bɔjʌ]	60.00	Voiceless				
1111	...man cooking	[mænkʰʌkɪŋ]	[...ˌmæ̃nɐ̃'kʰʊkʰɪŋə]	56.00	Voiceless				
1124	carrot	['kʰɛɹət]	['kʰɛˌvæ]	46.00	Voiceless				
1133	cracker,cheese, ice cream	['kʰɹɑkəɹ'ʧi:z'aʲskɹi:m]	[dætʰa'kʰɔkʰɐ̃ˌdædən'ʧijʔʌˌɪkʰij]	38.00	Voiceless				
1137	spoon cook	['spʰuʷn'kʰʊk]	[ə'pʰuwɛ̃n'kʰʊkə]	35.00	Voiceless				
1141	clock	[kʰlɑk]	['kʰɑkʰ]	68.00	Voiceless				
1167	cat	[kʰæt˺]	['kʰætʰ]	105.00	Voiceless				
1179	clothes	[kʰloʷðz]	['kʰʌˌəd]	90.00	Voiceless				
1186	cats	[kʰæts]	['kʰæt˺]	44.00	Voiceless				
1206	cat too	[kʰæt˺tʰuʷ]	[əˌkʰæ'tʰuw]			31.00	Voiceless		
1207	cat hair	[kʰæt˺hɛɹ]	['kʰæt˺ʔɐ̃'haw]	50.00	Voiceless				
1220	Cathy, a horse	[kʰæθijəhɔɹs]	[əˌkʰæʃijʔɐ̃ʔə'hɔjs]			47.00	Voiceless		
1227	comb mama	[kʰoʷmmɑmə]	[ˌkʰʌj'majˌhɔ]			61.00	Voiceless		
1236	corn	[kʰɔɹn]	['kʰɔ̃n]	66.00	Voiceless				
1253	cat	[kʰæt˺]	['kʰætʰ]	90.00	Voiceless				
1264	piggy come	['pʰɪgitʰuʷ]	[ˌpʰɪgij'kʰɐ̃mna]	88.00	Voiceless				
1265	carrots	['kʰɛɹəts]	['kʰɛɹæʔ]	51.00	Voiceless				
1277	cat	[kʰæt˺]	['kʰæt˺]	118.00	Voiceless				
1281	Cathy	ɕʔ.,ʏ[ð;ɡʁɻɸ]ɢβɳχɜ ʒ	[ə'kʰæʈij]	97.00	Voiceless				
1307	knife	[naʲf]	[kʰə'najf]					93.00	Voiceless
1325	no want that kind	[nowɑntðætkʰaʲnd]	[nowɑ'dæʔkʰajn]	65.00	Voiceless				
1340	and corn pie	[ənkʰɔɹnpʰiʲ]	[ænəˌkʰɔ̃m'pʰaj]			99.00	Voiceless		
1341	my cooking	[maʲkʰʌⁿkɪŋ]	[ə'majkʰʊˌkʰɛ̃n]					63.00	Voiceless

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1346	...cook a duck	[ˌkʰʊkəˈdʌk]	[ˌkʰʊkʰəˈdækʰ]			59.00	Voiceless		
1347	cook a chicken	[kʰʊkətʃɪkn̩]	[əˈkʰʊkʰəˌtʃɪkʰĩn]	59.00	Voiceless				
1397	tractor	[ˈtɹæktə˞]	[ˈkʰɑtʃ̃ʌm]	104.00	Voiceless				
1408	carrots	[ˈkʰɛɹəts]	[ˈkʰɛɹɛts]	111.00	Voiceless				
1444	kids like toast	[kʰɪdslaʲktʰowˀstˀ]	[ˈkʰɪdəˈlajkˀˌtʰows]	41.00	Voiceless				
1445	kids like toast	[kʰɪdzlaʲktʰowˀstˀ]	[kʰɪdˈlajkˀˌtʰows]					36.00	Voiceless
1446	corn	[kʰɔɪn]	[ˈkʰɑwĩŋ]	87.00	Voiceless				
1457	Cathy	[ˈkʰæθi]	[ˈkʰætʃ̃ij]	83.00	Voiceless				
1461	give it mom, to Cathy	[gɪvɪtmɑmtʰuʷkʰæθi]	[ɾ̃gɛvɪ.əˈmɑ̃ʔəˈkʰæs.tʰijə]	70.00	Voiceless				
1494	heart	[haɹtˀ]	[ˈkʰɔ.ɛ]	83.00	Voiceless				
1511	...somebody coming sit down	[sʌmbʌdikʰʌmɪŋsɪʔdaʷn]	[ˈmɑ̃mijʔɛʔæ̃ndəˌsɑ̃mbʌ.ijˈkʰɾ̃mijnæ̃nʃ̃ijˈdawn]	50.00	Voiceless				
1512	mama is cooking	[mɑmɑɪzkʰʌkɪŋ]	[ˌmɑ̃məʔĩnˈkʰʊkʰĩjnə]	55.00	Voiceless				
1526	carrots	[ˈkʰɛɹəts]	[əˈkʰɛvɛtʰ]	57.00	Voiceless				
1566	can't find cow	[ˌkʰænʔfaʲndˈkʰaʷ]	[ˌkæ̃.fãjˈhaw]			58.00	Voiceless		
1586	Cathy ... too	[kʰæθi...tʰuʷ]	[ˌkʰæʔij...ˈtʰuw]			53.00	Voiceless		
1592	country	[ˈkʰʌntɹi]	[ˈkʰɾ̃ntʃ̃ij]	74.00	Voiceless				
1604	that's a cow	[ðætsəkʰaʷ]	[ˈðætəˌkʰaw]			49.00	Voiceless		
1616	can't find my spoon	[ˈkʰæntˀfajndˀmajˈspʰuwn]	[ˌkʰɛ̃ˈfwajmajsmuw]			42.00	Voiceless		
1691	cats	[kʰæts]	[ˈkʰætʰ]	76.00	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1811	cat go	[kʰæt˺go^{w}]	[ˈkʰæˌdow]	53.00	Voiceless				
1839	cut its, cut its	[ˈkʰʌɾɪtskʰʌɾɪ ts]	[ˈkʰɛɾæts‘kʰɛɾæ t˺]	66.00	Voiceless				
1902	came back	[kʰeʲmbæk˺]	[ˈkʰejmˌbæːkʰ]	53.00	Voiceless				
1904	come	[kʰʌm]	[ˈkʰɤ̃m]	88.00	Voiceless				
2317	cappucino	[ˌkʰæpəˈtʃino^{w}]	[ˌkʰæpʰəˈkʰijnow]			30.00	Voiceless		
2342	cut	[kʰʌt˺]	[ˈkʰʌtʰ]	68.00	voiceless				
2586	something else	[sʌmpθɪŋˈɛɬs]	[ˌkʰɤ̃mhəˈnɛɬs]			31.00	Voiceless		
2889	O.K., they	[^{ʊw}keʲðeʲ]	[kʰejˈðej]					36.00	Voiceless
3038	cup of tea	[kʰʌpəfˈtʰi]	[ˈkʰʌpʰˌtʰij]	88.00	Voiceless				
3092	Cathy, can you lift this up?	[ˌkʰæθikənju^{w}ˈlɪfðɪsˌʌp˺]	[ˈkʰæθijkʰə̃nlɪfdɪ ˌzʌpʰ]	27.00	Voiceless				
3168	curb fall	[kʰəˑbˈfɑɬ]	[kʰʊɾəbˈfɑɬ]					67.00	Voiceless
3444	I can't cut it	[ajˌkænt‘kʌtɪ t]	[kæ̃ʔˈkʰʌɾɪtʰ]					25.00	Voiceless
3495	to call us	[tuwˈkɑɬʌs]	[ˈkʰɑwʌs]	52.00	Voiceless				
3530	coffee	[ˈkɑfij]	[ˈkʰɑfij]	66.00	Voiceless				
3587	cats	[ˈkæts]	[ˈkʰætʰ]	49.00	Voiceless				
3597	cats	[ˈkæts]	[ˈkʰæts]	75.00	Voiceless				
3663	ok, lets keep this there	[owkejˌlɛtskijpˈðɪsðɛɹ]	[kʰejlɛsˈkʰijpdʌ θˌðɛ]					48.00	Voiceless
3819	Kathy met P.J.?	[ˌkæθijmɛtˈpijd͡ʒej]	[ˈkʰæθijmɛ.əˌpʰij‘d͡ʒij]	51.00	Voiceless				
3828	to drink	[tuwˈdɹɪŋk]	[kʰɛ̃ˈdwĩŋkʰ]					28.00	Voiceless
			Voiceless		127		25		13

Appendix B - VOT and Initial Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
			Borderline		3		1		0
			Voiced		1		0		0

Appendix B - VOT and Initial Voicing Labels
Word-initial [g]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
0022	cup	[kʰʊpˀ]	[ˈgʌʔ]	15.00	Borderline				
0051	car	[kʰaɹ]	[ˈgɑʔ]	10.00	Voiced				
0136	dada cookie	[dædæˈkʰʊkiˀ]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]					5.00	Voiced
0146	gorilla	[gəˈɪɪlə]	[owgəˈwɛ.ə]					1.00	Voiced
0331	cat(?)	[kʰætˀ]	[ˈga]	8.00	Voiced				
0382	two, three, go	[ˌtʰuʷˌθɹiˈgoʷˀ]	[ˌtʃuːwˌfwaːjˈgow]	8.00	Voiced				
0384	two, three, go	[ˌtʰuʷˌθɹiˈgoʷˀ]	[ˌtʰuːwˌfwajˈgoːwˀ]	2.00	Voiced				
0391	two, go	[ˌtʰuʷˌgoʷ]	[ˈtʃuːwˈgoːw]	10.00	Voiced				
0403	two, three, go	[ˌtʰuʷˌθɹiˈgoʷˀ]	[ˌtʰuːwˌhwaːjˈgoːw]	5.00	Voiced				
0404	two, three, go	[ˌtʰuʷˌθɹiˈgoʷˀ]	[ˌtʰuːwˌfwaːjˈgoːw]	19.00	Borderline				
0408	two, three, go	[ˌtʰuʷˌθɹiˈgoʷˀ]	[ˌtʰuːwˌlaːjˈgoːw]	8.00	Voiced				
0589	glass(?)	[glæs]	[majˈgæː]	8.00	Voiced				
0704	garden(?)	[ˈgaɹdn̩]	[əˈgɑˌdʌ]					10.00	Voiced
0816	mm, green	[mːˈgɹiːn]	[ãːˈgẽjn]	3.00	Voiced				
0823	uh, Grandma	[ʌˈgɹæ̃mɑ]	[ʌ̃ˈgæ̃m.mɑ]	4.00	Voiced				
0829	green	[gɹiːn]	[ʊˈgiˌjnə]	8.00	Voiced				
0959	glasses	[ˈglæsəz]	[ˈgæʃə]	13.00	Voiced				
1016	green one	[ˈgɹiːnwən]	[ˈgɪ.uw.ˌwɐ̃n]	17.00	Borderline				
1021	going ... car	[goʷɪŋ...kʰaɹˀ]	[ˌgowijnawʔəpʰˌʔʌʔəˈkʰɑ]			5.00	Voiced		
1025	going in the car	[goʷɪŋɪnðəkʰaɹ]	[əˈgowɐ̃nĩŋnʊʔɐ̃ːˈkʰɑː]	2.00	Voiced				
1057	man all gone	[mænɑɬgɑn]	[ˌmæ̃nəˈʔɑgɐ̃n]	6.00	Voiced				
1081	getting something	[ˌgɛɾɪŋˈsʌmpθɪŋ]	[ɐ̃ˌgɛdəʔɐ̃ˈʂɐ̃ma]	11.00	Voiced				
1139	good eating	[gʊˈdiɾiŋ]	[əˌgʊdɛˈʔijtʃĩnɛ]			3.00	Voiced		

Appendix B - VOT and Initial Voicing Labels
Word-initial [g]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
1225	guitar	[gɪˈtʰaɹ]	[gɛˈtʰɑ]					7.00	Voiced
1413	glasses	[ˈglæsəz]	[əˈgæt͡ʃɑ]	9.00	Voiced				
1449	good soup	[gʊdsuʷp̚]	[ˌgʊdˈt͡suwp̚]			3.00	Voiced		
1458	give to mom	[gɪvtəmɑm]	[ˈgɪvəˌmɑ̃mij]	2.00	Voiced				
1461	give it mom, to Cathy	[gɪvɪtmɑmtʰuʷkʰæθi]	[x̃gɛvɪ.əˈmɑ̃ʔəˈkʰæs.tʰijə]	8.00	Voiced				
1462	give it Cathy	[gɪvɪtkʰæθi]	[ˈgɪvɪˈkʰætʰij]	5.00	Voiced				
1507	that guy ... purple	[ðæt̚gaj...pʰəˑpɬ]	[dæˈgajʔɛt̚ʔõnˌpʰɜɹpʊ]	15.00	Borderline				
1533	get bean	[gɛt̚ˈbiʲn]	[ˌgɛtˈbijn]			3.00	Voiced		
1535	where did bean go	[wɛɹdɪdbiʲngoʷ]	[əwəˈbɛŋˌgow]			8.00	Voiced		
1671	green	[gɹiːn]	[ˈgiːjn]	12.00	Voiced				
1765	gone	[gɑn]	[ˈgɑ̃n]	14.00	Voiced				
1772	going	[gowɪŋ]	[ˈgowĩjnə]	14.00	Voiced				
1889	go to kitchen	[goʷtuʷkʰɪtʃn]	[gowtʰə̆ˈkʰɪtʃə̃n]					5.00	Voiced
1956	getting the hot	[ˌgɛrɪŋðəˈhɑt̚]	[ˈgɛ.ĩnðəˌhɑt̚]	7.00	Voiced				
1958	getting more	[gɛrɪŋˈmɔɹ]	[gɪðĩˈmɔː]					14.00	Voiced
2126	keys	[kʰiʲz]	[ˈgijð]	13.00	Voiced				
2157	got blue?	[gɑtˈbluː]	[gaˈbwuw]					5.00	Voiced
2279	get	[gɛt̚]	[ˈgɪtʰ]	19.00	Borderline				
2370	get that out	[ˌgɛʔðæˈɹaʷt̚]	[ˈgɛˈðæˌʔawtʰ]	19.00	Borderline				
2371	get that out	[gɛʔðæɹɑaʷt̚]	[gɪt̚ˈðæɹawt̚]					6.00	Voiced
2373	get those	[gɛʔˌðoʷz]	[gɛt̚ˈðowz]					6.00	Voiced
2504	gum	[gʌm]	[ˈgɐ̃m]	19.00	Borderline				
2541	get it off	[ˈgɛrɪɹɑf]	[ˈgɛrɪɹɑf]	13.00	Voiced				
2573	going in the water	[ˌgowɪŋɪnðəˈwɑɹəˑ]	[ˌgowĩŋĩnəˈwɑdɑ]			4.00	Voiced		

Appendix B - VOT and Initial Voicing Labels
Word-initial [g]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
2708	he's got sharp nails	[hizgɑʔˌʃaɹpˈneʲɫz]	[ˈgɑt̚ˈθɑp̚ˌnejʌɫs]	14.00	Voiced				
2821	they ran away	[ˌðeʲɹænəˈwej]	[gɛ.əˌwʌ̃nəˈwej]					6.00	Voiced
2878	got a boo-boo	[gɑɾəˈbuʷbuʷ]	[ˌgɑˈbuwbuw]			3.00	Voiced		
2913	going, wanna eat	[gowɪŋwɑnəʔit̚]	[ˈgowĩnsijˌwɑ̃.əˈʔijt̚]	15.00	Borderline				
2924	going to that	[gowɪŋtəðæt̚]	[ˈgowĩnˌtʰuwˈðæt̚]	14.00	Voiced				
2984	get the keys, I'm coming in	[gɛʔðəˈkʰizaʲmkʰʌmɪŋˌɪn]	[ˈgɪðətʰəkʰijzajmˌkʰʌ̃mĩ.ˈĩn]	16.00	Borderline				
3034	that all done?	[ðæɾɑɫˈdʌn]	[ˈgaʔɑɫˌdʌ̃n]	16.00	Borderline				
3073	go home	[goʷˈhoʷm]	[gʌˈhõwm]					5.00	Voiced
3202	going to see the fishies	[gowɪŋtəsiðəˈfɪʃiz]	[gowĩnˌsijəˈfɪʃijs]					4.00	Voiced
3436	get it	[ˈgɛtɪt]	[ˈgɪɾɛʔ]	18.00	Borderline				
3464	going to get the pump	[gowɪŋtuwˌgɛtðəˈpʌmp]	[gowĩŋˈgɪt̚dʌˌpʰʌp̚]					7.00	Voiced
3639	go	[ˈgow]	[ˈgɔ]	23.00	Borderline				
3643	go	[ˈgow]	[ˈgow]	11.00	Voiced				
3655	go on there	[ˌgowɑnˈðɛɹ]	[gowˌʌ̃ˈnɛ.a]					8.00	Voiced
3712	guy	[ˈgaj]	[ˈgʌʔaj]	15.00	Borderline				
3808	go on here again	[gowɑnˈhɪɹəˌgɛn]	[gowɑ̃nˈhijaˈgɛ̃n]					6.00	Voiced
			Voiceless		0		0		0
			Borderline		13		0		0

Appendix B - VOT and Initial Voicing Labels
Word-initial [g]

Record #	Orthography	Target	Realization	WI-1S	Label	WI-2S	Label	WI-U	Label
			Voiced		28		7		15

Appendix B - VOT and Initial Voicing Labels
Word-medial [p]

Record #	Orthpgraphy	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
0005	papa	[ˈpʰɑpə]	[ˈpʰʌpˌpʰɑʔ]			55.00	Voiceless		
0049	apple	[ˈæp̚]	[ʌˈpʰɑ]	85.00	Voiceless				
0050	apple	[ˈæp̚]	[ˈpʰɑ]	36.00	Voiceless				
0067	apple	[ˈæp̚]	[ˈpʰʊʔʌ]	102.00	Voiceless				
0119	apple	[ˈæp̚]	[hʊˈpʰʌ]	34.00	Voiceless				
0472	apple	[ˈæp̚]	[ˈæˌpʰɑː]			21.00	Borderline		
0553	purple	[ˈpʰɚ˞p̚]	[ˈpʰʌˌpʊ]			43.00	Voiceless		
0563	apple	[ˈæp̚]	[ˈʔæˌpʰɑ]			33.00	Voiceless		
0647	airplane	[ˈɛɹpleˌɪn]	[ɛˈpʰẽjn]	55.00	Voiceless				
0649	apple	[ˈæp̚]	[ˈʔæˌpʰa]			41.00	Voiceless		
0650	apple	[ˈæp̚]	[ˈʔæˌpʰuwə]			76.00	Voiceless		
0711	airplane	[ˈɛɹpleˌɪn]	[ʊˈpʰẽn]	25.00	Voiceless				
0761	uh, apple	[ʌʔˈæp̚]	[ɛ̃ˈʔæˌpʰuw]			62.00	Voiceless		
0804	oh, purple...	[oʷˈpʰɚ˞p̚...]	[owˈpʰɜpʰʊˌwɑ̃n]					60.00	Voiceless
0840	hippo	[ˈhɪpoʷ]	[ˈhʌpʰowæ]					33.00	Voiceless
0847	apple	[ˈæp̚]	[ˈʔæˌpʰuw]			61.00	Voiceless		
0861	newspaper	[ˈnuʷzˌpʰeˌɪpɚ˞]	[ˈowpʰɑpʰɑ]			59.00	Voiceless	17.00	Borderline
0867	elephant ... bicycle	[ɛɬəfənt...ˈbaˌɪsɪkɬ]	[æ̃nəˈɛɬfɛ̃...ˈpʰʌtʰæ]	25.00	Voiceless				
0868	aligator on bicycle	[ˌæɬigeˌɪɹə˞ɑnˈbaˌɪdsɪkɬ]	[mˌˈægɛləʔɑ̃ʔõnˌpʰʌtʰɑ]	31.00	Voiceless				
0945	apple	[ˈæp̚]	[ˈʔæpʰʊ]					31.00	Voiceless
0947	apple	[ˈæp̚]	[ˈʔæpʰʊ]					50.00	Voiceless
0967	blue and red and purple too	[ˈbluːənˈɹɛdənˈpəɹpəltuː]	[ˌwuwɑ̃nəˈwɛdʔɑ̃nˈpʰɜpʰʌˌtʰuwə]					75.00	Voiceless
0974	airplane	[ˈɛɹpleˌɪn]	[ʔɑ̃mˈpʰẽjn]	52.00	Voiceless				
0979	paper	[ˈpʰeˌɪpɚ˞]	[ˈpʰejˌpʰʊ]			62.00	Voiceless		
1002	airplane	[ˈɛɹpleˌɪn]	[ˈʔɛˌpʰẽjn]			32.00	Voiceless		
1058	...apple	[ˈæp̚]	[....ˈʔæpʰow]					35.00	Voiceless
1093	that's a purple	[ðætsəˈpʰɚ˞p̚]	[ˌʔætʰaˈpʰɜˌpʰʊ]			27.00	Voiceless		

Appendix B - VOT and Initial Voicing Labels
Word-medial [p]

Record #	Orthpgraphy	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
1097	that's a blue and a purple	[ðætsə'bluːændə'pəɹpəl]	[ə'dæt^{h}ʌˌbuwə̃nə'bɔ p^{h}ʌ]					46.00	Voiceless
1107	diaper	['daʲpə˞]	['t^{h}ɛpɛʔ]					24.00	Borderline
1154	apple	['æpɬ]	['ʔæp^{h}ow]					69.00	Voiceless
1181	airplane	['ɛɹpleʲn]	['ʔɛ̃ˌp^{h}ẽjlə]			63.00	Voiceless		
1202	purple	['p^{h}ə˞pɬ]	[mˌ'p^{h}ʌp^{h}ɔ]					59.00	Voiceless
1204	slippers	['slɪp͡p^{h}ə˞z]	['tʃɪp^{h}ɛ]					52.00	Voiceless
1217	rabbit	['ɹæbɪt͡]	[ə'wæˌp^{h}ʌt^{h}]			92	Voiceless		
1238	apple	['æpɬ]	['ʌp^{h}ɔ]					63.00	Voiceless
1263	apple	['æpɬ]	['ʔæp^{h}ow]					115.00	Voiceless
1271	apples	['æpɬz]	['ʔæp^{h}ɔjs]					54.00	Voiceless
1480	airplane	['ɛɹpleʲn]	['ʔɛˌp^{h}ẽj]			77.00	Voiceless		
1483	airplane	['ɛɹpleʲn]	['hɜˌp^{h}ẽj]			69.00	Voiceless		
1658	that's yucky	[ðæts'jʌki]	['ðæˌdjʌp^{h}ij]					29	Voiceless
1668	airplane	['ɛɹpleʲn]	['ɛp^{h}ẽjn]					17.00	Borderline
1723	I want the puppets	[aʲwɑntðəp^{h}ʌpəts]	[wə̃ndə'p^{h}ʌp^{h}ʌjts]					50.00	Voiceless
1726	we'll eat something	[wiɬ'itsʌmpθɪŋ]	[wə'ʔijt͡sə̃mp^{h}ijnə]					63.00	Voiceless
1793	watch my jumping	[wɑtʃmaʲ'dʒʌmpɪŋ]	[wɑʃ'majˌdʒ̃ə̃mp^{h}ijnə]					55.00	Voiceless
1796	want the puppet	[wɑntðə'p^{h}ʌpɪt]	[ʔə̃də'p^{h}ʌp^{h}ɛt^{h}]					84.00	Voiceless
1840	I want go, something a cookie	[aʲwɑntgo^{w}sʌmpθɪŋək^{h}ʌki]	[ˌʔə̃mgowə̃ˌdʒ̃ə̃mp^{h}ĩnej'k^{h}ʌk^{h}ij]					25.00	Voiceless
1979	this guy happy	[ðɪsgaʲ'hæpi]	[dɪsgʌ'hæp^{h}ij]					68.00	Voiceless
1980	happy	['hæpi]	['ʔæp^{h}ij]					70.00	Voiceless
2039	sweeping	['swiʲp^{h}ɪŋ]	[fwɪ'p^{h}ijdə]	62.00	Voiceless				
2051	apple	['æpɬ]	['ʔæp^{h}ʌɬ]					56.00	Voiceless
2059	apple	['æpɬ]	['ʔæp^{h}ɔɬ]					32.00	Voiceless

Appendix B - VOT and Initial Voicing Labels
Word-medial [p]

Record #	Orthpgraphy	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
2065	and a pear and a apple	[ændə‘pʰɛɹændə‘næpḷ]	[æ̃nə,pʰæʔæ̃ndə‘ʔæpʰʌɫ]					99.00	Voiceless
2110	all sleepy	[aɫ‘sliʲpʰiʲ]	[,ʔɑɫ‘ɬijpʰijnə]					64.00	Voiceless
2207	and a caterpillar	[ænə‘kʰærɚ,pʰɪlɚ]	[ʔæ̃ːnə‘kʰælə,pʰɪlʌ]			27.00	Voiceless		
2208	and a hippopotamus	[ænə,hɪpoʷ‘pʰɑrəmʌs]	[‘æ̃ːnhɪpʰow‘pʰɑ.ʌ]			41.00	Voiceless	29.00	Voiceless
2262	purple	[‘pʰɚpɫ]	[‘pʰʌpʰɔ]					25.00	Voiceless
2316	something spicy	[‘sʌmθɪŋ‘spʰʌʲsiʲ]	[,sʌ̃mpʰɪ̃ŋ‘pʰajsij]					40.00	Voiceless
2317	cappucino	[,kʰæpə‘tʃinoʷ]	[,kʰæpʰə‘kʰijnow]					27.00	Voiceless
2398	apples	[‘æpḷz]	[‘ʔæpʰʌɫ]					39.00	Voiceless
2455	a lot of people	[ə,lærə‘pʰipḷ]	[lɑrə‘pʰijpʰʌɫ]					52.00	Voiceless
2471	You open the door and see here	[juʷoʷpn̩ðədɔɹənsihiɹ]	[juw‘ʔowpʰɪ̃ndə,dɔ.əsijhija]					33.00	Voiceless
2494	is this one happy?	[ɪzðɪswʌnhæpi]	[ɪ‘ðɪswʌ̃ŋ,hæ̃pʰij]					28.00	Voiceless
			Voiceless		10		17		33
			Borderline		0		1		3
			Voiced		0		0		0

Appendix B - VOT and Initial Voicing Labels
Word-medial [b]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
0023	Peter	[ˈpʰiˌɹə˞]	[ˈbʌˌbʊ.ɛʔ]			38.00	Voiceless		
0027	Booboo	[ˈbuʷbuʷ]	[ˌbʊˈbʊː]	4.00	Voiced				
0043	Babar	[ˈbæbaɹ]	[ˈbæbʌʔ]					8.00	Voiced
0080	Peter	[ˈpʰiˌɹə˞]	[ˈbʊbʊ]					2.00	Voiced
0115	baby	[ˈbeʲbi]	[bijʔˈbejˌbij]			4.00	Voiced		
0116	baby	[ˈbeʲbi]	[ˈbejbɪ]					2.00	Voiced
0118	baby	[ˈbeʲbi]	[ˈbejbɪ]					6.00	Voiced
0120	baby	[ˈbeʲbi]	[ˈbɛbij]					3.00	Voiced
0155	Peter, Hanna	[pʰiɹə˞hænə]	[ʌˌbʊbəˈhæ̃nɛ]					4.00	Voiced
0283	rabbit	[ɹæbaʲ]	[ˈbʊˌbuwˈɹæt̚]			4.00	Voiced		
0300	garbage truck	[ˈgɑɹbədʒˌtʃɹʌk]	[ˈbejtʃʌ]	7.00	Voiced				
0303	oh, garbage truck	[oʷˈgɑɹbədʒˌtʃɹʌk]	[ˌoːwbejˈʃæ]					5.00	Voiced
0467	garbage truck	[ˈgɑɹbədʒˌtʃɹʌk]	[bæˈtʃɛkʰ]					4.00	Voiced
0700	teddybear	[ˈtʰɛdibɛɹ]	[ˈtʰejˌbʌʔ]			3.00	Voiced		
0794	wheelbarrow	[wiɬbɛɹoʷ]	[owˈwejbɛbɑ]			9.00	Voiced		
0873	teddybear(?)	[ˈtʰɛdibɛɹ]	[əˈtʰɛˌbɑː]			17.00	Borderline		
0961	hippo	[ˈhɪpoʷ]	[ajmˈpʰɪ̃mˌbow]			8.00	Voiced		
0962	that's a hippo	[ðætsəhɪpoʷ]	[dæsaˈbʌ̃mˌbow]			9.00	Voiced		
1012	hippo like it	[hɪpoʷlaʲkɪt̚]	[ʔʌ̃mˈpʰʌ̃mˌbowˈlaj kʰɪtʰ]			3.00	Voiced		
1020	hippo	[ˈhɪpoʷ]	[ˈbʌ̃mˌboːw]			4.00	Voiced		
1028	hippo drive	[ˈhɪpoʷˌdʒɹaʲv]	[ʌ̃ʔəˈpʰə̃mbowɪ̃ˌdəʁ ajf]					5.00	Voiced
1029	hippo drive	[ˈhɪpʰoʷˌdʒɹaʲv]	[m̩ˈpʰə̃mˈbowə̃ˌd͡ʒaj]	8.00	Voiced				
1042	hippo ... towel ... toys	[ˈhɪpoʷ...ˈtʰæwɬ...tʰ oʲz]	[əˈθɪ̃mbow...ˈtʰʌwa ...ˈtʰɔjs]					4	Voiced
1103	little baby	[lɪɾɬbeʲbi]	[ˌlejˈbijbij]					12	Voiced
1106	baby	[ˈbeʲbi]	[ˈbejbij]					5	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-medial [b]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
1129	apple	[ˈæpɫ]	[ˈʔæthæbæʔ]					8.00	Voiced
1146	that's a baby and thats' a lady...	[ðætsəˈbeʲbijənðæts əˌleʲdi...]	[ˌðæsɑˈbejbijʔəthæs əˈlejdijˈkhɹɪkhɪth]					7	Voiced
1283	two rabbits	[thuwˈɹæbɪts]	[thuwʔˈwæbɛt̚]					7	Voiced
1424	elbow	[ˈɛɬbow]	[ˈʔæbow]					3	Voiced
1436	wheelbarrow	[ˈwiɬɬbɛɹow]	[ˈwijbʌ.ow]					5	Voiced
1478	a rabbit	[əˈɹæbɪt̚]	[ədˈɹæbɛth]					7	Voiced
1511	...somebody coming sit down	[sʌmbʌdikhʌmɪŋsɪʔ dawn]	[ˈmãmijʔɛʔændəˌsʌ̃ mbʌ.ijˈkhʌ̃mijnæ̃nʃi jˈdawn]			11.00	Voiced		
1513	...mama cooking, somebody eat to	[mɑmɑkhʌkɪŋsʌmb ʌdijithuw]	[ˈmãmijthejʔɛ̃nʌːm ãmijˈthɛkhɪtˈʌʒʌ̃mb ʌ.ijʔʌ̃ʔijˈthuw]			8.00	Voiced		
1669	purple	[ˈphəˑpɫ]	[ˈphʊbʌ]					33.00	Voiceless
1688	rabbits	[ˈɹæbɪts]	[ˈɹæbɪts]					7	Voiced
1856	another rabbit	[ənʌðəˑɹæbɪt̚]	[ˈnʌvˌɹæbɪth]					3	Voiced
1893	rabbits	[ˈɹæbɪts]	[ˈwæbɛth]					5	Voiced
2000	rabbits	[ˈɹæbɪt̚]	[ˈwæbɛts]					3	Voiced
2004	and that rabbit	[ənðætˈɹæbɪt̚]	[uwʔəˈðæˌwæbɪθʌ]					4	Voiced
2017	all the rabbits	[ɑɬðəˈɹæbɪts]	[ʔɑɬˈwæbɛt]					3	Voiced
2048	the baby	[ðəˈbeʲbi]	[dɪˈbejbij]					8	Voiced
2101	zebra	[ˈzibrə]	[ˈzijba]					6	Voiced
2142	a rabbit	[əɹæbɪt̚]	[əˈɹæbɪt̚]					7	Voiced
2195	a rabbit	[əˈɹæbɪt̚]	[əˈwæbɪth]					3	Voiced
2199	a zebra	[əˈzibɹə]	[əˈʒijbəʔɑ̃n]					6	Voiced
2246	rabbits	[ˈɹæbɪts]	[ˈwæbɪts]					4	Voiced
2280	everybody in	[ˈɛvɹibʌdiˌjin]	[ʔʌˈbajĩn]	7.00	Voiced				

Appendix B - VOT and Initial Voicing Labels
Word-medial [b]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
2281	and the rabbit	[ænðəˈɹæbɪt̚]	[ʔɛ̃nðə̯wæˈbɛtʰ]	3	Voiced				
2332	a rabbit	[əˈɹæbɪt̚]	[əˈwæbɪʔ]					4	Voiced
2368	apple	[ˈæp̚l̩]	[ˈʔæp̚bow]					3	Voiced
2402	a cheapy	[əˈtʃipi]	[ʔəˈtʃ̬ijbij]	5.00	Voiced				
2403	strawberries	[ˈstʰɹabəɹiz]	[ˈtʰwɑːbejz]					6	Voiced
2436	you my baby	[juʷmaʲbeʲbi]	[juw̯majʔˈbejbij]					7	Voiced
2450	other baby	[ˈʌðəˌbeʲbi]	[ˈʔʌðə̯bejbij]					7	Voiced
2483	baby cat	[beʲbikʰæt̚]	[ˈbejbij̯pʰætʰ]					7	Voiced
			Voiceless		0		1		1
			Boderline		0		1		0
			Voiced		6		10		36

Appendix B - VOT and Initial Voicing Labels
Word-medial [t]

Record #	Orthography	Target	Realization	W-1S	Label	WM-2S	Label	WM-U	Label
0188	turtle	[ˈtʰɚɾ̩]	[ˈtʰʒːtʰɛ̃]					67.00	Voiceless
0273	turtle	[ˈtʰɚɾ̩]	[ˈtʰɜˌtʰuw]			61.00	Voiceless		
0446	potato head	[pəˈtʰeɪɾoʷhɛd]	[ˈtʰejˌhɑɹʔ]	56.00	Voiceless				
0461	turtle	[ˈtʰɚɾ̩]	[ˈtʰʊtʰʌ]					22.00	Borderline
0512	bicycle	[ˈbaɪsɪˌkɬ]	[ˈpʰowˌtʰʌ]			16.00	Borderline		
0513	bicycle	[ˈbaɪsikɬ]	[ˌbɛʔjəˈpʰʊtʰʌ]					19.00	Borderline
0690	painting	[ˈpʰeɪntɪŋ]	[ˈpʰejˌtʰij]			36.00	Voiceless		
0696	guitar	[gɪˈtʰaɪ]	[əˈtʰæ]	107	Voiceless				
0728	bicycle	[ˈbaɪsɪkɬ]	[ˌbʷawsˈtʰʌtʰʌ]			30.00	Voiceless	30.00	Voiceless
0867	elephant ... bicycle	[ɛɬəfənt...ˈbaɪsɪkɬ]	[ãnəˈɛɬfɛ̃...ˈpʰʌtʰæ]					33.00	Voiceless
0868	aligator on bicycle	[ˌæɬigeɪɾɚɑnˈbaɪdsɪkɬ]	[mˌ̩ægɛləʔɑ̃ʔõnˌpʰʌtʰɑ]					117.00	Voiceless
0890	eating.....	[ˈiɾɪŋ.....]	[ˈʔejtʰɪ̃...]					54.00	Voiceless
0936	guitar	[gɪˈtaɪ]	[ɑ̃ŋˈtʰɛ.a]	38.00	Voiceless				
1196	whiskers	[wɪskɚz]	[ʔɪkˇˈtʰɛ]	55	Voiceless				
1225	guitar	[gɪˈtʰaɪ]	[gɛˈtʰɑ]	50	Voiceless				
1239	mm, potato	[mmpəˈtʰeɪɾoʷ]	[mˌ̩ˈtʰejdow]	75	Voiceless				
1245	guitar	[gɪˈtʰaɪ]	[ˈtʰɑː]	40	Voiceless				
1292	turtle	[tʰɚɾ̩]	[ˈtʰʊˌtʰow]			45	Voiceless		
1345	potato	[pəˈtʰeɪdoʷ]	[ˈtʰejdow]	76	Voiceless				
1383	turtle	[ˈthɚɾ̩]	[ˈtʰʊˌtʰʌ]			41	Voiceless		
1433	a guitar, guitar	[əgətʰaɪgətʰaɪ]	[ðægəˈtʰɑːˌgɛˈdɑ]	109	Voiceless				
1450	potato	[pəˈtʰeɪdoʷ]	[ənʊˈtʰeːjdoːw]	94	Voiceless				
1460	potato	[pətʰeɪdoʷ]	[ˈtʰejdow]	65	Voiceless				
1462	give it Cathy	[gɪvɪtkʰæθi]	[ˈgɪvɪˈkʰætʰij]					60.00	Voiceless
1548	turtle	[ˈtʰɚɾ̩]	[ˌʌˈtʰɔtʰɪ]					95.00	Voiceless
1642	cutting	[ˈkʰʌɾɪŋ]	[ˈkʰʌtʰijn]					48.00	Voiceless
1775	dancing	[ˈdænsɪŋ]	[ˈdæ̃ntʰɪŋ]					80.00	Voiceless
1961	eating the	[ˈiɾɪŋðə]	[ˈʔijtʰɪŋnɛ]					13.00	Voiced
2166	potato	[ˈpətʰeɪɾoʷ]	[ˈtʰejdow]	81	Voiceless				

Appendix B - VOT and Initial Voicing Labels
Word-medial [t]

Record #	Orthography	Target	Realization	W-1S	Label	WM-2S	Label	WM-U	Label
2407	painting	[pʰeɪntʰɪŋ]	[ˈpʰẽjntʰɪ̃jn]					29.00	Voiceless
			Voiceless		12		5		10
			Borderline		0		1		2
			Voiced		0		0		1

Appendix B - VOT and Initial Voicing Labels
Word-medial [d]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
0004	dada	[ˈdædæ]	[ˈdɛdæʔ]					5.00	Voiced
0019	dada	[ˈdædæ]	[ʌˈdædɛ]					2.00	Voiced
0020	dada	[ˈdædæ]	[ʌˈdædæ]					2.00	Voiced
0024	dada	[ˈdædæ]	[ˈdæˌdæ]			5.00	Voiced		
0025	dada	[ˈdædæ]	[ˈdæˌdɛ]			2.00	Voiced		
0045	Babar's dada	[ˌbəbaɹzˈdædæ]	[ˈbowˌdædæ]					4.00	Voiced
0069	dada	[ˈdædæ]	[ˈdæˌdæ]			4.00	Voiced		
0070	dada	[ˈdædæ]	[ˈdæˌdʌ]			2.00	Voiced		
0084	dada	[ˈdædæ]	[ˈdɛdæ]					2.00	Voiced
0113	dada	[ˈdædæ]	[ˈdæˌdɛ]			3.00	Voiced		
0136	dada cookie	[dædæˈkʰʊki]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]					3.00	Voiced
0156	dada	[dædæ]	[ˈdɛdæ]					11.00	Voiced
0500	candle	[ˈkʰændɬ]	[ˈkʰæːdaː]					5.00	Voiced
0523	um, uh, dada	[ʌmʌˈdædæ]	[m̩ʔõnˈdædæ]					4.00	Voiced
0541	dada	[ˈdædæ]	[ˌdɛˈda]	6.00	Voiced				
0666	dada	[ˈdædæ]	[ˈdædæ]					3.00	Voiced
0669	dada	[dædæ]	[ˈdædæ]					5.00	Voiced
0693	I want blanket	[ˈaɪwɑnt̚ˌblæŋkɪt]	[ʌjwãˈbædij]					7.00	Voiced
0695	want blanket	[wɑnt̚ˈblæŋkɪt]	[ãʔˈbædiːj]					9.00	Voiced
0707	potato(?)	[pəˈtʰeɪroʷ]	[tʰʊˈdij]	6.00	Voiced				
0900	window	[wɪndoʷ]	[ˈwĩnˌdowən]			8.00	Voiced		
0934	crocodile	[ˈkʰɹɑkʰəˌdaɪəl]	[ˈkʰɑkʰəˌdajvə]			10.00	Voiced		
0956	water	[ˈwɑɾɚ]	[ˈwʌdʊ]					4.00	Voiced
1062	...that's a daddy one	[ðætsədædiwʌn]	[...dædəˈdædijˌwãn]					7	Voiced
1136	putting that	[ˌpʰʊɾɪŋˈðæt̚]	[m̩ˌpʰɪtʰẽnˈdæd]					14	Voiced
1147	dada	[ˈdædæ]	[ãmˈdæda]					7	Voiced
1270	birdies	[ˈbɚdiz]	[ˈbʌdejz]					4	Voiced
1345	potato	[pəˈtʰeɪdoʷ]	[ˈtʰejdow]					4	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-medial [d]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
1357	...they're eating their food	[ðɛˌɹiɾɪŋðɛɹˈfuʷd]	[ðɪʔijdĩŋðɪˈfuwdə]					6	Voiced
1395	birdies	[ˈbə˞diz]	[ˈbʊˌdij]			4	Voiced		
1433	a guitar, guitar	[əgətʰaɹgətʰaɹ]	[ðægəˈtʰɑːˌgɛˈdɑ]	3	Voiced				
1450	potato	[pəˈtʰeɪ̯doʷ]	[ənʊˈtʰeːjdoːw]					3	Voiced
1460	potato	[pətʰeɪ̯doʷ]	[ˈtʰejdow]					4	Voiced
1647	windy	[ˈwɪndi]	[əwĩnˈdij]	4	Voiced				
1771	daddy	[ˈdædi]	[ˈdædij]					3	Voiced
1795	other house	[ʌðə˞haʷs]	[ʔʌdʌˈhaws]					5	Voiced
1796	want the puppet	[wɑntðəˈpʰʌpɪt]	[ʔɑ̃dəˈpʰʌpʰɛtʰ]					2	Voiced
1844	a turtle	[əˈtʰə˞ɾ̩]	[əˈtʰɔdɑɬ]					3	Voiced
1846	another turtle	[ənʌðə˞tʰə˞ɾ̩]	[ɛ̃ntʰɔʔəˈnaˌtʰɔdow]					3	Voiced
1946	making a quesadilla	[ˌmeɪ̯kɪnəˌkʰeɪ̯sɪˈdijɑ]	[ˈwejkʰĩnəˌkʰijsəˈdija]	6	Voiced				
1958	getting more	[gɛɾɪŋˈmɔɹ]	[gɪdĩˈmɔː]					7	Voiced
1963	here a quesadilla	[hiɹəˌkʰeɪ̯sɪˈdijɑ]	[ˈhijɑːˌkʰijsəˈdija]	10	Voiced				
2005	eating	[ˈiɾɪŋ]	[ˈʔijdijnə]					3	Voiced
2010	water	[ˈwɑɾə˞]	[ˈwɑdɑː]					4	Voiced
2014	cleaning water	[ˈkʰliːnɪŋˌwɑɾəɹ]	[ɬijəˈwɑda]					6	Voiced
2046	rattle	[ˈɹæɾ̩]	[ˈwædɔɬ]					8	Voiced
2063	radish	[ˈɹædɪʃ]	[ˈwædow]					14	Voiced
2111	candle	[ˈkʰændɬ]	[ˈkʰæ̃ndijðə]					7	Voiced
2166	potato	[ˈpətʰeɪ̯ɾoʷ]	[ˈtʰejdow]					4	Voiced
2198	turtle	[ˈtʰə˞ɾ̩]	[ˈtʰɔdʌɬ]					3	Voiced
2200	beetle	[ˈbiɾ̩]	[ˈbijdʌɬ]					3	Voiced
2205	and a panda	[ænəˈpʰændə]	[ʔæ̃nəˈpʰæ̃ndɑ]					6	Voiced
2254	they're not eating	[ˌðɛɹnɑʔˈiɾɪŋ]	[ˈðijnɑʔˌijdĩŋ]					9	Voiced

Appendix B - VOT and Initial Voicing Labels
Word-medial [d]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
2290	the turtle needs help	[ðətʰə˞ɾɬnidshɛɬp̚]	[dɪˈtʰɔdənijz̩hɛɬp̚]					6	Voiced
2328	turtle	[ˈtʰə˞ɾɬ]	[ˈtʰʌɬduwd]					5	Voiced
2383	they're eating	[ðɛˈɹiɾɪŋ]	[dɛˈʔijd̪ɪŋ]					5	Voiced
2478	that's a nice bottle	[ˌðætsənaʲsbɑɾɬ]	[dæsənajəˈbɑdʌɬ]					5	Voiced
			Voiceless		0		0		0
			Borderline		0		0		0
			Voiced		6		8		43

Appendix B - VOT and Initial Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
0047	apple	[ˈæpɬ]	[ˈkʰuw]	102	Voiceless				
0158	cookie	[ˈkʰʊki]	[huwəˈtʰejkʰɪʔ]					76.00	Voiceless
0159	oh, cookie	[oʷkʰʊki]	[ˈowəˌtʰejkʰɛ]					81.00	Voiceless
0177	cookie	[ˈkʰʊki]	[hɪmojˈtʰejkʰɪʔ]					135.00	Voiceless
0178	cookie	[ˈkʰʊki]	[ˈkʰɪˈkʰɪ]	65.00	Voiceless				
0279	monkey	[ˈmʌŋki]	[hejˈkʰij]	74.00	Voiceless				
0414	uh, monkey	[ʌˈmʌŋki]	[ˈʊʔˌmʌ̃ŋkʰej]					26.00	Voiceless
0448	okay	[oʷkeʲ]	[ʌˌkʰej]			88.00	Voiceless		
0470	peacock	[ˈpʰikɑkˀ]	[ˈpʰijˌkʰɑ]			76.00	Voiceless		
0471	peacock	[ˈpʰikɑkˀ]	[pʰijˈkʰɑː]	72.00	Voiceless				
0473	uh, peacock	[ʌˈpʰikɑkˀ]	[ʌ̃ʔʌ̃ʔʌ̃ʔəˌpʰijˈkʰɑ]	98.00	Voiceless				
0483	monkey	[ˈmʌŋki]	[ˈmækʰij]					68.00	Voiceless
0490	cookie	[ˈkʰʊki]	[ˈkʰɪˈkʰij]	87.00	Voiceless				
0493	monkey	[ˈmʌŋki]	[ˈmækʰiːj]					72.00	Voiceless
0501	cookie	[ˈkʰʊki]	[ˈkʰɪkʰij]					91.00	Voiceless
0502	monkey	[ˈmʌŋki]	[ˈmɛˌkʰij]			43.00	Voiceless		
0504	cookie	[ˈkʰʊki]	[ˈkʰijˌkʰij]			53.00	Voiceless		
0737	...cookie	[...ˈkʰʊki]	[...ˈkʰijkʰij]					94.00	Voiceless
0785	cookie	[ˈkʰʊki]	[ˈkʰejkʰij]					55.00	Voiceless
0810	okay	[oʷkʰeʲ]	[owˈkʰɛʔɛ]	67.00	Voiceless				
0819	okay	[oʷkʰeʲ]	[ˈʔʌˌkʰej]			43.00	Voiceless		
0821	okay	[oʷkʰeʲ]	[ʌˈkʰøj]	55.00	Voiceless				
0934	crocodile	[ˈkʰɹɑkʰəˌdaʲəl]	[ˈkʰɑkʰəˌdajvə]					40.00	Voiceless
0970	monkey	[ˈmʌŋki]	[ˈmajʔˌkʰiːj]			111.00	Voiceless		
0976	vacuum	[ˈvækjuʷm]	[ˈbækʰĩnʌ̃]					120.00	Voiceless
0978	...monkey and hippo	[ˌmʌŋkihənˈhɪpoʷ]	[...əˈmɛkʰijʔʌ̃nˈpʰʌ̃mˌbow]					81.00	Voiceless
0987	...crocodile	[ˈkʰɹɑkʰəˌdaʲəl]	[ˈhajkʰɛdə]					64.00	Voiceless
0991	eating cookie	[iɾɪŋkʰʊki]	[ʔajʔə̃ˈejtʰĩʔəˈkʰijkʰij]					55.00	Voiceless
0993	cookie	[kʰʌki]	[əˈkʰɪˌkʰijs]			106.00	Voiceless		

Appendix B - VOT and Initial Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
1026	drive, monkey drive	[ˈʤɹaʲvˈmʌŋkiːʤɹaʲv]	[əˈʤajfˌmʌkʰijʔʊˈdɹajf]					36	Voiceless
1027	monkey drive	[ˈmʌŋkiːʤɹaʲv]	[ˈmɛkʰijˌʤaj]					43	Voiceless
1035	I like cookies	[aʲlaʲkˈ̚ˈkʰʌkiz]	[ˌlalajˈkʰɪʔkʰijs]					117	Voiceless
1043	monkey	[ˈmʌŋki]	[ˈmajˌkʰij]			150	Voiceless		
1047	okay	[ˈoʷkeʲ]	[ʔowˈkʰej]	31	Voiceless				
1111	...man cooking	[mænkʰʌkɪŋ]	[...ˌmæ̃nʌ̃ˈkʰʊkʰɪŋə]					56	Voiceless
1133	cracker,cheese, ice cream	[ˈkʰɹɑkəɹˈʧiːzˈaʲskɹiːm]	[dæthaˈkʰɔkʰx̃ˌdædənˈʧijʔʌˌɪkʰij]					40	Voiceless
1189	peacock	[ˈpʰiˌkʰɑk˺]	[ˈpʰejˌkʰɑkʰ]			96	Voiceless		
1257	my working on a tie-dye	[maʲwəˈkɪŋɑnəˈtʰaʲdaʲ]	[ˌmãjwɜkʰ̃ijnɑ̃nə̃ˈtʰajdaj]					101	Voiceless
1266	...my working ...	[maʲwəˈkɪŋ...]	[...ˈmajwʊkʰ̃ɪnə]					59	Voiceless
1269	my working ...	[maʲwəˈkɪŋ...]	[majˈwʊkʰ̃ɪŋ]					83	Voiceless
1272	chicken	[ˈʧɪkn̩]	[ˈʧɪʔkʰijn]					81	Voiceless
1329	I want ... a popsicle	[aʲwɑnt˺...əˈpʰɑpsɪkɬ]	[ʌwãʔawãtʰɛdədtʰ̥ʔɛðəʔɛnˈpʰɑˌkʰʌ]			80	Voiceless		
1331	want popsicle on my plate	[wɑnt˺ˈpʰɑpsɪkəlɑnmaʲˌpʰleʲt]	[ʌ̃ˌpʰɑkʰəʔɪ̃majˈpʰajtʰ]					42	Voiceless
1348	cook a chicken	[kʰʊkəʧɪkn̩]	[ʌ̃ˈkʰʊkʰəˈʧɪkʰ̃ɪn]					10	Voiced
1349	cook a chicken	[ˌkʰʊkəˈʧɪkn̩]	[əˌkʰʊkʰəˈʧɪkʰ̃ɪnəˈwʌ̃n]					16	Borderline
1434	peacock	[ˈpʰiˌkʰɑk˺]	[ˈpʰijˌkʰɑkʰ]			105	Voiceless		
1512	mama is cooking	[mɑmɑɪzkʰʌkɪŋ]	[ˌmãməʔĩnˈkʰʊkʰ̃ijnə]					97	Voiceless
1513	...mama cooking, somebody eat to	[mɑmɑkʰʌkɪŋsʌmbʌdijitʰuʷ]	[ˈmãmijtʰejʔɛ̃nʌːmãmijˈtʰɛkʰɪt˺ʌʒʌ̃mbʌ.ijʔʌ̃ʔijˈtʰuw]					27	Voiceless
1537	I wanna... Bean in blanket	[ˈaʲwɑnə...ˌbiːnɪnˈblæŋkɪt]	[ʌˈwɑ̃nəbĩŋdɪbwɛ̃ŋkʰɪtʰʔɛ̃nĩˌbɛ̃ŋkʰɛ̃nt˺]					84	Voiceless
1538	blanket	[blæŋkɪt]	[ˈbwejkʰɪn]					69	Voiceless

Appendix B - VOT and Initial Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
1546	walking ... Bean	[wɑɬkɪŋ...biʲn]	[ˈwɑkʰijnɑ̃ʔɑːbijn]					48	Voiceless
1625	o.k.	[oʷkaʲ]	[owˈkʰej]	37	Voiceless				
1643	haircut	[hɛrkʰʌtˀ]	[ˈhɛkʰætʰ]					76	Voiceless
1657	yucky	[ˈjʌki]	[ˈlɛkʰij]					61	Voiceless
1678	they're waking up	[ðɛɹˌweʲkɪŋˈʌpˀ]	[ʔœwejkʰijnˈʔʌpʰ]					69	Voiceless
1684	racoons	[ɹæˈkʰuʷnz]	[wæˈkʰuwns]	109	Voiceless				
1730	o.k. I get a pillow	[oʷkeʲaʲgɛɾəˈpʰɪɬoʷ]	[ʌkʰejˈʔajgɛɾəˌpʰɛlu w]			74	Voiceless		
1834	okay	[oʷkʰeʲ]	[ˈʌˌkʰej]			65	Voiceless		
1840	I want go, something a cookie	[aʲwɑntgoʷsʌmpθɪŋəkʰʌki]	[ˌʔɑ̃mgowɑ̃ˌdʒɑ̃mpʰĩnej ˈkʰʌkʰij]					104	Voiceless
1841	I want chocolate	[aʲwɑnˈtʃɑkˀlətˀ]	[ʌˌwɑ̃nˈtʃɑkʰɑtʰ]					17	Borderline
1849	a ducky	[əˈdukˀ]	[əˈdʌkʰij]					57	Voiceless
1857	a ducky	[əˈdʌki]	[əˈdʌkʰij]					79	Voiceless
1883	wash the cookie	[ˌwɑʃðəˈkʰʊki]	[wɑʃðəˈkʰʊkʰij]					74	Voiceless
1912	monkey	[ˈmʌŋki]	[dəˈmɑ̃kʰij]					64	Voiceless
1936	...cookie	[ˈkʰʊki]	[...ˈʔæ̃nəˈkʰʊkʰij]					88	Voiceless
1946	making a quesadilla	[ˌmeʲkɪnəˌkʰeʲsɪˈdijɑ]	[ˈwejkʰĩnəˌkʰijsəˈdija]					44	Voiceless
2020	racoons	[ɹæˈkʰuʷns]	[wæˈkʰuwnzə]	74	Voiceless				
2167	pickles	[ˈpʰɪkɬz]	[ˈpʰɪkʰɔɬs]					62	Voiceless
2218	he's eating chicken	[hiziɾɪŋˈtʃɪkn̩]	[hijˌʔijɾĩŋˈʃɪkĩn]					43	Voiceless
2232	Ichobod	[ˈɪkəbɑd]	[ɪgəˈbɑːd]					5	Voiced
2268	and the duckies	[ˌændəˈdʌkiʲz]	[ʔɛ̃nəˈdʌkʰijs]					35	Voiceless
2295	pickles	[ˈpʰɪkɬz]	[ˈpʰɪkʰəɬs]					32	Voiceless

Appendix B - VOT and Initial Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
2299	chicken	['tʃɪkn̩]	['tʃɪkʰɛ̃n]					59	Voiceless
2304	I'm just making his	[aɪ̯mdʒʌsmeɪ̯kɪŋhɪz]	[ə̃m'dɪsmejkʰɪ̃nəz]					39	Voiceless
2317	cappucino	[ˌkʰæpə'tʃinoʷ]	[ˌkʰæpʰə'kʰijnow]	71	Voiceless				
2395	this marker's not working	[ðɪsˌmaɹkə˞zɲɑʔ'wə˞kɪ ŋ]	[dɪs'mɑkʰənɑʔˌwʌkʰ̃ij n]					39	Voiceless
2395	this marker's not working	[ðɪsˌmaɹkə˞zɲɑʔ'wə˞kɪ ŋ]	[dɪs'mɑkʰənɑʔˌwʌkʰ̃ij n]					48	Voiceless
2427	peacock	['pʰikɑk̚]	['pʰijkʰɑ]					23	Borderline
2441	the wacky witches	[ðəˌwæki'wɪtʃɪz]	[ðəˌwækʰij'wɪt͡ʃɛz]					69	Voiceless
2481	bacon	['beɪ̯kn̩]	['bejˌkʰ̃ɪn]					13	Voiced
2487	a pickle	[ə'pʰɪkɬ̩]	[ə'pʰɪkʰow]					40	Voiceless
2492	I want the wacky witches	[aɪ̯ˌwɑnt̚ðəˌwæki'wɪtʃɪ z]	[ʌwɑ̃nðəˌwɑkʰij'wɪt͡ʃə z]					73	Voiceless
			Voiceless		13		13		50
			Borderline		0		0		3
			Voiced		0		0		3

Appendix B - VOT and Initial Voicing Labels
Word-medial [g]

Record #	Orthography	Target	Realization	WM-1S	Label	WM-2S	Label	WM-U	Label
0386	again	[ə'gɛn]	['ægɛʔ]					12.00	Voiced
0388	again	[ə'gɛn]	[æ'gɛʔ]	7.00	Voiced				
0396	again	[ə'gɛn]	['ʌjgæʔ]					9.00	Voiced
0399	again	[ə'gɛn]	[ʌj'gæʔ]	8.00	Voiced				
0400	again	[ə'gɛn]	[ɛ'gæʔ]	8.00	Voiced				
0405	again	[ə'gɛn]	[ɛ'gæʔ]	6.00	Voiced				
0717	monkey	['mʌŋki]	['mejk.gij]			41.00	Voiceless		
0906	that's a piggy	[ðætsə'pʰɪgi]	['tʰætʰə,pʰɪgij]					6.00	Voiced
0915	daddy duck	[dædidʌk˺]	[dæθajnõm'dʌgej]					10.00	Voiced
1006	doggie	[dɑgi]	['bɪkʰ,dɑgij]					6	Voiced
1131	mango	['mæŋgoʷ]	['mẽgow]					15	Borderline
1219	piggy too	['pʰɪgitʰuʷ]	[ə'pʰɪgij,tʰuw]					7	Voiced
1250	piggy	['pʰɪgi]	['pʰɪgijʂ]					4	Voiced
1264	piggy come	['pʰɪgitʰuʷ]	[,pʰɪgij'kʰãmna]					10	Voiced
1300	piggy	['pʰɪgi]	['pʰɪgij]					6	Voiced
1301	piggy	['pʰɪ,gi]	['pʰɪgiːj]					5	Voiced
1389	doggie, mom read that	[dɑgimɑmɹɛdðæt]	[,dɑgijə'mɑ̃ɹij,dæ]					3	Voiced
1406	piggy, two piggy	[pʰɪgitʰuʷpʰɪgi]	['pʰɪgijtʰuw,pʰijgij]					5	Voiced
1406	piggy, two piggy	[pʰɪgitʰuʷpʰɪgi]	['pʰɪgijtʰuw,pʰijgij]					6	Voiced
1448	doggies	['dɑgiz]	['dɑgija]					7	Voiced
1528	wagon	['wægn̩]	['wægĩn]					8	Voiced
1701	yogurt	['joʷgə˞t˺]	['jʌgɛtʰ]					4	Voiced
1823	I'll get doggy	[aɫgɛt˺dɑgi]	[a'gɛt˺,dɑgij]					7	Voiced
2094	doggie	['dɑgi]	['dɑgij]					4	Voiced
2421	a wagon	[ə'wægn̩]	[ə'wejgẽn]					4	Voiced
2424	kangaroo	[,kʰæŋgə'ɹuʷ]	['kʰwẽŋgəuw]					8	Voiced
			Voiceless		0		1		0
			Borderline		0		0		1
			Voiced		4		0		20

Appendix B - VOT and Revised Voicing Labels
Word-initial [p]

Record #	Orthography	Target	Realization	WI-U	Label
0471	peacock	[ˈpʰikɑkˈ]	[pʰijˈkʰɑː]	24.00	Voiceless
1064	I wanna turn page	[aʲwɑnəˈtʰə˞npʰeʲdʒ]	[ɐ̃ˈmɑ̃n̩ˌtʰuːwpʰejd]	21.00	Voiceless
1637	put it on my hair	[ˌpʰʌɾɪɾɑnmaʲˈhɛɹ]	[pʰʊdəʔɐ̃ˈmaˌhaw]	30.00	Voiceless
3221	put some more	[pʰʊtˈsəˈmɔɹ]	[pʰəsɐ̃ˈbɔ.a]	15.00	Borderline
			Voiceless		3
			Borderline		1
			Voiced		0

Appendix B - VOT and Revised Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-U	Label
0082	Peter	[ˈpʰiˌɾɚ]	[bəˈwɛʔ]	4.00	Voiced
0115	baby	[ˈbeˌbi]	[bijʔˈbejˌbij]	3.00	Voiced
0225	bean	[biˌn]	[bejˈvij]	3.00	Voiced
0303	oh, garbage truck	[oʷˈgɑɹbədʒˌtʃɹʌk]	[ˌoːwbejˈʃæ]	2.00	Voiced
0335	oh, teddy bear	[oʷˈtʰɛdibɛɹ]	[owəˈdɛːwɛ]	5.00	Voiced
0467	garbage truck	[ˈgɑɹbədʒˌtʃɹʌk]	[bæˈtʃɛkʰ]	2.00	Voiced
0468	uh, dada	[ʌˈdædæ]	[bʊˈdæɾæ]	4.00	Voiced
0748	big tail	[bɪgtʰeɨ]	[bɪˈtʰejʌ]	3.00	Voiced
0904	big tail	[bɪgtʰeɨ]	[bɪˈtʰejəɨ]	3.00	Voiced
0916	big tail	[bɪgtʰeɨ]	[bɪʔˈtʰejʌː]	4.00	Voiced
0917	that's a big slide	[ˈðætsəˈbɪgˈslaˌd]	[ˈdætʰəbɪˌɬajtʰ]	2.00	Voiced
1060	big tail	[bɪgtʰeɨ]	[bɪˈtʰejow]	5.00	Voiced
1152	...big tail	[bɪgtʰeɨ]	[bijˈtʰejow]	3.00	Voiced
1195	big tail too	[bɪgtʰeɨtʰuʷ]	[əbɪˌtʰejəˈtʰuw]	5.00	Voiced
1222	big eyes	[bɪgaˌz]	[bijˈʔaj]	5.00	Voiced
1223	big toes	[bɪgtʰoʷz]	[bɪʔˈtʰows]	4.00	Voiced
1537	I wanna... Bean in blanket	[ˈaˌwɑnə...ˌbiːnɪnˈblæŋkɪt]	[ʌˈwɑ̃nəbĩŋdɪbwɛ̃ŋkʰɪtʰʔɛ̃nĩˌbɛ̃ŋkʰɛ̃ntˈ]	3.00	Voiced
1877	be careful	[biˈkʰɛɹfɨ]	[bɪˈkʰefʌɬ]	4.00	Voiced
2074	clock	[kʰlɑk]	[buwˈhɑ]	3.00	Voiced
2156	blue	[bluː]	[bəˈjʊ]	3.00	Voiced
2460	B,what B for?	[biwʌʔbifɔɹ]	[bijˌʔɤ̃ˈbijfɔ.a]	2.00	Voiced
2692	black	[blæk]	[bəˈwækʰ]	4.00	Voiced
2752	for these	[fɚˈðiz]	[bʌˈdij]	2.00	Voiced
			Voiceless		0

Appendix B - VOT and Revised Voicing Labels
Word-initial [b]

Record #	Orthography	Target	Realization	WI-U	Label
			Borderline		0
			Voiced		23

Appendix B - VOT and Revised Voicing Labels
Word-initial [t]

Record #	Orthography	Target	Realization	WI-U	Label
0106	cat	[kʰæt̚]	[tʰəˈkʰæt̚]	41.00	Voiceless
0903	that's a cow	[ðætsəkʰaʷ]	[tʰɐ̃tʰəʔʌˈkʰɑwa]	19.00	Borderline
1405	no my take knife	[noʷmaʲtʰeʲknaʲf]	[nowˈmajətʰɛkʰˌnejf]	21.00	Voiceless
1638	I have a big knot	[aʲhævəbɪgnɑt̚]	[tʰaˈbɪʔˌnɑtʰ]	48.00	Voiceless
1704	telephone	[ˈtʰɛɬəfoʷn]	[tʰɛləˈfɛwn]	15.00	Borderline
1898	too high	[tʰuʷˈhaʲ]	[tʰuwˈhaj]	43.00	Voiceless
2366	two books	[ˈtʰuʷbʊks]	[tʰuwˈbʊks]	63.00	Voiceless
2749	to the train	[tʰuðəˈʧɹeʲn]	[tʰuwðəˈtwejn]	63.00	Voiceless
3361	two cookies	[ˈtuwˌkʊkijz]	[tʰuwˈkʰʊkʰijs]	56.00	Voiceless
3558	turn it	[ˈtɜɹnɪt]	[ˈtʰɜnij]		
			Voiceless		7
			Borderline		2
			Voiced		0

Appendix B - VOT and Revised Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-U	Label
0090	dada	[ˈdædæ]	[dʌˈdæ]	2.00	Voiced
0132	dada	[dædæ]	[dæˈdæ]	2.00	Voiced
0538	dada	[ˈdædæ]	[dɛˈdæ]	5.00	Voiced
0636	mama	[mɑmə]	[dæˈˈmɐ̃mɐ̃]	7.00	Voiced
0910	that horsie	[ðætˈhɔɹsi]	[dæʔˈhɔʂij]	5.00	Voiced
0915	daddy duck	[dædidʌkˈ]	[dæθajnɵ̃mˈdʌgej]	6.00	Voiced
0937	cat	[kʰætˈ]	[ˈkʰætʰaˈduwijɛn]	2.00	Voiced
0962	that's a hippo	[ðætsəhɪpoʷ]	[dæsaˈbɐ̃m̩bow]	8.00	Voiced
1062	...that's a daddy one	[ðætsədædiwʌn]	[...dædəˈdædij̩wɐ̃n]	3.00	Voiced
1063	that's a tiny one	[ðætsətʰaɪniwʌn]	[dætʰəˈtʰajnij̩wɐ̃n]	16.00	Borderline
1084	that's a man	[ðætsəmæn]	[dætʰam̩ˈmæ̃n]	41.00	Voiceless
1664	that guy driving a	[ˈðætˈgaɪ̯d͡ʒɹaɪ̯vɪŋə]	[dæˈgaj̩dwajvijnʌʔ]	6.00	Voiced
1666	that drives	[ðætˈˈd͡ʒɹaɪ̯vz]	[dæˈdwajv]	7.00	Voiced
1925	eating corn	[iɾɪŋkʰɔɹn]	[dijðəˈklɔwən]	3.00	Voiced
1937	the white one	[ðəˈwaɪ̯twʌn]	[dəˈwajf̩wɐ̃n]	5.00	Voiced
2029	the little one is swimming	[ðəˈlɪɾɬwʌnɪzˈswɪmɪŋ]	[dəˈlɪɬwɐ̃n̩swĩmĩŋ]	5.00	Voiced
2083	down there	[daʷnˈðɛɹ]	[dawˈnɛː]	5.00	Voiced
2085	don't move	[doʷntˈmuʷv]	[dõwtˈˈmjuwv]	6.00	Voiced
2273	the horse don't swim	[ðəˈhɔɹsdoʷntˈˈswɪm]	[dəˈhɔlə̯fwĩm]	5.00	Voiced
2290	the turtle needs help	[ðətʰəˑɾɬnidshɛɬpˈ]	[dɪˈtʰɔdənijz̩hɛɬpˈ]	7.00	Voiced
2340	the cat got a tail	[ðəkʰætˈgɑɾətʰeɪ̯ɬ]	[dəˈkʰægɑðə̯tʰejəɬ]	3.00	Voiced
2391	the little duck	[ðəlɪɾɬdʌk]	[də̯lɪ.əˈdʌkʰ]	6.00	Voiced

Appendix B - VOT and Revised Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-U	Label
2451	the other baby	[ðə'jʌðəˌbeʲbi]	[də'ʔʌðəˌbejbij]	6.00	Voiced
2457	D for Dada	[difəˌdædæ]	[dijfa'dærɑ]	5.00	Voiced
2574	them animals	[ðɛm'mɑnəmɬz]	[dɛ̃m'ʔæ̃nəwʌɬs]	5.00	Voiced
2640	don't like it	[doʷnʔ'laʲkɪt̚]	[dõwʔ'lajgɛt̚]	7.00	Voiced
2644	the bowl	[ðə'boʷɬ]	[də'bowʌɬ]	4.00	Voiced
2722	there's keys	[ðɛɹs'kʰiz]	[dɪs'kʰij]	5.00	Voiced
2738	they're running away	[ðɛɹʌnɪŋə'weʲ]	[dɛwʌ̃nĩjə'wej]	6.00	Voiced
2739	there's his hat	[ðɛɹzhɪz'hæt̚]	[dɛshɪz'hæːʔ]	3.00	Voiced
2787	she got mad on this page?	[ʃɪgɑt̚ˌmadɑn'ðɪspeʲdʒ]	[dʊnɑt̚'mædɑ̃nˌðɪθ'pʰejt̚ʃ]	3.00	Voiced
2833	they got soup	[ðeʲgɑʔ'suʷp̚]	[dejgɑt̚'suwpʰ]	3.00	Voiced
2844	they like pickles	[ðeʲlaʲk'pʰɪkɬz]	[dɛˌlajk̚'pʰɪkʰəɬ]	5.00	Voiced
2860	there's a knife for the big one	[ðɛɹzənaʲfəˌðə'bɪgwʌn]	[dɪzə'najˌfɔ.ə'bɪg'wʌ̃n]	3.00	Voiced
3016	the wind's coming in	[ðə'wɪndskʰʌmɪˌŋɪn]	[də'wĩnkʰʌ̃mĩŋˌĩn]	3.00	Voiced
3070	they really like each other	[ðeʲˌɹɪli'laʲkiˌtʃʌðəˌ]	[dejɹəlij'lajk̚dəˌtʃʌðə]	5.00	Voiced
3072	these guys gotta	['ðizgaʲzgɑrə]	[dɪ'gajˌgɑrə]	5.00	Voiced
3077	they're kissing each other	[ðɛɹ'kʰɪsɪŋiˌtʃʌðəˌ]	[dɛ'kʰɪsĩnəˌt̚ʃʌd̚ʒa]	4.00	Voiced

Appendix B - VOT and Revised Voicing Labels
Word-initial [d]

Record #	Orthography	Target	Realization	WI-U	Label
3114	there's the spoon	[ˈðɛɹzðəˈspʰuwn]	[dəθdəˈpʰuːwn]	4.00	Voiced
3415	this is yellow	[ˌðɪsɪzˈjɛlow]	[dɪsəˈjɛlə]	4.00	Voiced
3431	do that	[duwˈðæt]	[duwˈðætʰ]	3.00	Voiced
3482	do you wanna back?	[duwjuwˌwɑnəˈbæk]	[djuwɑ̃nɪˈbækʰ]	5.00	Voiced
3715	little piggy	[ˌlɪtəɬˈpɪgij]	[dɪɬˈpʰɪgij]	3.00	Voiced
3767	the dirt fell down	[ðəˈdɜɹtfɛɬˌdawn]	[dəˈdøʔˌfɛɬdɑ̃wn]	3.00	Voiced
			Voiceless		1
			Borderline		1
			Voiced		42

Appendix B - VOT and Revised Voicing Labels
Word-initial [k]

Record #	Orthography	Target	Realization	WI-U	Label
0421	lion king	[ˈlaʲn̩kʰɪŋ]	[əˈlawkʰɛ]	90.00	Voiceless
0422	lion king	[ˈlaʲn̩kʰɪŋ]	[əˈlajkʰɛ]	72.00	Voiceless
0428	lion king	[ˈlaʲn̩ˈkʰɪŋ]	[ˈlɛkʰɛ]	44.00	Voiceless
0430	lion king	[ˈlaʲn̩kʰiŋ]	[ˈlajkʰɛ]	61.00	Voiceless
0433	lion king	[ˈlaʲn̩kʰɪŋ]	[ˈlajkʰɛ]	77.00	Voiceless
1307	knife	[naʲf]	[kʰəˈnajf]	93.00	Voiceless
1341	my cooking	[maʲkʰʌⁿkɪŋ]	[əˈmajkʰʊ̩kʰɛ̃n]	63.00	Voiceless
1445	kids like toast	[kʰɪdzlaʲktʰoʷstˀ]	[kʰɪdˈlajkˀ̩tʰows]	36.00	Voiceless
2889	O.K., they	[ᵒʷkeʲðeʲ]	[kʰejˈðej]	36.00	Voiceless
3168	curb fall	[kʰəˑbˈfɑɬ]	[kʰʊɾəbˈfɑɬ]	67.00	Voiceless
3444	I can't cut it	[aj̩kæntˈkʌtɪt]	[kæ̃ʔˈkʰʌɾɪtʰ]	25.00	Voiceless
3663	ok, lets keep this there	[owkej̩lɛtskijpˈðɪsðɛɹ]	[kʰejlɛsˈkʰijpdʌθ̩ðɛ]	48.00	Voiceless
3828	to drink	[tuwˈdɹɪŋk]	[kʰɛ̃ˈdwĩŋkʰ]	28.00	Voiceless
			Voiceless		13
			Borderline		0
			Voiced		0

Appendix B - VOT and Revised Voicing Labels
Word-initial [g]

Record #	Orthography	Target	Realization	WI-U	Label
0136	dada cookie	[dædæˈkʰʊki]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	5.00	Voiced
0146	gorilla	[gəˈɹɪɬə]	[owgəˈwɛ.ə]	1.00	Voiced
0704	garden(?)	[ˈgaɹɪdn̩]	[əˈgɑ̟dʌ]	10.00	Borderline
1225	guitar	[gɪˈtʰaɹ]	[gɛˈtʰɑ]	7.00	Voiced
1889	go to kitchen	[goʷtuʷkʰɪtʃn̩]	[gowtʰɘ̆ˈkʰɪtʃɛ̃n]	5.00	Voiced
1958	getting more	[gɛɾɪŋˈmɔɹ]	[gɪdɪˈmɔː]	14.00	Borderline
2157	got blue?	[gɑtˈbluː]	[gaˈbwuw]	5.00	Voiced
2371	get that out	[gɛʔðæɾɑaʷt̚]	[gɪt̚ˈðæɾawt̚]	6.00	Voiced
2373	get those	[gɛʔ̟ðoʷz]	[gɛt̚ˈðowz]	6.00	Voiced
2821	they ran away	[ˌðeˈɹæ̃nəˈweˈ]	[gɛ.əˌwɐ̃nəˈwej]	6.00	Voiced
3073	go home	[goʷˈhoʷm]	[gʌˈhõwm]	5.00	Voiced
3202	going to see the fishies	[gowɪŋtəsiðəˈfɪʃiz]	[gowĩn̩sijəˈfɪʃijs]	4.00	Voiced
3464	going to get the pump	[gowɪŋtuwˌgɛtðəˈpʌmp]	[gowĩŋˈgɪt̚dʌˌpʰʌp̚]	7.00	Voiced
3655	go on there	[ˌgowɑnˈðɛɹ]	[gowˌɐ̃ˈnɛ.a]	8.00	Voiced
3808	go on here again	[gowɑnˈhɪɹəˌgɛn]	[gowɑ̃nˈhijaˈgɛ̃n]	6.00	Voiced
			Voiceless		0
			Borderline		2
			Voiced		13

Appendix B - VOT and Revised Voicing Labels
Word-medial [p]

Record #	Orthography	Target	Realization	WM-U	Label
0804	oh, purple...	[oʷˈpʰəˌpɻ...]	[owˈpʰɜpʰʊˌwɐ̃n]	60.00	Voiceless
0840	hippo	[ˈhɪpoʷ]	[ˈhʌpʰowæ]	33.00	Voiceless
0861	newspaper	[ˈnuʷzˌpʰeɹpəˌ]	[ˈowpʰɑpʰɑ]	17.00	Borderline
0945	apple	[ˈæpɻ]	[ˈʔæpʰʊ]	31.00	Voiceless
0947	apple	[ˈæpɻ]	[ˈʔæpʰʊ]	50.00	Voiceless
0967	blue and red and purple too	[ˈbluːənˈɹɛdənˈpəɹpəltuː]	[ˌwuwɐ̃nəˈwɛdʔɐ̃nˈpʰɜpʰʌˌtʰuwə]	75.00	Voiceless
1058	...apple	[ˈæpɻ]	[....ˈʔæpʰow]	35.00	Voiceless
1097	that's a blue and a purple	[ðætsəˈbluːændəˈpəɹpəl]	[əˈdætʰʌˌbuwɐ̃nəˈbɔpʰʌ]	46.00	Voiceless
1107	diaper	[ˈdaɹpəˌ]	[ˈtʰɛpɛʔ]	24.00	Voiceless
1154	apple	[ˈæpɻ]	[ˈʔæpʰow]	69.00	Voiceless
1202	purple	[ˈpʰəˌpɻ]	[mˌˈpʰʌpʰɔ]	59.00	Voiceless
1204	slippers	[ˈslɪpˈpʰəˌz]	[ˈtʃɪpʰɛ]	52.00	Voiceless
1238	apple	[ˈæpɻ]	[ˈʌpʰɔ]	63.00	Voiceless
1263	apple	[ˈæpɻ]	[ˈʔæpʰow]	115.00	Voiceless
1271	apples	[ˈæpɻz]	[ˈʔæpʰɔjs]	54.00	Voiceless
1658	that's yucky	[ðætsˈjʌki]	[ˈðæˌdjʌpʰij]	29	Voiceless
1668	airplane	[ˈɛɹpleɹn]	[ˈɛpʰɛ̃jn]	17.00	Borderline
1723	I want the puppets	[aɹwɑntðəpʰʌpəts]	[wɐ̃ndəˈpʰʌpʰʌjts]	50.00	Voiceless
1726	we'll eat something	[wiɻˈitsʌmpθɪŋ]	[wəˈʔijtˈsɐ̃mpʰijnə]	63.00	Voiceless
1793	watch my jumping	[wɑtʃmaɹˈdʒʌmpɪŋ]	[wɑʃˈmajˌdʒɐ̃mpʰijnə]	55.00	Voiceless
1796	want the puppet	[wɑntðəˈpʰʌpɪt]	[ʔɐ̃dəˈpʰʌpʰɛtʰ]	84.00	Voiceless
1840	I want go, something a cookie	[aɹwɑntgoʷsʌmpθɪŋəkʰʌki]	[ˌʔɐ̃mgowə̃ˌdʒɐ̃mpʰĩnejˈkʰʌkʰij]	25.00	Voiceless
1979	this guy happy	[ðɪsgaɹˈhæpi]	[dɪsgʌˈhæpʰij]	68.00	Voiceless
1980	happy	[ˈhæpi]	[ˈʔæpʰij]	70.00	Voiceless
2051	apple	[ˈæpɻ]	[ˈʔæpʰʌɻ]	56.00	Voiceless
2059	apple	[ˈæpɻ]	[ˈʔæpʰɔɻ]	32.00	Voiceless
2065	and a pear and a apple	[ændəˈpʰɛɹændəˈnæpɻ]	[æ̃nəˌpʰæʔæ̃ndəˈʔæpʰʌɻ]	99.00	Voiceless
2110	all sleepy	[aɻˈsliːpʰiɹ]	[ˌʔɑɻˈɻijpʰijnə]	64.00	Voiceless

Appendix B - VOT and Revised Voicing Labels
Word-medial [p]

Record #	Orthography	Target	Realization	WM-U	Label
2208	and a hippopotamus	[ænə˛hɪpoʷˈpʰɑɾəmʌs]	[ˈæ̃ːnhɪpʰowˈpʰɑ.ʌ]	29.00	Voiceless
2262	purple	[ˈpʰəˑpɬ]	[ˈpʰʌpʰɔ]	25.00	Voiceless
2316	something spicy	[ˈsʌmθɪŋˈspʰʌʲsiʲ]	[˛sʌ̃mpʰ͡ɱŋˈpʰajsij]	40.00	Voiceless
2317	cappucino	[˛kʰæpəˈtʃinoʷ]	[˛kʰæpʰəˈkʰijnow]	27.00	Voiceless
2398	apples	[ˈæpɬz]	[ˈʔæpʰʌɬ]	39.00	Voiceless
2455	a lot of people	[ə˛lærəˈpʰipɬ]	[lɑɾəˈpʰijpʰʌɬ]	52.00	Voiceless
2471	You open the door and see here	[juʷoʷpn̥ðədɔɹənsihiɹ]	[juwˈʔowpʰ͡ɱndə˛dɔ.əsijhija]	33.00	Voiceless
2494	is this one happy?	[ɪzðɪswʌnhæpi]	[ɪˈðɪswʌ̃ŋ˛hæ̃pʰij]	28.00	Voiceless
			Voiceless		34
			Borderline		2
			Voiced		0

Appendix B - VOT and Revised Voicing Labels
Word-medial [b]

Record #	Orthography	Target	Realization	WM-U	Label
0043	Babar	[ˈbæbaɹ]	[ˈbæbʌʔ]	8.00	Voiced
0080	Peter	[ˈpʰiʲɾɚ]	[ˈbʊbʊ]	2.00	Voiced
0116	baby	[ˈbeʲbi]	[ˈbejbɪ]	2.00	Voiced
0118	baby	[ˈbeʲbi]	[ˈbejbɪ]	6.00	Voiced
0120	baby	[ˈbeʲbi]	[ˈbɛbij]	3.00	Voiced
0155	Peter, Hanna	[pʰiɾɚhænə]	[ʌˌbʊbəˈhæ̃nɛ]	4.00	Voiced
0303	oh, garbage truck	[oʷˈɡɑɹbədʒˌtʃɹʌk]	[ˌoːwbejˈʃæ]	5.00	Voiced
0467	garbage truck	[ˈɡɑɹbədʒˌtʃɹʌk]	[bæˈtʃɛkʰ]	4.00	Voiced
1028	hippo drive	[ˈhɪpoʷˌdʒɹaʲv]	[ʌ̃ʔəˈpʰə̃mbowĩˌdəʁajf]	5.00	Voiced
1042	hippo ... towel ... toys	[ˈhɪpoʷ...ˈtʰæwl̩...tʰoʲz]	[əˈθĩmbow...ˈtʰʌwa...ˈtʰɔjs]	4	Voiced
1103	little baby	[lɪɾl̩beʲbi]	[ˌlejˈbijbij]	12	Borderline
1106	baby	[ˈbeʲbi]	[ˈbejbij]	5	Voiced
1129	apple	[ˈæpl̩]	[ˈʔætʰæbæʔ]	8.00	Voiced
1146	that's a baby and thats' a lady...	[ðætsəˈbeʲbijənðætsəˌleʲdi...]	[ˌðæsɑˈbejbijʔə̃tʰæsəˈlejdijˈkʰɹɪkʰɪtʰ]	7	Voiced
1283	two rabbits	[tʰuʷˈɹæbɪts]	[tʰuwʔˈwæbɛt̚]	7	Voiced
1424	elbow	[ˈɛɫboʷ]	[ˈʔæbow]	3	Voiced
1436	wheelbarrow	[ˈwiʲɫbɛɹoʷ]	[ˈwijbʌ.ow]	5	Voiced
1478	a rabbit	[əˈɹæbɪt̚]	[ədˈɹæbɛtʰ]	7	Voiced
1669	purple	[ˈpʰɚpl̩]	[ˈpʰʊbʌ]	33.00	Voiceless
1688	rabbits	[ˈɹæbɪts]	[ˈɹæbɪts]	7	Voiced
1856	another rabbit	[ənʌðɚɹæbɪt̚]	[ˈnʌvˌɹæbɪtʰ]	3	Voiced
1893	rabbits	[ˈɹæbɪts]	[ˈwæbɛtʰ]	5	Voiced
2000	rabbits	[ˈɹæbɪt̚]	[ˈwæbɛts]	3	Voiced
2004	and that rabbit	[ənðætˈɹæbɪt̚]	[uwʔə̃ˈðæˌwæbɪθʌ]	4	Voiced
2017	all the rabbits	[ɑɫðəˈɹæbɪts]	[ʔɑɫˈwæbɛt]	3	Voiced

Appendix B - VOT and Revised Voicing Labels
Word-medial [b]

Record #	Orthography	Target	Realization	WM-U	Label
2048	the baby	[ðə'beʲbi]	[dɪ'bejbij]	8	Voiced
2101	zebra	['zibrə]	['zijba]	6	Voiced
2142	a rabbit	[əɹæbɪt̚]	[ə'ɹæbɪt̚]	7	Voiced
2195	a rabbit	[ə'ɹæbɪt̚]	[ə'wæbɪtʰ]	3	Voiced
2199	a zebra	[ə'zibɹə]	[ə'ʒijbəʔɑ̃n]	6	Voiced
2246	rabbits	['ɹæbɪts]	['wæbɪts]	4	Voiced
2332	a rabbit	[ə'ɹæbɪt̚]	[ə'wæbɪʔ]	4	Voiced
2368	apple	['æp̚ɫ]	['ʔæp̚bow]	3	Voiced
2403	strawberries	['stʰɹabəɹiz]	['tʰwɑːbejz]	6	Voiced
2436	you my baby	[juʷmaʲbeʲbi]	[juw,majʔ'bejbij]	7	Voiced
2450	other baby	['ʌðɚ,beʲbi]	['ʔʌðə,bejbij]	7	Voiced
2483	baby cat	[beʲbikʰæt̚]	['bejbij,pʰætʰ]	7	Voiced
			Voiceless		1
			Boderline		1
			Voiced		35

Appendix B - VOT and Revised Voicing Labels
Word-medial [t]

Record #	Orthography	Target	Realization	WM-U	Label
0188	turtle	[ˈtʰɚɾl̩]	[ˈtʰɜ̰ːtʰɛ̃]	67.00	Voiceless
0461	turtle	[ˈtʰɚɾl̩]	[ˈtʰʊtʰʌ]	22.00	Voiceless
0513	bicycle	[ˈbaʲsikl̩]	[ˌbɛʔjəˈpʰʊtʰʌ]	19.00	Borderline
0728	bicycle	[ˈbaʲsɪkɫ]	[ˌbʷawsˈtʰʌtʰʌ]	30.00	Voiceless
0867	elephant ... bicycle	[ɛɫəfənt...ˈbaʲsɪkl̩]	[æ̃nəˈɛɫfɛ̃...ˈpʰʌtʰæ]	33.00	Voiceless
0868	aligator on bicycle	[ˌæɫigeʲɾɚɑnˈbaʲdsɪkɫ]	[m̩ˈægɛləʔʌ̃ʔʊ̃nˌpʰʌtʰɑ]	117.00	Voiceless
0890	eating..........	[ˈiɾɪŋ.........]	[ˈʔejtʰ̃ɪ...]	54.00	Voiceless
1462	give it Cathy	[gɪvɪtkʰæθi]	[ˈgɪvɪˈkʰætʰij]	60.00	Voiceless
1548	turtle	[ˈtʰɚɾl̩]	[ˌʌˈtʰɔtʰɪ]	95.00	Voiceless
1642	cutting	[ˈkʰʌɾɪŋ]	[ˈkʰʌtʰijn]	48.00	Voiceless
1775	dancing	[ˈdænsɪŋ]	[ˈdæ̃ntʰ̃ɪŋ]	80.00	Voiceless
1961	eating the	[ˈiɾɪŋðə]	[ˈʔijtʰ̃ɪŋnɛ]	13.00	Borderline
2407	painting	[pʰeʲntʰɪŋ]	[ˈpʰẽjntʰ̃ijn]	29.00	Voiceless
			Voiceless		11
			Borderline		2
			Voiced		0

Appendix B - VOT and Revised Voicing Labels
Word-medial [d]

Record #	Orthography	Target	Realization	WM-U	Label
0004	dada	[ˈdædæ]	[ˈdɛdæʔ]	5.00	Voiced
0019	dada	[ˈdædæ]	[ʌˈdædɛ]	2.00	Voiced
0020	dada	[ˈdædæ]	[ʌˈdædæ]	2.00	Voiced
0045	Babar's dada	[ˌbəbaɹzˈdædæ]	[ˈbowˌdædæ]	4.00	Voiced
0084	dada	[ˈdædæ]	[ˈdɛdæ]	2.00	Voiced
0136	dada cookie	[dædæˈkʰʊki]	[gʌʔˈdʌdʌˈkʰɪhʊɪ]	3.00	Voiced
0156	dada	[dædæ]	[ˈdɛdæ]	11.00	Borderline
0500	candle	[ˈkʰændl̩]	[ˈkʰæːdaː]	5.00	Voiced
0523	um, uh, dada	[ʌmʌˈdædæ]	[m̩ʔõnˈdædæ]	4.00	Voiced
0666	dada	[ˈdædæ]	[ˈdædæ]	3.00	Voiced
0669	dada	[dædæ]	[ˈdædæ]	5.00	Voiced
0693	I want blanket	[ˈaɪ̯wɑnt̚ˌblæŋkɪt]	[ʌjwãˈbædij]	7.00	Voiced
0695	want blanket	[wɑnt̚ˈblæŋkɪt]	[ãʔˈbædiːj]	9.00	Voiced
0956	water	[ˈwɑɾəˑ]	[ˈwʌdʊ]	4.00	Voiced
1062	...that's a daddy one	[ðætsədædiwʌn]	[...dædəˈdædijˌwʌ̃n]	7	Voiced
1136	putting that	[ˌpʰʊɾɪŋˈðæt̚]	[m̩ˌpʰɪtʰɛ̃nˈdæd]	14	Borderline
1147	dada	[ˈdædæ]	[ʌ̃mˈdæda]	7	Voiced
1270	birdies	[ˈbəˑdiz]	[ˈbʌdejz]	4	Voiced
1345	potato	[pəˈtʰeɪ̯dowˑ]	[ˈtʰejdow]	4	Voiced
1357	...they're eating their food	[ðɛˌɹiɾɪŋðɛɹˈfuʷd]	[ðɪʔijdĩŋðɪˈfuwdə]	6	Voiced
1450	potato	[pəˈtʰeɪ̯dowˑ]	[ənʊˈtʰeːjdoːw]	3	Voiced
1460	potato	[pətʰeɪ̯dowˑ]	[ˈtʰejdow]	4	Voiced
1771	daddy	[ˈdædi]	[ˈdædij]	3	Voiced
1795	other house	[ʌðəˑhaʷs]	[ʔʌdʌˈhaws]	5	Voiced
1796	want the puppet	[wɑntðəˈpʰʌpɪt]	[ʔʌ̃dəˈpʰʌpʰɛtʰ]	2	Voiced
1844	a turtle	[əˈtʰəˑɾl̩]	[əˈtʰɔdɑɬ]	3	Voiced
1846	another turtle	[ənʌðəˑtʰəˑɾl̩]	[ɛ̃ntʰɔʔəˈnaˌtʰɔdow]	3	Voiced
1958	getting more	[gɛɾɪŋˈmɔɹ]	[gɪɾĩˈmɔː]	7	Voiced
2005	eating	[ˈiɾɪŋ]	[ˈʔijdijnə]	3	Voiced
2010	water	[ˈwɑɾəˑ]	[ˈwɑdɑː]	4	Voiced
2014	cleaning water	[ˈkʰliːnɪŋˌwɑɾəɹ]	[ˌɬijəˈwɑda]	6	Voiced

Appendix B - VOT and Revised Voicing Labels
Word-medial [d]

Record #	Orthography	Target	Realization	WM-U	Label
2046	rattle	[ˈɹæɾɬ]	[ˈwædɔɬ]	8	Voiced
2063	radish	[ˈɹædɪʃ]	[ˈwædow]	14	Borderline
2111	candle	[ˈkʰændɬ]	[ˈkʰæ̃ndijðə]	7	Voiced
2166	potato	[ˈpətʰeɪɾoʷ]	[ˈtʰejdow]	4	Voiced
2198	turtle	[ˈtʰəˑɾɬ]	[ˈtʰɔdʌɬ]	3	Voiced
2200	beetle	[ˈbiɾɬ]	[ˈbijdʌɬ]	3	Voiced
2205	and a panda	[ænəˈpʰændə]	[ʔæ̃nəˈpʰæ̃ndɑ]	6	Voiced
2254	they're not eating	[ˌðɛɹnɑʔˈiɾɪŋ]	[ˈðijnɑʔˌijdĩŋ]	9	Voiced
2290	the turtle needs help	[ðətʰəˑɾɬnidshɛɬpˀ]	[dɪˈtʰɔdənijzˌhɛɬpˀ]	6	Voiced
2328	turtle	[ˈtʰəˑɾɬ]	[ˈtʰʌɬduwd]	5	Voiced
2383	they're eating	[ðɛˈɹiɾɪŋ]	[dɛˈʔijdĩŋ]	5	Voiced
2478	that's a nice bottle	[ˌðætsənaɪsbɑɾɬ]	[dæsənajəˈbɑdʌɬ]	5	Voiced
			Voiceless		0
			Borderline		3
			Voiced		40

Appendix B - VOT and Revised Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-U	Label
0158	cookie	[ˈkʰʊki]	[huwəˈtʰejkʰɪʔ]	76.00	Voiceless
0159	oh, cookie	[oʷkʰʊki]	[ˈowəˌtʰejkʰɛ]	81.00	Voiceless
0177	cookie	[ˈkʰʊki]	[hɪmojˈtʰejkʰɪʔ]	135.00	Voiceless
0414	uh, monkey	[ʌˈmʌŋki]	[ˈʊʔˌmʌ̃ŋkʰej]	26.00	Voiceless
0483	monkey	[ˈmʌŋki]	[ˈmækʰij]	68.00	Voiceless
0493	monkey	[ˈmʌŋki]	[ˈmækʰiːj]	72.00	Voiceless
0501	cookie	[ˈkʰʊki]	[ˈkʰɪkʰij]	91.00	Voiceless
0737	...cookie	[...ˈkʰʊki]	[...ˈkʰijkʰij]	94.00	Voiceless
0785	cookie	[ˈkʰʊki]	[ˈkʰejkʰij]	55.00	Voiceless
0934	crocodile	[ˈkʰɹɑkʰəˌdaʲəl]	[ˈkʰɑkʰəˌdajvə]	40.00	Voiceless
0976	vacuum	[ˈvækjuʷm]	[ˈbækʰ̃ɪnʌ̃]	120.00	Voiceless
0978	...monkey and hippo	[ˌmʌŋkihənˈhɪpoʷ]	[...əˈmɛkʰijʔʌ̃nˈpʰʌ̃mˌbow]	81.00	Voiceless
0987	...crocodile	[ˈkʰɹɑkʰəˌdaʲəl]	[ˈhajkʰɛdə]	64.00	Voiceless
0991	eating cookie	[iɾɪŋkʰʊki]	[ʔajʔə̃ˈejtʰ̃ɪ̃ʔəˈkʰijkʰij]	55.00	Voiceless
1026	drive, monkey drive	[ˈdʒɹaʲvˈmʌŋkiːˌdʒɹaʲv]	[ə̃ˈdʒajfˌmʌkʰijʔʊˈdɹajf]	36	Voiceless
1027	monkey drive	[ˈmʌŋkiːˌdʒɹaʲv]	[ˈmɛkʰijˌdʒaj]	43	Voiceless
1035	I like cookies	[aʲlaʲk˺ˈkʰʌkiz]	[ˌlalajˈkʰɪʔkʰijs]	117	Voiceless
1111	...man cooking	[mænkʰʌkɪŋ]	[...ˌmæ̃nʌ̃ˈkʰʊkʰɪŋə]	56	Voiceless
1133	cracker,cheese, ice cream	[ˈkʰɹɑkəɹˈtʃiːzˈaʲskɹiːm]	[dætʰaˈkʰɔkʰʌ̃ˌdædənˈtʃijʔʌˌɪkʰij]	40	Voiceless
1257	my working on a tie-dye	[maʲwɚkɪŋɑnəˈtʰaʲdaʲ]	[ˌmɑ̃jwɜkʰ̃ijnɑ̃nə̆ˈtʰajdaj]	101	Voiceless
1266	...my working ...	[maʲwɚkɪŋ...]	[...ˈmajwʊkʰ̃ɪnə]	59	Voiceless
1269	my working ...	[maʲwɚkɪŋ...]	[majˈwʊkʰ̃ɪŋ]	83	Voiceless
1272	chicken	[ˈtʃɪkn̩]	[ˈtʃɪʔkʰijn]	81	Voiceless
1331	want popsicle on my plate	[wɑnt˺ˈpʰɑpsɪkəlɑnmaʲˌpʰleʲt]	[ʌ̃ˌpʰɑkʰəʔɪ̃majˈpʰajtʰ]	42	Voiceless
1348	cook a chicken	[kʰʊkətʃɪkn̩]	[ʌ̃ˈkʰʊkʰəˈtʃɪkʰ̃ɪn]	10	Borderline
1349	cook a chicken	[ˌkʰʊkəˈtʃɪkn̩]	[əˌkʰʊkʰəˈtʃɪkʰ̃ɪnəˈwʌ̃n]	16	Borderline
1512	mama is cooking	[mɑmɑɪzkʰʌkɪŋ]	[ˌmɑ̃məʔɪ̃nˈkʰʊkʰ̃ijnə]	97	Voiceless
1513	...mama cooking, somebody eat to	[mɑmɑkʰʌkɪŋsʌmbʌdijitʰuʷ]	[ˈmɑ̃mijtʰejʔɛ̃nʌːˌmɑ̃mijˈtʰɛkʰɪt˺ʌʒʌ̃mbʌ. ijʔʌ̃ʔijˈtʰuw]	27	Voiceless
1537	I wanna... Bean in blanket	[ˈaʲwɑnə...ˌbiːnɪnˈblæŋkɪt]	[ʌˈwɑ̃nəbɪ̃ŋdɪbwɛ̃ŋkʰɪtʰʔɛ̃nɪ̃ˌbɛ̃ŋkʰɛ̃nt˺]	84	Voiceless

Appendix B - VOT and Revised Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-U	Label
1538	blanket	[blæŋkɪt]	[ˈbwejkʰɪn]	69	Voiceless
1546	walking ... Bean	[wɑɫkɪŋ...biʲn]	[ˈwɑkʰijnɑ̃ʔɑːˌbijn]	48	Voiceless
1643	haircut	[hɛrkʰʌt˺]	[ˈhɛkʰætʰ]	76	Voiceless
1657	yucky	[ˈjʌki]	[ˈlɛkʰij]	61	Voiceless
1678	they're waking up	[ðɛɹˌweʲkɪŋˈʌp˺]	[ʔœwejkʰijnˈʔʌpʰ]	69	Voiceless
1840	I want go, something a cookie	[aʲwɑntgoʷsʌmpθɪŋəkʰʌki]	[ˌʔʌ̃mgowə̃ˌd͡ʒʌ̃mpʰ̃ĩnejˈkʰʌkʰij]	104	Voiceless
1841	I want chocolate	[aʲwɑnˈtʃɑk˺lət˺]	[ʌˌwʌ̃nˈt͡ʃɑkʰɑtʰ]	17	Borderline
1849	a ducky	[əˈduk˺]	[əˈdʌkʰij]	57	Voiceless
1857	a ducky	[əˈdʌki]	[əˈdʌkʰij]	79	Voiceless
1883	wash the cookie	[ˌwɑʃðəˈkʰʊki]	[wɑʃðəˈkʰʊkʰij]	74	Voiceless
1912	monkey	[ˈmʌŋki]	[dəˈmʌ̃kʰij]	64	Voiceless
1936	...cookie	[ˈkʰʊki]	[...ˈʔæ̃nəˈkʰʊkʰij]	88	Voiceless
1946	making a quesadilla	[ˌmeʲkɪnəˌkʰeʲsɪˈdijɑ]	[ˈwejkʰ̃ĩnəˌkʰijsəˈdija]	44	Voiceless
2167	pickles	[ˈpʰɪkl̴̩z]	[ˈpʰɪkʰɔɫs]	62	Voiceless
2218	he's eating chicken	[hiziɾɪŋˈtʃɪkn̩]	[hijˌʔijɾĩŋˈʃɪkĩn]	43	Voiceless
2232	Ichobod	[ˈɪkəbɑd]	[ɪgəˈbɑːd]	5	Voiced
2268	and the duckies	[ˌænðəˈdʌkiʲz]	[ʔɛ̃nəˈdʌkʰijs]	35	Voiceless
2295	pickles	[ˈpʰɪkɫz]	[ˈpʰɪkʰəɫs]	32	Voiceless
2299	chicken	[ˈtʃɪkn̩]	[ˈt͡ʃɪkʰɛ̃n]	59	Voiceless
2304	I'm just making his	[aʲmdʒʌsmeʲkɪŋhɪz]	[ə̃mˈdɪsmejkʰ̃ĩnəz]	39	Voiceless
2395	this marker's not working	[ðɪsˌmaɹkɚznɑʔˈwɚkɪŋ]	[dɪsˈmɑkʰənɑʔˌwʌkʰ̃ijn]	39	Voiceless
2395	this marker's not working	[ðɪsˌmaɹkɚznɑʔˈwɚkɪŋ]	[dɪsˈmɑkʰənɑʔˌwʌkʰ̃ijn]	48	Voiceless
2427	peacock	[ˈpʰikɑk˺]	[ˈpʰijkʰɑ]	23	Voiceless
2441	the wacky witches	[ðəˌwækiˈwɪtʃɪz]	[ðəˌwækʰijˈwɪt͡ʃɛz]	69	Voiceless
2481	bacon	[ˈbeʲkn̩]	[ˈbejˌkʰ̃ĩn]	13	Borderline
2487	a pickle	[əˈpʰɪkl̴̩]	[əˈpʰɪkʰow]	40	Voiceless
2492	I want the wacky witches	[aʲˌwɑnt˺ðəˌwækiˈwɪtʃɪz]	[ʌwɑ̃nðəˌwɑkʰijˈwɪt͡ʃəz]	73	Voiceless

Appendix B - VOT and Revised Voicing Labels
Word-medial [k]

Record #	Orthography	Target	Realization	WM-U	Label
			Voiceless		51
			Borderline		4
			Voiced		1

Appendix B - Revised Voicing Labels
Word-medial [g]

Record #	Orthography	Target	Realization	WM-U	Label
0386	again	[ə'gɛn]	['ægɛʔ]	12.00	Borderline
0915	daddy duck	[dædidʌk̚]	[dæθajnõm'dʌgej]	10.00	Borderline
1131	mango	['mæŋgoʷ]	['mẽgow]	15	Borderline
1264	piggy come	['pʰɪgitʰuʷ]	[ˌpʰɪgij'kʰɐ̃mna]	10	Borderline
0396	again	[ə'gɛn]	['ʌjgæʔ]	9.00	Voiced
0906	that's a piggy	[ðætsə'pʰɪgi]	['tʰætʰaˌpʰɪgij]	6.00	Voiced
1006	doggie	[dɑgi]	['bɪkʰˌdɑgij]	6	Voiced
1219	piggy too	['pʰɪgitʰuʷ]	[ə'pʰɪgijˌtʰuw]	7	Voiced
1250	piggy	['pʰɪgi]	['pʰɪgijʂ]	4	Voiced
1300	piggy	['pʰɪgi]	['pʰɪgij]	6	Voiced
1301	piggy	['pʰɪˌgi]	['pʰɪgiːj]	5	Voiced
1389	doggie, mom read that	[dɑgimɑmɹɛdðæt]	[ˌdɑgijə'mɑ̃ɹijˌdæ]	3	Voiced
1406	piggy, two piggy	[pʰɪgitʰuʷpʰɪgi]	['pʰɪgijtʰuwˌpʰijgij]	5	Voiced
1406	piggy, two piggy	[pʰɪgitʰuʷpʰɪgi]	['pʰɪgijtʰuwˌpʰijgij]	6	Voiced
1448	doggies	['dɑgiz]	['dɑgija]	7	Voiced
1528	wagon	['wægn̩]	['wægĩn]	8	Voiced
1701	yogurt	['joʷgəˑt̚]	['jʌgɛtʰ]	4	Voiced
1823	I'll get doggy	[aɬgɛt̚dɑgi]	[a'gɛtˌdɑgij]	7	Voiced
2094	doggie	['dɑgi]	['dɑgij]	4	Voiced
2421	a wagon	[ə'wægn̩]	[ə'wejgẽn]	4	Voiced
2424	kangaroo	[ˌkʰæŋgə'ɹuʷ]	['kʰwɛ̃ŋgəuw]	8	Voiced
			Voiceless		0
			Borderline		4
			Voiced		17

Appendix C - Onset Clusters
Obstruent+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;04.18	blue	ˈbluw	ˈbuw	WI-1						1		
1;05.00	blue	ˈbluw	əˈbwuːw	WI-1				1				
1;05.29	plate	ˈplejt	hʊˈwɛː	WI-1								1
1;05.29	blue	ˈbluw	ˈbuw	WI-1						1		
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈɛ̃gmijtʰə	WM-2								1
1;05.29	butterfly	ˈbʌtəɹˌflaj	ˈfwɑ	WM-2				1				
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈɛmɪhĩ	WM-2								1
1;05.29	airplane	ˈɛɹplejn	ˈɛ̃fʊ	WM-2								1
1;06.10	blue	ˈbluw	ˈbuw	WI-1						1		
1;06.10	plate	ˈplejt	ˈpʰæː	WI-1						1		
1;06.10	plate	ˈplejt	ɐ̃ˈpʰæː	WI-1						1		
1;06.10	airplane	ˈɛɹplejn	ˈɛ̃ʔˌhɛ̃n	WM-2								1
1;06.10	flower	ˈflɑwəɹ	ʊ̃ˌfʊ̃	WI-1						1		
1;06.10	blue	ˈbluw	ˈbluw	WI-1	1							
1;06.10	bluebird	ˈbluwˌbəɹd	ˈbluwˌajs	WI-1	1							
1;06.10	blue	ˈbluw	ˈbwuːw	WI-1				1				
1;06.10	blue	ˈbluw	əˈbuwə	WI-1						1		
1;06.10	blue	ˈbluw	ˈbuw	WI-1						1		
1;06.10	blue	ˈbluw	ˈbuw	WI-1						1		
1;06.23	blue	ˈbluw	ˈbʊ	WI-1						1		
1;06.23	blue	ˈbluw	ˈbuw	WI-1						1		
1;07.27	uh, blue	ʔʌˈbluw	ʌgˈvuw	WI-1						1		
1;08.06	blue	ˈbluw	ˈbuːw	WI-1						1		
1;08.06	blue	ˈbluw	ˈbwuw	WI-1				1				
1;08.06	glass(?)	ˈglæs	majˈgæː	WI-1						1		
1;08.06	glass(?)	ˈglæs	mˌˈgæ	WI-1						1		

Appendix C - Onset Clusters
Obstruent+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.06	plate	ˈplejt	ˈpwejtʰ	WI-1				1				
1;08.06	butterfly	ˈbʌtəɹˌflaj	ˈbɛfɛj	WM-2						1		
1;08.06	climbing trunk	ˌklajmɪŋˈtɹʌŋk	ˈkʰajŋənˈt͡ʃʌkˀ	WI-1						1		
1;08.06	blue	ˈbluw	ˈbuw	WI-1						1		
1;08.11	airplane	ˈɛɹplejn	ɛˈpʰẽjn	WM-2						1		
1;08.11	airplane	ˈɛɹplejn	ɪməˈʔæˌfẽːjn	WM-2						1		
1;08.11	plate	ˈplejt	ˈpʰej	WI-1						1		
1;08.11	blue	ˈbluw	m̩ˈbuw	WI-1						1		
1;08.11	blanket	ˈblæŋkət	ˈuwɪɛˌdɪ	WI-1								1
1;08.11	I want blanket	ˌajwantˈblæŋkət	ʌjwãˈbædij	WI-1						1		
1;08.11	want blanket	wantˈblæŋkət	ʌ̃ʔˈbædiːj	WI-1						1		
1;08.11	flower(?)	ˈflawəɹ	ˈhwɑdʊ	WI-1		1						
1;08.11	airplane	ˈɛɹplejn	ʊˈpʰɛ̃n	WM-2						1		
1;08.11	I want blanket	ʔajˌwantˈblaŋkət	ˈowbʌˌd͡ʒij	WI-1						1		
1;08.22	mm, blue	m̩ˈbluw	m̩ˈbuw	WI-1						1		
1;08.22	blue	ˈbluw	ˈbuw	WI-1						1		
1;08.22	blue	ˈbluw	ˈbuw	WI-1						1		
1;08.22	blue	ˈbluw	m̩ˈbluw	WI-1	1							
1;08.22	clock	ˈklɑk	ˈkʰɑkʰ	WI-1						1		
1;08.22	um, block	ʔʌmˈblɑk	ˌʌ̃ːmˈbwɑkʰ	WI-1				1				
1;08.22	airplane	ˈɛɹˌplejn	ˈʔɛ̃ˌfẽj	WM-2						1		
1;08.22	blue	ˈbluw	ˈbluːw	WI-1	1							
1;08.22	blue	ˈbluw	ˈbuw	WI-1						1		

Appendix C - Onset Clusters
Obstruent+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;09.11	blue	ˈbluw	ˈbuwə	WI-1						1		
1;09.11	blocks	ˈblɑks	ˈbwɑkʰ	WI-1				1				
1;09.11	clock	ˈklɑk	ˈkʰɑkʰ	WI-1						1		
1;09.11	...flowers	ˈflɑwəɪz	ˈpʰwʊlʌ	WI-1		1						
1;09.11	glasses	ˈglæsəz	ˈgæʃə	WI-1						1		
1;09.11	blue and red and purple too	bluwənɪɛdənˈpɜɪpəɬˌtuw	ˌwuwɑ̃nəˈwɛdʔɑ̃nˈpʰɜpʰʌˌtʰuwə	WI-1					1			
1;09.11	airplane	ˈɛɪˌplejn	ʔɑ̃mˈpʰẽjn	WM-2						1		
1;09.11	...blue one	ˈbluwwʌn	ˈbuwwɑ̃nə	WI-1						1		
1;09.11	airplane	ˈɛɪˌplejn	ˈʔɛˌpʰẽjn	WM-2						1		
1;09.11	a blue one	əˈbluwwʌn	ɑ̃nˈbuwɑ̃n	WI-1						1		
1;09.11	blue one	ˈbluwwʌn	ˈbuwɑ̃n	WI-1						1		
1;09.11	blue one	ˈbluwwʌn	ˈbuwɑ̃nə	WI-1						1		
1;09.11	that's a blue and a purple	ðætsəˌbluwɛndəˈpɜɪpəɬ	əˈdætʰʌˌbuwə̃nəˈbɔpʰʌ	WI-1						1		
1;09.11	clock	ˈklɑk	ˈkʰɑkʰ	WI-1						1		
1;09.11	I want blow	ˌajwantˈblow	ɑ̃ˈwɑ̃ːbow	WI-1						1		
1;09.11	that's a blue one	ˌðætsəˈbluwwʌn	ˌdætʰəˈbuwɑ̃n	WI-1						1		
1;09.26	black	ˈblæk	ˈbækʰ	WI-1						1		
1;09.26	clothes	ˈklowðz	ˈkʰʌəd	WI-1						1		
1;09.26	airplane	ˈɛɪˌplejn	ˈʔɛ̃ˌpʰẽjlə	WM-2						1		
1;09.26	butterflies	ˈbʌtəɪˌflajz	ˈbɛˌfaj	WM-2						1		
1;09.26	airplane	ˈɛɪˌplejn	ˈʔɛˌpʰẽjn	WM-2						1		

Appendix C - Onset Clusters
Obstruent+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
				70	4	2	0	7	1	50	0	6
					6%	3%	0%	10%	1%	71%	0%	9%
				CC	19%							
1;10.10	black	ˈblæk	mˌˈbwækʰ	WI-1				1				
1;10.10	plate	ˈplejt	ˈpʰejtˀ	WI-1						1		
1;10.10	airplane	ˈɛɹˌplejn	ˈɛpʰwẽjn	WM-2				1				
1;10.10	...black one	ˈblækwʌn	ˈblækʰwʌ̃n	WI-1	1							
1;10.10	want popsicle on my plate	wantˈpɑpsəkʌɬɑnm ajˌplejt	ʌ̃ˌpʰɑkʰəʔĩmajˈpʰajtʰ	WI-1						1		
1;10.10	...b, blue one	bəˈbluwˌwʌn	bəˈbwuwwʌ̃n	WI-1				1				
1;10.10	plate	ˈplejt	mˌˈpwejtʰ	WI-1				1				
1;10.10	...climbing a ladder	ˌklajmɪŋəˈlæɾəɹ	ˈkʰajmijməˈlædɔ	WI-1						1		
1;10.10	clothes	ˈklowz	ˈkʰowwəz	WI-1				1				
1;10.10	glasses	ˈglæsəz	əˈgæt͡ʃɑ	WI-1						1		
1;10.10	blue one, want blue one mom	ˌbluwwʌnˌwantˈblu wwʌnˌmɑm	buwˈwẽnəʔãˈbuww ʌ̃nˌmɑ̃m	WI-1						1		
1;10.10	blue one, want blue one mom	ˌbluwwʌnˌwantˈblu wwʌnˌmɑm	buwˈwẽnəʔãˈbuww ʌ̃nˌmɑ̃m	WI-1						1		
1;10.10	butterfly	ˈbʌtəɹˌflaj	əˈbwɛɹˌfaj	WM-2						1		
1;10.24	plate	ˈplejt	ʌ̃mˈpʰwejt	WI-1				1				
1;10.24	want plate	wantˈplejt	awəˈpʰwej	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;10.24	airplane	ˈɛɹˌplejn	ˈʔɛˌpʰɛ̃j	WM-2						1		
1;10.24	airplane	ˈɛɹˌplejn	ˈhɜˌpʰɛ̃j	WM-2						1		
1;10.24	that guy ... blue	ˈðætgajˌbluw	dəˈðætˀˈgajʔə̃ʔə̃ˈblu w	WI-1	1							
1;10.24	uh, blow	ʔʌˈblow	ʌ̃ˈfuw	WI-1								1
1;10.24	blow	ˈblow	ʌ̃mˈbəoːw	WI-1						1		
1;10.24	bean in my blanket(?)	ˌbijnɪnmajˈblæŋkət	ˈbejŋgowˌwʌːʔəˌbɪɛ̃ŋkʰɛ̃n	WI-1				1				
1;10.24	I wanna... Bean in blanket	ajwɑnəˈbijnɪnˌblæŋkət	ʌˈwɑ̃nəbĩŋdɪbwɛ̃ŋkʰɪtʰʔɛ̃nĩˌbɛ̃ŋkʰɛ̃ntˀ	WI-1						1		
1;10.24	blanket	ˈblæŋkət	ˈbwejkʰɪn	WI-1				1				
1;11.08	I wanna play that	ajˌwɑnəˈplejˌðæt	ajwɑ̃ˌpʰwejˈdæː	WI-1				1				
1;11.08	blue one	ˈbluwˌwʌn	ˈbwuwɛ̃n	WI-1				1				
1;11.08	airplane	ˈɛɹˌplejn	ˈɛpʰɛ̃jn	WM-2						1		
1;11.08	blue	ˈbluw	ˈbuw	WI-1						1		
1;11.08	flowers	ˈflɑwəɹz	ˈawʌs	WI-1							1	
				28	2	0	0	11	0	13	1	1
					7%	0%	0%	39%	0%	46%	4%	4%
				CC	46%							
1;11.27	get the plates	ˌgɛtðəˈplejts	ˈʔʊdəˌpʰwejts	WI-1				1				
1;11.27	my plate	majˈplejt	ˈmajˌplajtʰ	WI-1	1							
1;11.27	plate	ˈplejt	ˈpʰwejtʰ	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;11.27	playing beads	ˌplejɪŋˈbijdz	pwejĩŋˈbijdzə	WI-1				1				
1;11.27	blue	ˈbluw	ˈbwuw	WI-1				1				
1;11.27	I want chocolate	ˌajwantˈt͡ʃɑklət	ʌˌwɑ̃nˈt͡ʃɑkʰɑtʰ	WM-U						1		
2;00.04	clean	ˈklijn	ɑ̃mˈkʰɋijn	WI-1				1				
2;00.04	cleaning water	ˈklijnɪŋˌwɑtəɹ	ˌɬijəˈwɑda	WI-1								1
2;00.04	airplanes	ˈɛɹˌplejnz	ˈʔɛˌpʰɋẽjn	WM-2				1				
2;00.04	in big glasses	ɪnˌbɪgˈglæsəz	ʔĩnbɪgˈglæʒɛð	WI-1	1							
2;00.04	clock	ˈklɑk	buwˈhɑ	WI-1						1		
2;02.03	plate	ˈplejt	ˈpwej	WI-1				1				
2;02.03	blue	ˈbluw	ˈbwuw	WI-1				1				
2;02.03	airplane	ˈɛɹˌplejn	ˈʔɛpwẽjn	WM-2				1				
2;02.03	another plate	əˈnʌðəɹˌplejt	ˈnʌðˌpʰlejtʰ	WI-1	1							
2;02.03	you got blue?	juwˌgɑtˈbluw	jəˈgɑˌbuw	WI-1						1		
2;02.03	blue	ˈbluw	bəˈjʊ	WI-1								1
2;02.03	got blue?	gɑtˈbluw	gaˈbwuw	WI-1				1				
2;02.03	butterfly	ˈbʌtəɹˌflaj	ˈbʌˌfwaj	WM-2				1				
2;02.03	a blue one	əˈbluwwʌn	ʌˈbowˌwɑ̃n	WI-1						1		
2;02.03	the airplane	ðəˈɛɹˌplejn	ðəˈʔɛɹpwẽjn	WM-2				1				
2;02.03	and blue	ɛndˈbluw	ɑ̃nˈbluw	WI-1	1							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;02.03	and black mom	ɛnd'blæk,mɑm	æ̃n'blæk^{h},mɑ̃m	WI-1	1							
2;02.03	airplane	'ɛɹ,plejn	'ʔɛp^{h}wejn	WM-2				1				
2;02.03	this my place	ðɪs'maj,plejs	ðɪs,maj'pwejs	WI-1				1				
2;02.22	a plate	ə'plejt	ʔə'p^{h}wejt^{h}	WI-1				1				
2;02.22	black	'blæk	'bwæk^{h}	WI-1				1				
2;02.22	airplane	'ɛɹ,plejn	'ʔɛ,p^{h}lejn	WM-2	1							
2;02.22	glasses	'glæsəz	'k^{h}wæθɪz	WI-1		1						
2;02.22	slide	'slajd	'la:jt^{h}	WI-1					1			
2;02.22	airplane	'ɛɹ,plejn	'ʔɛpwẽjn	WM-2				1				
2;02.22	butterfly	'bʌtəɹ,flaj	'bwɛfaj	WM-2						1		
2;02.22	butterfly	'bʌtəɹ,flaj	'bwɛfaj	WM-2						1		
2;02.22	this Mowgli's gum	ðɪs'mowglijz,gʌm	'dɪsmowgij,gɐ̃m	WM-U						1		
2;03.03	you play with this?	juw,plejwɪθ'ðɪs	juwp^{h}ə̃law'dɪ	WI-1								1
2;03.03	claws	'klɑz	'wɑəs	WI-1								1
2;03.03	blue	'bluw	'bwuw	WI-1				1				
2;03.03	black ball	'blæk'bɑɫ	'blæk^{h},bɑɫ	WI-1	1							
2;03.03	airplane	'ɛɹ,plejn	'ʔæp^{h}wĩn	WM-2				1				
2;03.03	blowing away	,blowɪŋə'wej	bwowĩnə'wej	WI-1				1				
2;03.03	something on a plate	,sʌmθɪŋɑn'plejt	,sɐ̃mp^{h}ĩŋɐ̃nə'p^{h}wejt	WI-1				1				

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Obstruent+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.03	there's my glasses	ˌðɛɹzmajˈglæsəz	ðɛzmajˈgwæsəz	WI-1				1				
2;03.03	how about the blanket slide?	hawəbawtðəˈblæŋk ətˌslajd	hawbawtdəˈblɛ̃ŋgɪt ˈˌslajd	WI-1	1							
2;03.03	put the blanket slide	pʊtðəˈblæŋkətˌslajd	ˈpʰʊðəˈblɛ̃ŋkʰɪtˈˌt͡saj	WI-1	1							
2;03.03	I don't wanna play with Kathy's toys	ʔajdowntˌwɑnəplej wɪθˈkæθijzˌtojz	ʔajõwˈwɑ̃əpʰwejˈkʰ æðijˌtʰɔj	WI-1				1				
2;03.03	claws	ˈklɑz	ˈkʰlɔəz	WI-1	1							
2;03.03	bleed	ˈblijd	ˈbwijd	WI-1				1				
2;03.17	it's a airplane	ˌɪtsəˈɛɹˌplejn	ɛ̃dəˈʔɛˌpwɛ̃jn	WM-2				1				
2;03.17	black	ˈblæk	bəˈwækʰ	WI-1								1
2;03.17	plate	ˈplejt	ˈpwejtʰ	WI-1				1				
2;03.17	blue	ˈbluw	ˈbwuw	WI-1				1				
2;03.17	he's tickling	hijzˈtɪklɪŋ	hijsˈtʰɪklĩŋ	WM-U	1							
2;03.17	look, it's flying away	ˌlʊkʔɪtsˈflajɪŋəˌwej	ˈlʌkʰʔɪtfʌnəˈwej	WI-1						1		
2;03.17	plane	ˈplejn	ˈwɛ̃jn	WI-1					1			
2;03.17	airplane	ˈɛɹˌplejn	ˈʔɛpwɛ̃jn	WM-2				1				
2;03.17	the flashing one	ðəˈflæʃɪŋwɔn	dəˈpʰlæʃijˌwʌ̃n	WI-1			1					

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.17	we want the plate	wijˈwantðəˌplejt	wijˈwãndəˌpʰlejtˀ	WI-1	1							
2;03.27	plate	ˈplejt	ˈplej	WI-1	1							
2;03.27	plate	ˈplejt	ˈpʰwejtˀ	WI-1				1				
2;03.27	they wanna play with the ij	ðejwɑnəˈplejwɪθˌm	dejˈwãdɛˌwãpʰwej wɪtˀˈðʌ̃m	WI-1				1				
2;03.27	wanna play with the horse	wɑnəˌplejwɪθðəˈhɔ ɹs	ˈdõwã?pwejˌwɪθðəˈ hɔəθɛ	WI-1				1				
2;03.27	you wanna play with us	juwwɑnəˈplejwɪˌθʌ s	ˈjuwãəˌplijwɪˈθʌθ	WI-1	1							
2;03.27	that, I'm gonna blow	ðætˌ?ajmgownəˈbl ow	ˈdæ?ajŋgʌ̃ˌbwow	WI-1				1				
2;03.27	green and blue	ˌgɹijnɛndˈbluw	ˈgwijnæ̃ˈbwuw	WI-1				1				
2;03.27	this blue	ðɪsˈbluw	ˈdɪθˌbluw	WI-1	1							
2;03.27	what's that blue thing?	watsðætˈbluwˌθɪŋ	ʌ̃ðæˈbwuwˌθĩŋ	WI-1				1				
2;04.29	got claws on	gɑtˈklɑzɑn	gɑtˀˈwɑzʌ̃nɪtʰ	WI-1				1	1			
2;04.29	blue	ˈbluw	ˈbwuwə	WI-1				1				
2;04.29	or black	ɔɹˈblæk	ɔˈbwækʰ	WI-1				1				
2;05.12	I play green thing	ajˌplejˈgɹijnθɪŋ	ɑʔˈfmejˌkwijpˀθĩŋs	WI-1		1						
2;05.12	claws	ˈklɑz	ˈpʰwɑːz	WI-1		1						
2;05.12	I'm just playing	ajmˌd͡ʒʌstˈplejɪŋ	ʌ̃?ʌ̃mˈd͡ʒɪsˌpʰlẽjŋ	WI-1	1							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.12	we played Mrs. McGregor	ˌwijplejdmɪsmɪkˈgɹ ɛgəɹ	wəˌpwejˈmɪsəzməˈg weja	WI-1				1				
2;05.12	climbing in the	ˈklajmɪŋɪnðə	ˈklajmĩŋĩnðʊ	WI-1	1							
2;05.12	purple and blue	ˌpɜɹpəɬendˈbluw	ˌpʰɔpʰəæ̃nˈwuw	WI-1					1			
2;05.12	I'll have a chocolate one	ajɬhævəˈt͡ʃɑklətˌwʌn	ˈɑɬhævəˈt͡ʃɑklɛtˀˌwã̃n	WM-U	1							
2;05.12	a chocolate one	əˈt͡ʃɑklətˌwʌn	əˈt͡ʃɑklɛtˀwã̃n	WM-U	1							
2;05.12	wanna have some chocolate one?	wɑnəhævsʌmˈt͡ʃɑkl ətˌwʌn	uwˌhæsã̃mˈt͡ʃɑklɪtˀ wã̃n	WM-U	1							
2;05.12	blue	ˈbluw	ˈbwuw	WI-1				1				
2;05.12	I like the chocolate	ajˌlajkðəˈt͡ʃɑklət	əlajkˀðəˈt͡ʃɑklɛtˀ	WM-U	1							
2;05.12	chocolate	ˈt͡ʃɑklət	ˈtʰɑgɑˌlɛʔ	WM-U								1
2;05.12	blue	ˈbluw	ˈbwuw	WI-1				1				
2;05.12	cause he got sharp claws	kʌzhijgɑtˌʃɑɹpˈklɑz	kʰʌzhijˈgɑtˀθʌˌpwɑ z	WI-1		1						
2;05.25	no, its a plate	ˌnowʔɪtsəˈplejt	nʌtsəˈpwejtʰ	WI-1				1				
2;05.25	and black	ɛndˈblæk	æ̃nˈbwæː	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.25	blue	ˈbluw	ˈbwuw	WI-1				1				
2;05.25	this blue	ðɪsˈbluw	ˌdɪsˈbwuw	WI-1				1				
2;05.25	it's a airplane	ɪtsəˈʔɛɪˌplejn	səˈʔɛɪpʰwẽjn	WM-2				1				
2;05.25	it's flying	ɪtsˈflajɪŋ	ˈɪsθəˌfwajĩŋ	WI-1				1				
2;05.25	I got blueberry bagel	ajgatˌbluwbɛɪijˈbej gəɬ	ajgaˌbwuwbɛɪijˈbej gəɬ	WI-1				1				
2;05.25	he played drums	hijˌplejdˈdɪʌmz	wijˌpʰwejˈdɪɐ̃ms	WI-1				1				
2;05.25	it's blowing	ɪtsˈblowɪŋ	əˈblowĩŋ	WI-1	1							
2;05.25	blowed	ˈblowd	ˈbwow	WI-1				1				
2;05.25	What doing her clothes?	watˌduwɪŋhɜɹˈklowz	wʌduwəhʌˈkʰwoːwð	WI-1				1				
2;05.25	blowing the wind	ˌblowɪŋðəˈwɪnd	ˈpʰowĩŋəˈwẽnd	WI-1						1		
2;06.02	Let's play with car	lɛtsˈplejwɪθˌkɑɹ	ʊtˀˈðɛɪðʔəθˌkʰɑ	WI-1								1
2;06.02	blue	ˈbluw	ˈbwuw	WI-1				1				
2;06.02	Blue right here	ˌbluwɹajtˈhɪɹ	ˈbwuwwajˈkʰija	WI-1				1				
2;06.02	flowers	ˈflɑwəɹz	ˈfawʌz	WI-1						1		
2;06.02	the trees blowing in it	ðəˌtɹijzˈblowɪŋɪnɪt	dəˈtɹijˈbwowijñĩnɪ	WI-1				1				
2;06.02	It's blowing away	ɪtsˈblowɪŋəˌwej	ɪˈblowijəˌd͡ʒʌˈwejɛ	WI-1	1							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;06.02	blocks	ˈblɑks	ˈblɑks	WI-1	1							
2;06.02	airplane	ˈɛɹplejn	ˈɛˌpwẽjn	WM-2				1				
2;06.02	I wanna see your glasses	ajwɑnəˌsijɔɹˈglæsəz	ʌ̃sijəˈgwæθəð	WI-1				1				
2;06.02	Yeah, I wanna see your glasses	jæʔajwɑnəˌsijɔɹˈglæsəz	ˈjæ̃nθijəˌgwʌ	WI-1				1				
2;06.02	black	ˈblæk	ˈbwækʰ	WI-1				1				
2;06.02	That's a ladder can climb up	ðætsəˌlædəɹkænˈklajmʌp	ˈðæθəˈbaəˌkʰæˈkʰwajˈmʌpʰ	WI-1				1				
				108	24	4	1	58	4	10	0	7
					22%	4%	1%	54%	4%	9%	0%	6%
				CC	81%							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;04.18	Gabriella	ˈgæbɹijˌɛɬa	ˈʃɛzɬæ	WM-U								1
1;04.18	Gabriella	ˈgæbɹijˌɛɬa	ˈhɛðæ	WM-U								1
1;05.29	truck	ˈtɹʌk	ˈt͡ʃʌə	WI-1						1		
1;05.29	truck	ˈtɹʌk	ɪˈt͡ʃʊʔə	WI-1						1		
1;05.29	throw(?)	ˈθɹow	ˈd͡ʒow	WI-1						1		
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈẽgmijtʰə	WI-1								1
1;05.29	dragonfly	ˈdɹægənˌflaj	ˈɛmɪhĩ	WI-1								1
1;06.10	brown(?)	ˈbɹawn	əˈbɑkˀ	WI-1						1		
1;06.10	oh, truck	owˈtɹʌk	ˈoːwuːwˌt͡ʃʌkˀ	WI-1						1		
1;06.10	oh, truck	owˈtɹʌk	ˌowʔˈt͡ʃʌʔ	WI-1						1		
1;06.10	garbage truck	ˈgaɹbəd͡ʒˌtɹʌk	ˈbejt͡ʃʌ	WI-1						1		
1;06.10	garbage truck	ˈgaɹbəd͡ʒˌtɹʌk	ˈbɛʃ͡ɛ̃	WI-1						1		
1;06.10	oh, garbage truck	owˈgaɹbəd͡ʒˌtɹʌk	ˌoːwbejˈʃæ	WI-1						1		
1;06.10	tree	ˈtɹij	ˈt͡ʃij	WI-1						1		
1;06.10	tree	ˈtɹij	ˈʃijə	WI-1						1		
1;06.23	truck(?)	ˈtɹʌk	ˈt͡ʃʊʔ	WI-1						1		
1;06.23	tree	ˈtɹij	ˈsjij	WI-1		1						
1;07.27	truck	ˈtɹʌk	ˈt͡ʃʌkʰ	WI-1						1		
1;07.27	garbage truck	ˈgaɹbəd͡ʒˌtɹʌk	bæˈt͡ʃɛkʰ	WI-1						1		
1;07.27	uh, tractor(?)	ʔʌˈtɹæktəɹ	ə̃nnʊəˈkʰijm	WI-1								1
1;07.27	uh, gran	ʔʌˈgɹæn	ʌ̃ˈʔõnɑ	WI-1								1
1;08.06	tractor	ˈtɹæktəɹ	əˈt͡ʃɛtˈt͡ʃʌ̃ː	WI-1						1		
1;08.06	truck	ˈtɹʌk	ˈt͡ʃʌkʰ	WI-1						1		
1;08.06	tree	ˈtɹij	ənəˈʃijʔˌtʰɪð	WI-1								1
1;08.06	tree	ˈtɹij	ˈkʰij	WI-1						1		

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.06	giving tree	ˈgɪvɪŋˌtɹij	ˈgijvˌtʰiːj	WI-1						1		
1;08.06	giving tree	ˈgɪvɪŋˌtɹij	ɐ̃ˈbijˈd͡ʒiːj	WI-1						1		
1;08.06	climbing trunk	ˌklajmɪŋˈtɹʌŋk	ˈkʰajŋənˈt͡ʃʌkˀ	WI-1						1		
1;08.11	throw away	ˌθɹowəˈwej	ˌuwʃowˈveːj	WI-1						1		
1;08.11	tractor	ˈtɹæktəɹ	ˈkʰæt͡ʃɬɑ	WI-1						1		
1;08.11	truck	ˈtɹʌk	ˈʃɑʔ	WI-1								1
1;08.11	treehouse	ˈtɹijˌhaws	ˈtʰijˌhʌw	WI-1						1		
1;08.22	um, brown	ʔʌmˈbɹawn	ɐ̃mˈbawn	WI-1						1		
1;08.22	mm, green	mˌˈgɹijn	ɐ̃ːˈgẽjn	WI-1						1		
1;08.22	brush(?)	ˈbɹʌʃ	ˈbʌt͡ʃ	WI-1						1		
1;08.22	uh, Grandma	ʔʌˈgɹændma	ɐ̃ˈgæ̃mmɑ	WI-1						1		
1;08.22	green	ˈgɹijn	ʊˈgijɲə	WI-1						1		
1;08.22	truck	ˈtɹʌk	ˈt͡ʃɹʌkʰ	WI-1	1							
1;08.22	throw away	ˌθɹowəˈwej	ˈvwowəˌvej	WI-1		1						
1;08.22	...up tree	ʔʌpˈtɹij	ʌpʰəˈt͡ʃij	WI-1						1		
1;09.11	fridge	ˈfɹɪd͡ʒ	ˈpʰɪ̃mpʰ	WI-1								1
1;09.11	crocodile	ˈkɹɑkədajəɬ	ˈkʰɑkʰəˌdajvə	WI-1						1		
1;09.11	grass	ˈgɹæs	nˌˈdæs	WI-1						1		
1;09.11	boat ... drive	ˈbowtˌdɹajv	ˈbowtʰəʔɐ̃wɐ̃nədəˈdɹajv	WI-1	1							
1;09.11	crocodile	ˈkɹakədajəɬ	ˈhækʰadə	WI-1						1		
1;09.11	...crocodile	ˈkɹakədajəɬ	ˈhajkʰɛdə	WI-1						1		
1;09.11	...drink	ˈdɹɪŋk	əˈmajˌd͡ʒɪ̃ŋkʰɐ̃	WI-1						1		
1;09.11	oh, green one	ʔowˈgɹijnwʌn	oːwˈgijnˌwɐ̃n	WI-1						1		
1;09.11	green one	ˈgɹijnwʌn	ˈgɹuwˌwɐ̃n	WI-1						1		

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;09.11	drive, monkey drive	dɹajvˈmʌŋkijˌdɹajv	əˈd͡ʒajfˌmʌkʰijʔuˈdɹajf	WI-1						1		
1;09.11	drive, monkey drive	dɹajvˈmʌŋkijˌdɹajv	əˈd͡ʒajfˌmʌkʰijʔuˈdɹajf	WI-1	1							
1;09.11	monkey drive	ˈmʌŋkijˌdɹajv	ˈmɛkʰijˌd͡ʒaj	WI-1						1		
1;09.11	hippo drive	ˈhɪpowˌdɹajv	ʌ̃ʔəˈpʰə̃mbowĩˌdəʁajf	WI-1								1
1;09.11	hippo drive	ˈhɪpowˌdɹajv	m̩ˈpʰə̃mˈbowə̃ˌd͡ʒaj	WI-1						1		
1;09.11	drive	ˈdɹajv	ˈdwajvtʰə	WI-1				1				
1;09.11	I'm crying	ajmˈkɹajɪŋ	ʌ̃ːŋˌmãjwowˈkʰwajn	WI-1				1				
1;09.11	I'm crying in bed	ajmˈkɹajɪŋɪnˌbɛd	ɛ̃nʌ̃ˌmajuwˈkʰwãjnɑ̃ˈbɛtʰ	WI-1				1				
1;09.11	green	ˈgɹijn	ˈgĩjn	WI-1						1		
1;09.11	mushroom	ˈmʌʃɹuwm	ˈhʌ̃ˌsuːw	WM-U						1		
1;09.11	cracker,cheese, ice cream	ˌkɹækəɹˌt͡ʃijzˈʔajskɹijm	dætʰaˈkʰɔkʰʌ̃ˌdædənˈt͡ʃijʔʌˌɪkʰij	WI-1						1		
1;09.11	cracker,cheese, ice cream	ˌkɹækəɹˌt͡ʃijzˈʔajskɹijm	dætʰaˈkʰɔkʰʌ̃ˌdædənˈt͡ʃijʔʌˌɪkʰij	WI-1						1		
1'09.26	truck	ˈtɹʌk	ˈt͡ʃʌkʰ	WI-1						1		
1'09.26	riding ... truck	ˌɹajdɪŋˈtɹʌk	owˈɹajdəʔʌdʔowəˈt͡ʃʌkʰ	WI-1						1		
1'09.26	brush	ˈbɹʌʃ	ʌ̃ˈbas	WI-1						1		
1'09.26	brushing	ˈbɹʌʃɪŋ	ʌ̃ˈdɛsĩŋə	WI-1						1		
1'09.26	brushing	ˈbɹʌʃɪŋ	ˈdɹɛsijnʌ	WI-1			1					

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1'09.26	...up a tree	ˌʌpəˈtɹij	ˈʔʌpʰəˌt͡ʃij	WI-1						1		
1'09.26	truck	ˈtɹʌk	ˈt͡ʃʌkʰ	WI-1						1		
				68	3	2	1	3	0	49	0	10
					4%	3%	1%	4%	0%	72%	0%	15%
				CC	13%							
1;10.10	one two three four five	ˌwʌntuwˌθɹijfɔɹˈfajv	ˌɛ̃ntʰuwˌfwijfɔˈfaj	WI-1		1						
1;10.10	two brush	ˈtuwˌbɹʌʃ	ˈtʰuwbwɛːˌʃtʰ	WI-1				1				
1;10.10	no want broken	ˌnowwantˈbɹowkən	ˈnowəəwɐ̃ˈbwowkʰɛ̃n	WI-1				1				
1;10.10	grapes	ˈgɹejps	ˈgwɛəpʰ	WI-1				1				
1;10.10	trucks	ˈtɹʌks	ˈt͡ʃʌ	WI-1						1		
1;10.10	tractor	ˈtɹæktəɹ	ˈkʰɑt͡ʃɐ̃m	WI-1						1		
1;10.10	...driving a truck	ˌdɹajvɪŋəˈtɹʌk	ˌhajmijɛ̃tʰəˈɹʌkʰ	WI-1						1		
1;10.10	...driving a truck	ˌdɹajvɪŋəˈtɹʌk	ˌhajmijɛ̃tʰəˈɹʌkʰ	WI-1								1
1;10.10	grapes	ˈgɹejps	ˈɛgstʰ	WI-1							1	
1;10.10	mushrooms	ˈmʌʃɹuwm	ˈmʌˌʃow	WM-U						1		
1;10.24	want the truck	ˌwantðəˈtɹʌk	ʌˈwɑ̃ntˀʔɪˈt͡ʃʌkʰ	WI-1						1		
1;10.24	one two three five	ˌwʌntuwθɹijˈfajv	dəˈwɐ̃nˌtʰuwfwijfj ætʰ	WI-1		1						
1;11.08	one, two, three	ˌwʌntuwˈθɹij	ˈwɐ̃nˈtʰuwˈfwij	WI-1		1						
1;11.08	I take off all the bruise	ajˌtejkafɑɬðəˈbɹuwz	əˌtʰejkʰɑfɑlə̃ˈbwuwd	WI-1				1				

Appendix C - Onset Clusters
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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;11.08	take ... bruise off	tejkˈbɹuwzaf	ˈtʰɛkʰəmbʊˈʔɑʔəbʌ bwuwzɑf	WI-1				1				
1;11.08	country	ˈkʌntɹij	ˈkʰɐ̃n͡tʃij	WM-U						1		
1;11.08	oh, country	ʔowˈkʌntɹij	ˈowˌkʰɐ̃n͡tʃij	WM-U						1		
1;11.08	one, two, three	ˌwʌntuwˈθɹij	ˈwɐ̃nˈtʰuwˈfwij	WI-1				1				
1;11.08	to have a brush too	tuwhævəˈbɹʌʃˌtuw	hənaːwbəʃˈhuw	WI-1						1		
1;11.08	that guy driving a	ðætˈgajˌdɹajvɪŋə	dæˈgajˌdwajvijnʌʔ	WI-1				1				
1;11.08	that drives	ðætˈdɹajvz	dæˈdwajv	WI-1				1				
1;11.08	green	ˈgɹijn	ˈgiːjn	WI-1						1		
1;11.08	tractors	ˈtɹæktəɹz	ˈt͡ʃʌʃɛʔ	WI-1						1		
1;11.08	frogs	ˈfɹɑgz	ˈfwɑ	WI-1				1				
1;11.27	bread	ˈbɹɛd	ˈbwɛd	WI-1				1				
1;11.27	that's the ground	ˌðætsðəˈgɹawnd	ˈdæzəˌgawn	WI-1						1		
1;11.27	in the front	ɪnðəˈfɹʌnt	ɐ̃nəˈfwɐ̃ntʰ	WI-1				1				
1;11.27	truck	ˈtɹʌk	ˈt͡ʃɥʌkˀ	WI-1						1		
				28	0	3	0	11	0	12	1	1
					0%	11%	0%	39%	0%	43%	4%	4%
				CC	50%							
2;00.04	ice cream	ˈajsˌkɹijm	ʔijkʰijjɔədˀʔaˈbɛlij	WI-1						1		
2;00.04	and a bread	ɛndəˈbɹɛd	ˌɐ̃ndəˈbwɛd	WI-1				1				
2;00.04	more dresses	ˌmoɹˈdɹɛsəz	məˈdɹɛsɪz	WI-1	1							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;00.04	we need more dresses	wij,nijdmɔɹˈdɹɛsəz	wijnijmɔˈdɹɛseð	WI-1	1							
2;00.04	bring it	ˈbɹɪŋɪt	ˈbw̃ĩŋɪtʰ	WI-1				1				
2;00.04	dresses	ˈdɹɛsəz	ˈdwɛʃɛð	WI-1				1				
2;00.04	all of dresses	ɑɬʌvˈdɹɛsəz	ˈɑːɬˈdɹɛseðə	WI-1	1							
2;00.04	three	ˈθɹij	ˈfwij	WI-1		1						
2;00.04	frogs	ˈfɹɑgz	ˈfwɑg	WI-1				1				
2;00.04	trucks	ˈtɹʌks	ˈt͡ʃʌkˀ	WI-1						1		
2;00.04	frogs	ˈfrɑgz	ˈwɑɪzə	WI-1					1			
2;00.04	frogs	ˈfɹɑgz	ˈpwɑgə	WI-1		1						
2;00.04	laundry	ˈlɑndɹij	ˈwɑ̃nd͡ʒij	WM-U						1		
2;00.04	mushroom	ˈmʌʃɹuwm	ˈmʌt͡ʃuw	WM-U								1
2;00.04	cracker	ˈkɹækəɹ	ˈkwækwa	WI-1		1						
2;00.04	bring in that book	bɹɪŋɪn,ðætˈbʊk	ˈwĩŋĩnæʔˈbʊkʰ	WI-1					1			
2;00.04	tree	ˈtɹij	ˈtwijə	WI-1				1				
2;00.04	crying	ˈkɹajɪŋ	ˈχwajjɑ̃ŋ	WI-1		1						
2;00.04	driver	ˈdɹajvəɹ	ˈdɥajf	WI-1				1				
2;00.04	zebra	ˈzijbɹa	ˈzijba	WM-U						1		
2;02.03	one, two, three and four	ˌwʌntuwˌθɹijɛndˈfɔɹ	ˈwɑ̃ntuwfwijəfɔə	WI-1		1						
2;02.03	brown one	ˈbɹawnˌwʌn	ˈbɹɑ̃wwɑ̃n	WI-1	1							
2;02.03	french fries	ˈfɹɛnt͡ʃˌfɹajz	ˈfɛ̃ntˀˌfaj	WI-1						1		
2;02.03	french fries	ˈfɹɛnt͡ʃˌfɹajz	ˈfɛ̃ntˀˌfaj	WI-1						1		
2;02.03	Gran's	ˈgɹænz	ˈgwæ̃ns	WI-1				1				
2;02.03	a zebra	əˈzijbɹa	əˈʒijbəʔɑ̃n	WM-U						1		

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;02.03	a frog	əˈfɹɑg	əˈfwɑg	WI-1				1				
2;02.03	trucks	ˈtɹʌks	ˈtʰəɹʌks	WI-1								1
2;02.03	a green one	əˈgɹijnwʌn	əˈgwijnwʌ̃n	WI-1				1				
2;02.03	some frogs	sʌmˈfɹɑgz	sə̃mˈfwɑːs	WI-1				1				
2;02.03	Andrew	ˈændɹuw	ˈʔæ̃ndquw	WM-U				1				
2;02.03	this ground	ˈðɪsˌgɹawnd	dɪsˈgwɑ̃wnd	WI-1				1				
2;02.03	this is the ground	ˌðɪsɪzðəˈgɹawnd	ˌdɪzəˈgwawn̥t	WI-1				1				
2;02.03	everybody in	ˈɛvɹijbɑdijʔɪn	ʔʌˈbajĩn	WM-U								1
2;02.03	he drips his	hijˈdɹɪpshɪz	ˌhijˈdrɪptʰɪð	WI-1	1							
2;02.03	I like the french fries	ajlajkˈfɹɛnt͡ʃˌfɹajz	əlajkˀðəˈfɹɛ̃nˌfwaj	WI-1	1							
2;02.03	I like the french fries	ajlajkˈfɹɛnt͡ʃˌfɹajz	əlajkˀðəˈfɹɛ̃nˌfwaj	WI-1				1				
2;02.03	don't drip it	downtˈdɹɪpɪt	ˈdownˌdɹɛpʰɪtʰ	WI-1	1							
2;02.22	brown	ˈbɹawn	ˈbwawn	WI-1				1				
2;02.22	grapes	ˈgɹejps	ˈgwejpˀ	WI-1				1				
2;02.22	train	ˈtɹejn	ˈpwejn	WI-1		1						
2;02.22	G for Gran	ˌd͡ʒijfɔɹˈgɹæn	ʔijfɔˈgwæ̃ːn	WI-1				1				
2;02.22	green	ˈgɹijn	ˈgwijn	WI-1				1				
2;02.22	she's a tree	ˌʃijzəˈtɹij	ʃijʔˈtʰwij	WI-1				1				
2;02.22	brown	ˈbɹawn	ˈbwawn	WI-1				1				
2;02.22	brown	ˈbɹawn	ˈbwawn	WI-1				1				
2;03.03	One, two, three, four, five	ˌwʌntuwˌθɹijfɔɹˈfajv	ˈwʌ̃nˈtʰuwˌfwijˈfɔəˈfajv	WI-1		1						
2;03.03	green	ˈgɹijn	ˈgwijn	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.03	they're all getting dry	ˌðɛɹɑɬgɛtɪŋˈdɹaj	ðɛˌʔɑ̃gɛɾ̃ɪŋˈdɹaj	WI-1	1							
2;03.03	they're dry	ðɛɹˈdɹaj	ðəˈdwaj	WI-1				1				
2;03.03	one, two, three	ˌwʌntuwˈθɹij	ˈwɐ̃nˈtʰuwˈfwij	WI-1		1						
2;03.03	a zebra and a peacock	əˌzijbɹəʔɛndəˈpijk ɑk	əˌzijbɹəæ̃nəˈpʰijkʰ ɑkʰ	WM-U	1							
2;03.03	a lot of fruit	əˌlɑtʌvˈfɹuwt	əlɑˈfwuwtʰ	WI-1				1				
2;03.03	right down the tree house	ˌrajtdawnðəˈtɹijha ws	ˈwajtˀdawnəˈpʰijˌh aws	WI-1			1			1		
2;03.03	trucks	ˈtɹʌks	ˈbʌkʰ	WI-1			1			1		
2;03.03	my favorite bear	majˈfejvɹɪtˌbɛɹ	majˈfejvɪtˀˌbɛa	WM-U						1		
2;03.17	he eats grass	hijˌʔijtsˈgɹæs	hijˈgwæ	WI-1				1				
2;03.17	he's licking the grass	hijsˈlɪkɪŋðəˌgɹæs	hijˈlɪkɐ̃ŋðijˌgɹæ	WI-1	1							
2;03.17	he's eating grass	hijzˌʔijtɪŋˈgɹæs	hijzˌijɾɪŋˈgwæs	WI-1				1				
2;03.17	to the train	tuwðəˈtɹejn	tʰuwðəˈtwejn	WI-1				1				
2;03.17	they're trucks	ðɛɹˈtɹʌks	ðəˈtwʌkʰ	WI-1				1				
2;03.17	library	ˈlajbɹɛɹij	ˈlajbwɛwij	WM-2				1				
2;03.17	frogs	ˈfɹɑgz	ˈwɑ	WI-1					1			
2;03.17	they got ice cream	ˌðejgɑtˈajsˌkɹijm	ˈðejgɑtˀˈʔajswiːjm	WI-1					1			
2;03.17	One, two, three, four	wʌntuwθɹijˈfɔɹ	ˈwɐ̃ntʰuwfwijˌfɔa	WI-1		1						
2;03.17	wanna break it?	ˌwɑnəˈbɹejkɪt	ɐ̃mˈbɹejkʰɪtˀ	WI-1	1							

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.17	I wanna break it	ˌajwɑnəˈbɹejkɪt	ʔajwɑ̃ˈbɹejkʰɪtʰ	WI-1	1							
2;03.17	brown	ˈbɹawn	ˈbwawn	WI-1				1				
2;03.17	it's pretty hot	ɪtsˌpɹɪtijˈhɑt	ɪsˈpʰɪtʰijˌhɑ	WI-1						1		
2;03.17	he can eat it with his trunk	hijkæˌnijtɪtwɪθhɪzˈ tɹʌŋk	hijgɪˈnijəʔijɾɪʔɪθhɪ zˈtʰwɑ̃ŋkʰ	WI-1				1				
2;03.17	grass	ˈgɹæs	ˈgwæ	WI-1				1				
2;03.27	not eating your dress	nɑtˌʔijtɪŋjɔɹˈdɹɛs	nɑʔiʃ̃ɪ̃ŋjʌˈdɹɛə	WI-1	1							
2;03.27	yeah, he want see a friendly one	ˌjæhijˌwantsijəˈfɹɛ ndlijwʌn	ˈjæhijwɑ̃nʔəˈsijəˈfɪ ɛ̃nwijˌwɑ̃n	WI-1	1							
2;03.27	he wanna go see a friendly monster	hijˌwɑnəgowsijəˌfɪ ɛndlijˈmɑnstəɹ	nowˈhijwɑ̃nəgʌˈsij əfɪɛ̃nlijˌmɑ̃nstʰa	WI-1	1							
2;03.27	under the bridge	ˌʌndəɹðəˈbɹɪd͡ʒ	zʌ̃ndʌðəˈbwɛd͡ʒ	WI-1				1				
2;03.27	he friendly one	hijˈfɹɛndlijˌwʌn	hɪðəˈfwɛ̃nwijˌwɑ̃n	WI-1				1				
2;03.27	everything out	ˈɛvɹɪijθɪŋˌawt	ˈʌ̃wijˌθɛ̃jŋˈʔawtʰ	WM-U					1			
2;03.27	brought the hat	ˌbɹɑtðəˈhæt	ˌbɑtdaˈhætˀ	WI-1						1		
2;03.27	there's turtle on your dress	ðɛɹsˈtɜɹtəɬɑnjɔɹˌdɹ ɛs	ðɪsˈtʰɔləʔɑ̃njɪˈdwɛs	WI-1				1				
2;03.27	they like frogs	ðejˌlajkˈfɹɑgz	ʌlajkˀˈfwagz	WI-1				1				
2;03.27	they like frogs	ðejˌlajkˈfɹɑgz	ðɛlajkˀˈvwɑgz	WI-1		1						
2;03.27	ya they're eating frogs	jæðɛɹˌʔijtɪŋˈfɹɑgz	jæðɛˈʔijðĩŋəˈwɑgs	WI-1					1			

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.27	I could try and take them out	ajkʊdˌtɹajɛndtejkðɛˈmawt	ʔajkʰəˈfɹajən̩ˌtʰejkˀðə̃ˈmawtˀ	WI-1			1					
2;03.27	look at the froggy	ˌlʊkætðəˈfɹɑgij	ʊghɪdˈfwɑgij	WI-1				1				
2;03.27	green and blue	ˌgɹijnɛndˈbluw	ˈgwijnæˈbwuw	WI-1				1				
2;03.27	green and blue	ˌgɹijnɛndˈbluw	ˈgwijnæˈbwuw	WI-1				1				
2;03.27	green	ˈgɹijn	ˈgwijn	WI-1				1				
2;03.27	it's my favorite guy	ɪtsmajˈfejvɹɪtˌgaj	ɪθmajˈfejvɹɪtˀˌgaj	WM-U	1							
2;03.27	he's very friendly	hijzˈvɛɹijˌfɹɛndlij	hɪvɛɹijˈfẽnwij	WI-1						1		
2;04.29	inside his crib	ɪnˌsajdhɪzˈkɹɪb	ĩsajdˀˈkwɪb	WI-1				1				
2;04.29	you know how to break this?	juwnowˌhawtuwˈbɹejkðɪs	juwnəˈhawəˌbwejtˀdɪθ	WI-1				1				
2;04.29	I just saw some on the ground	ajd͡ʒʌstˌsɑsʌmɑnðəˈgɹawnd	ajˈd͡ʒʊsɑθʌ̃mɑ̃nəˌgwɑ̃wn	WI-1				1				
2;04.29	brown	ˈbɹawn	ˈbawn	WI-1						1		
2;04.29	the farm with Adrian	ðəˌfaɹmwɪˈθejdɹɪjən	wɪt͡ʃˈwejˌwĩˈʔejd͡ʒijwʌ̃n	WM-U						1		
2;05.12	he's trying get off of the	hijzˈtɹajɪŋgɛˠtɑfʌvðə	ɪsˈtɹɑ̃jnəgɛˈʔɑfədɪʔ	WI-1	1							
2;05.12	I play green thing	ajˌplejˈgɹijnθɪŋ	ɑʔˈfmejˌkwijpˀθĩŋs	WI-1		1						
2;05.12	green	ˈgɹijn	ˈgwijn	WI-1				1				
2;05.12	cream	ˈkɹijm	ˈkwijm	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.12	It's pretty creamy	its,pɹɪtij'kɹijmij	'ɪzpʰɪtʰij,kwi:jm	WI-1						1		
2;05.12	It's pretty creamy	its,pɹɪtij'kɹijmij	'ɪzpʰɪtʰij,kwi:jm	WI-1				1				
2;05.12	we played Mrs. McGregor	,wijplejdmɪsmɪk'gɹɛgəɹ	wə,pwej'mɪsəzmə'gweja	WI-1				1				
2;05.12	everything	'ɛvɹijθɪŋ	'ɛvɹijθĩj	WM-U	1							
2;05.12	green	'gɹijn	'gwijn	WI-1				1				
2;05.12	I like them brown	aj,lajkðɛm'bɹawn	'ajpʰɪtˀðɐ̃m'bwɐ̃wn	WI-1				1				
2;05.12	brown	'bɹawn	'bwawn	WI-1				1				
2;05.12	brown	'bɹawn	'bɐ̃wn	WI-1						1		
2;05.25	green	'gɹijn	'gwijn	WI-1				1				
2;05.25	and brown	ɛnd'bɹawn	æ̃n'bwawn	WI-1				1				
2;05.25	brown	'bɹawn	'bwawn	WI-1				1				
2;05.25	eyebrows	'ajbɹawz	'aj,bwaw	WM-U				1				
2;05.25	this favourite...	ðɪs'fejvɹət	'ðɪsfwejvɹɪʔ,majf	WM-U	1							
2;05.25	this favourite	ðɪs'fejvɹət	,ðɪs'fwejvwɛtʰ	WM-U				1				
2;05.25	this my favourite colour	ðɪsmaj'fejvɹət,kʌlə ɹ	'ðɪsmajfwejwɪtˀ,kʰʌla	WM-U				1	1			
2;05.25	grey	'gɹej	'gwej	WI-1				1				
2;05.25	we saw some trucks	wij,sɑsʌm'tɹʌks	wij'sɑsɐ̃m,twʌks	WI-1				1				
2;05.25	he played drums	hij,plejd'dɹʌmz	wij,pʰwej'dɹɐ̃ms	WI-1	1							
2;05.25	I want Gran	,ajwant'gɹæn	ʌwɐ̃'gwæ̃n	WI-1				1				

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Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.25	on the ground	ˌɑnðəˈgɹawnd	ɑ̃ndəˈgɹæ̃ːwn	WI-1	1							
2;05.25	a broom	əˈbɹuwm	əˈbwũwm	WI-1				1				
2;05.25	What's a frisbee mom?	watsəˈfɪɹzbijˌmɑm	ˈfwɪðbijˌmɑ̃m	WI-1				1				
2;05.25	a tractor	əˈtɹæktəɹ	əˈtɹækˀda	WI-1	1							
2;05.25	you hear the truck?	juwˌhɪɹðəˈtɹʌk	juwhɪɹəˈtɹʌkʰ	WI-1	1							
2;05.25	one, two, three	ˌwʌntuwˈθɹij	ˈwɑ̃nˌtʰuwˈfwij	WI-1		1						
2;05.25	a tractor	əˈtɹæktəɹ	əˈtɹækˀtʰa	WI-1	1							
2;05.25	trucks	ˈtɹʌks	ˈtɹʌks	WI-1	1							
2;06.02	uh oh where did that come from	ˌʔʌʔowwɛɹdɪdˌðæt kʌmˈfɹʌm	ʔʌʔʌwˌwɪðætˈkʰɑ̃ mˈfɑ̃m	WI-1						1		
2;06.02	the trees blowing in it	ðəˌtɹijzˈblowɪŋɪmɪt	dəˈtɹijˈbwowijɲĩnɪ	WI-1	1							
2;06.02	broom	ˈbɹuwm	ˈbwuwm	WI-1				1				
2;06.02	umbrella	ʌmˈbɹɛlə	ˈɑ̃mˌbwɛla	WM-1				1				
2;06.02	one two three four five six seven eight nine	wʌntuwθɹijfɔɹfajv sɪksɛvənejtnajn	ˈwɑ̃ntʰuwˈfijfɔfajsɪ kˌsɛvĩejtˀˈnãjn	WI-1			1			1		
2;06.02	I wanna try it	ajˌwɑnəˈtɹajɪt	ɑ̃ndəˈtɹaj	WI-1	1							
2;06.02	Yeah, I wanna try it	ˌjæʔajˌwɑnəˈtɹajɪt	jæəˈtɹaj	WI-1	1							
2;06.02	A christmas tree	əˈkɹɪsmɪsˌtɹij	əˈkʰwɪsəˌwɪsˈtʰwiːj	WI-1				1				

Appendix C - Onset Clusters
Obstruent+Rhotic

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;06.02	A christmas tree	əˈkɹɪsmɪsˌtɹij	əˈkʰwɪsəˌwɪsˈtʰwiːj	WI-1				1				
2;06.02	a present	əˈpɹɛzɪnt	əˌpʰwɛˈðɛ̃n	WI-1				1				
2;06.02	Where did that come from?	wɛɹdɪdˈðætkʌmˌfɹ ʌm	ɜdɪˈdɜʔˈkʰɐ̃mˌfɹɐ̃m	WI-1	1							
2;06.02	I'm trying to	ajmˈtɹajɪŋˌtuw	ɐ̃ˈtɹãjətʰuw	WI-1	1							
2;06.02	this is a trunk	ˌðɪsɪzəˈtɹʌŋk	dɪθɪðəˈtwɐ̃ŋkʰ	WI-1				1				
2;06.02	try to balance on it	tɹajtuwˈbaləˌsɑnɪt	ˈtɹajɾəˈbãwnsɑ̃nɪtˀ	WI-1	1							
2;06.02	there's no drink	ˌðɛɹɪznowˈdɹɪŋk	dɪðˈnowˌdɪ̃ŋkʰ	WI-1	1							
2;06.02	to drink	tuwˈdɹɪŋk	kʰɛ̃ˈdwĩŋkʰ	WI-1				1				
2;06.02	I lose my grip	ajˌluwzmajˈgɹɪp	əˈluwzmajˌgwɪpʰ	WI-1				1				
				146	32	12	4	69	7	19	0	3
					22%	8%	3%	47%	5%	13%	0%	2%
					CC	80%						
						117						

Appendix C - Onset Clusters
Obstruent+Glide

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.22	vacuum	ˈvækjuwm	ˈvækjuwˈkʰuwkʰuwˈvæ kʰjuwˌnɐ̃	WM-U	1						
1;09.11	vacuum	ˈvækjuwm	ˈbækʰĩnɐ̃	WM-U					1		
1;09.11	cucumber	ˈkjuwkʌmbəɹ	ˈkʰɐ̃mabɑ:	WI-1							1
1;11.27	I want the penguin	ajˌwantðəˈpɛŋgwɪn	ʌwɐ̃nðəˈpʰɛ̃ŋˌwɐ̃n	WM-U				1			
2;00.04	so cute	sowˈkjuwt	səʔsuˈkʰjɨowtʰ	WI-1	1						
2;02.03	penguin	ˈpɛŋgwɪn	ˈpʰɛ̃ŋwĩn	WM-U				1			
2;02.22	penguins	ˈpɛŋgwɪnz	ˈpʰɛ̃ŋwĩns	WM-U				1			
2;03.03	penguin	ˈpɛŋgwɪn	ˈpʰɛ̃ŋwĩn	WM-U				1			
2;06.02	no this one is a square	nowˌðɪswʌmɪsəˈskwɛɹ	mɐ̃mˈdɪθwɐ̃nɪðəˌkwɛ	WI-1	1						

Appendix C - Onset Clusters
s+Obstruent

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;04.18	uh, Steve	ʌˈstijv	ʌəˈt͡ʃiːj	WI-1								1
1;05.29	stroller	ˈstɹowləɹ	ˈhɜtʰʌ	WI-1								1
1;05.29	stroller	ˈstɹowləɹ	əˈd͡ʒɛphũ	WI-1								1
1;05.29	spoon	ˈspuwn	ˈpʰũːw	WI-1					1			
1;05.29	spoon	ˈspuwn	ˈpʰuw	WI-1					1			
1;05.29	spoon	ˈspuwn	ˈpʰuw	WI-1					1			
1;05.29	spoon	ˈspuwn	ˈpʰow	WI-1					1			
1;08.11	squeeze	ˈskwijz	ˈçiːj	WI-1					1			
1;08.11	squeeze	ˈskwijz	ˈnɪ	WI-1					1			
1;08.22	squeeze	ˈskwijz	ˈkʰeːjv	WI-1					1			
1;09.11	spoon	ˈspuwn	ˈpʰõw	WI-1					1			
1;09.11	...tiny stairs	tajnijˈstɛɹz	ˈtʰãjˈtʰɛjə	WI-1					1			
1;09.11	tiny stairs	tajnijˈstɛɹz	˜ˈtʰãjˈtʰɛ	WI-1					1			
1;09.11	tiny stairs	tajnijˈstɛɹz	ˈtʰajnˌtʰɛ	WI-1					1			
1;09.11	spoon cook	spuwnˈkʊk	əˈpʰuwẽnˈkʰʊkə	WI-1					1			
1;10.10	spoon	ˈspuwn	ˈpʰũw	WI-1					1			
1;10.10	spicy	ˈspajsij	ˈpʰajsij	WI-1					1			
1;10.10	stand up	ˌstænˈdʌp	uwˈtʰæ̃mʌpʰ	WI-1					1			
1;10.10	there's a spoon	ˌðɛɹzəˈspuwn	ˈbɛzɛˌpʰuwŋ	WI-1					1			
1;10.10	...steaming	ˈstijmɪŋ	ˈtʰijˈmijnə	WI-1					1			
1;10.10	spoon	ˈspuwn	ˈpʰũwə	WI-1					1			
1;10.24	and spoon and knife	ɛndˌspuwnɛndˈnajf	ʌ̃ˈpʰuwnʔəʔʌ̃ʔˈnajf	WI-1					1			

Appendix C - Onset Clusters
s+Obstruent

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;11.08	can't find my spoon	kant,fajndmaj'spuwn	ˌkʰɛ̃'fwajmajsmuw	WI-1				1				
1;11.27	have you seen my spoon	hæv'juwsijnmajˌspuwn	ʔɐ̃ʔfəmaj'pʰuwnə	WI-1					1			
2;00.04	spoons	'spuwnz	'pʰuwuwnə	WI-1					1			
2;00.04	all the ice cream spilled	ɑɬðə'ʔajskɹijmˌspɪɬd	'ʔɑːɬʔijtʰijm'pʰɪɬdə	WI-1					1			
2;02.03	a spoon	ə'spuwn	ə'pʰuwn	WI-1					1			
2;02.03	in my stroller	ɪnmaj'stɹowləɹ	ĩnˌmaj'ʧɹʌlɑ	WI-1								1
2;02.03	something spicy	ˌsʌmθɪŋ'spajsij	ˌsɐ̃mpʰĩŋ'pʰajsij	WI-1					1			
2;02.03	this your spoon	ðɪs'jɔɹˌspuwn	'dɪʃjuw'pʰuwn	WI-1					1			
2;02.22	a spoon	ə'spuwn	ʔʌ'pʰuwn	WI-1					1			
2;02.22	a spoon	ə'spuwn	ʔʌ'pʰjuwn	WI-1					1			
2;02.22	strawberries	'stɹaˌbɛɹɪjz	'tʰwɑːbejz	WI-1					1			
2;03.03	a stem	ə'stɛm	ə'tʰɛ̃m	WI-1					1			
2;03.03	a spoon	ə'spuwn	ʔə'pʰɨuwn	WI-1					1			
2;03.03	oops, I stubbed my toe	ˌuwpsʔajˌstʌbdmaj'towˌ	'ʔuwpsə'stʰʌb˞maj'tʰaw	WI-1	1							
2;03.17	spoon	'spuwn	'pʰuw	WI-1					1			
2;03.17	they're standing his hat	ðɛɹˌstændɪŋhɪz'hæt	ðɪ'ðæ̃wijhɪzˌhæ	WI-1								1

Appendix C - Onset Clusters
s+Obstruent

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.17	splash	ˈsplæʃ	ˈpwæʃ	WI-1					1			
2;03.17	that spoon	ðætˈspuwn	ˈdætˀˌpʰuwn	WI-1					1			
2;03.27	I'm squeezing it	ajmˈskwijzɪŋɪt	ˌʌ̃ŋˈkwijvĩɲɪtˀ	WI-1					1			
2;04.29	and a spoon	ɛndəˈspuwn	ˈʔæ̃nəˌpʰũw	WI-1					1			
2;04.29	there's the spoon	ˌðɛɹzðəˈspuwn	dəθdəˈpʰuːwn	WI-1					1			
2;05.12	ice cream store	ˌajskɹijmˈstɔɹ	ˈajkʰˌθɔwa	WI-1								1
2;05.12	the going at the ice cream store	ðəˌgowɪŋætðəˈajskɹijmˌstɔɹ	nɑʔɛtˀdəˈʔajkˀˈkwĩjmˌtʰɔə	WI-1					1			
2;05.12	he goin' at the ice cream store	hijˌgowənætðəˈajskɹijmˌstɔɹ	hɪgowĩnætˀðəˈʔajskwijmˌtʰɔwa	WI-1					1			
2;05.12	they're standing up	ðɛɹˌstændɪŋˈʌp	ðɔˈtʰæ̃ñĩnʌpˀ	WI-1					1			
2;05.12	I dont like strawberries	ajdowntˈlajkˌstɹɑbɛɹijz	aowˈlajkˀˌtwɑwɛwij	WI-1					1			
2;05.12	there's some sprinkles over here	ðɛɹzsʌmˈspɹɪŋkəɬzowvəɹˌhɹ	ðɛɹsʌ̃mˌpwĩnkʌɬowəˈhijajtʰ	WI-1					1			
2;05.12	mom, I have some sprinkles?	ˌmɑmʔajhævsʌmˈspɹɪŋkəɬz	mʌ̃mˈʔajhæsʌ̃mˌpwĩnkʰəɬs	WI-1					1			

Appendix C - Onset Clusters
s+Obstruent

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.12	mom, I have some sprinkles?	ˌmɑmʔajhævsʌmˈspɹɪŋ kəɬz	ˈmɑ̃majhæsɐ̃mˌpwĩŋkʰ əɬs	WI-1					1			
2;05.12	I want some sprinkles	ajˌwantsʌmˈspɹɪŋkəɬz	ɑˈwɑ̃ʔθɐ̃mˌpʰwĩŋkʰəɬs	WI-1					1			
2;05.12	some sprinkles	ˌsʌmˈspɹɪŋkəɬz	ˌsɐ̃mˈpʰ˞ĩŋkʰəɬs	WI-1					1			
2;05.12	dogs like have sprinkles?	dɑgzˌlajkhævˈspɹɪŋklə z	ˈdɑgðˌlajkˀhævˈpwĩŋkʰ əɬs	WI-1					1			
2;05.12	no, dogs can't eat sprinkles	nowˌdɑgskæntˈʔijtˌspɹɪ ŋkləz	ˈnowdɑgsˌkʰæ̃nʔijtˀpw ĩnkʰəɬs	WI-1					1			
2;05.25	on street	ɑnˈstɹɪjt	ɑ̃nˈtɹij	WI-1					1			
2;05.25	wanna go to circus school?	wɑnəgowtuwˈsɜɹkəˌsk uwɬ	wɐ̃nˈgowtʰuwðˈsɪɹkʰɛ ðˌkʰʊɬ	WI-1					1			
2;05.25	What's a stage?	ˌwatsəˈstejd͡ʒ	ʌtʰəˈtʰejd͡ʒ	WI-1					1			
2;05.25	it spilled	ɪtˈspɪɬd	ɪtˀˈpʰɪɬ	WI-1					1			
2;06.02	say stop	sejˈstɑp	ˈθejˈtʰɑpˀ	WI-1					1			
2;06.02	say stop	sejˈstɑp	ˈθejsˌtʰɑpʰ	WI-1					1			
2;06.02	stop	ˈstɑp	ˈtʰɑ	WI-1					1			
2;06.02	stop	ˈstɑp	ˈdɑ	WI-1					1			
2;06.02	stop	ˈstɑp	ˈtʰɑpʰ	WI-1					1			
2;06.02	stop	ˈstɑp	ˈtʰɑpˀ	WI-1					1			
2;06.02	it's a square	ɪtsəˈskwɛɹ	ʔɪsəˈkwæ	WI-1					1			

Appendix C - Onset Clusters
s+Obstruent

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;06.02	no this one is a square	nowˌðɪswʌmɪsəˈskwɛɹ	mɑ̃mˈdɪθwʌ̃nɪðəˌkwɛ	WI-1					1			
				67	1	0	0	1	59	0	0	6
					1%	0%	0%	2%	88%	0%	0%	9%
				CC	3%							

Appendix C - Onset Clusters
s+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.11	slide	ˈslajd	ˈθlajˌwɪɬ	WI-1			1					
1;08.11	slide	ˈslajd	ˈs̬laj	WI-1	1							
1;08.22	a slide	əˈslajd	əˈslajtʰ	WI-1	1							
1;08.22	a slide	əˈslajd	ɛˈsla:j	WI-1	1							
1;08.22	a slide... wee, down	əˈslajdwijˌdawn	əˈslajdãdəˈwi:jˈdɑwn	WI-1	1							
1;09.11	that's a big slide	ðætsəˈbɪgˌslajd	ˈdætʰəbɪˌɬajtʰ	WI-1								1
2;00.04	all sleepy	ɑɬˈslijpij	ˌʔɑɬˈɬijpʰijnə	WI-1								1
2;02.22	slide	ˈslajd	ˈla:jtʰ	WI-1					1			
2;03.03	I'll swing on that slide	ajɬˌswɪŋɑnðætˈslajd	ʔejˈswĩŋẽnˈðætˀˌslaj	WI-1	1							
2;03.03	I go on slide	ˌʔajgowɑnˈslajd	ʔejˌgowənˈslajd	WI-1	1							
2;03.03	how about the blanket slide?	hawəbawtðəˈblæŋkətˌslajd	hawbawtdəˈblɛ̃ŋgɪtˀˌslajd	WI-1	1							
2;03.03	put the blanket slide	pʊtðəˈblæŋkətˌslajd	ˈpʰʊðəˈblɛ̃ŋkʰɪtˀˌt͡saj	WI-1								1
2;03.03	I really wanna slide	ʔajˌɹɪlijwɑnəˈslajd	ʔʌˈwɪlijˈwɑ̃nəˌslajd	WI-1	1							
2;03.17	going to sleep	ˌgowɪŋtuwˈslijp	gowĩnˈzejpʰ	WI-1						1		
2;03.17	I got a slipper on	ajgɑtəˈslɪpəɹɑn	aˌgɑtˀˈslɪpʰɑ̃n	WI-1	1							
2;03.27	he just wanna go sleep	hijd͡ʒʌstˌwɑnəgowˈslijp	jæˈhijdɪswɑ̃əgəˌslijpˀ	WI-1	1							
2;03.27	they gotta go sleep	ðejˌgɑtəgowˈslijp	ðejˈgɑəˌgowslijpˀ	WI-1	1							

Appendix C - Onset Clusters
s+Lateral

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C1Mod	C2Mod	C1Del	C2Del	CCDel	Oth
2;03.27	I wanna go sleep	aj,wɑnəgowˈslijp	ʌˈwɑ̃gow,slijpˀ	WI-1	1							
2;03.27	wanna go sleep right now	,wɑnəgow,slijpɹajtˈnaw	wɑ̃nəgowslijpˀ,wajtˀnaw	WI-1	1							
2;03.27	no I want to go to sleep	nowaj,wantuw,gowtuwˈslijp	ˈnowɑ̃ngərə,slijpʰ	WI-1	1							
2;03.27	I just wanna go sleep	ajd͡ʒʌst,wɑnəgowˈslijp	ˈʔajd͡ʒʌswɑ̃əgow,slij	WI-1	1							
2;06.02	a slide	əˈslajd	əˈfwajd	WI-1		1						
				22	15	1	1	0	1	1	0	3
					68%	5%	5%	0%	5%	5%	0%	14%
				CC	77%							

Appendix C - Onset Clusters
s+Nasal

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.22	snow	ˈsnow	ˈnow	WI-1				1			
1;09.11	snail	ˈsnejɬ	ˈmij	WI-1				1			
				2	0	0	0	2	0	0	0
					0%	0%	0%	100%	0%	0%	0%
				CC	0%						
2;00.04	smoke	ˈsmowk	ˈθmowkʰ	WI-1		1					
2;02.03	I don't want a smaller one	ajdowntˈwantəˌsmɑləɹˌwʌn	ɑ̃owˈwɑ̃ʔɛsmajɑ̃ˌwɑ̃n	WI-1	1						
2;03.03	you get the small one	juwgɛtðəˈsmɑɬˌwʌn	juwgɪdəˌsmɑɬˈwɑ̃n	WI-1	1						
2;03.03	the snow	ðəˈsnow	ðəˈsnowə	WI-1	1						
2;03.17	you have to see snowy one	juwˌhævtuwsijˈsnowij wʌn	juwˈhæftʰəsijˈhnowijˌ wɑ̃n	WI-1		1					
2;03.17	the snowy one	ðəˈsnowijwʌn	ʔɪˈsnowɪ̃ŋˌwɑ̃n	WI-1	1						
2;05.12	too small	ˌtuwˈsmɑɬ	ˈtʰuwsmɑɬ	WI-1	1						
2;05.25	a snake	əˈsnejk	əˈθnej	WI-1		1					
2;05.25	and a small boat	ɛndəˌsmɑɬˈbowt	æ̃nəˈθmɑˌbowtʰ	WI-1		1					
				9	5	4	0	0	0	0	0
					56%	44%	0%	0%	0%	0%	0%
				CC	100%						

Appendix C - Onset Clusters
s+Glide

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C2Mod	C1Del	C2Del	CCDel	Oth
1;08.06	swing, swing	ˈswɪŋˌswɪŋ	ˈhwĩŋˈpwijn	WI-1		1					
1;08.06	swing, swing	ˈswɪŋˌswɪŋ	ˈhwĩŋˈpwijn	WI-1		1					
1;08.11	swing	ˈswɪŋ	ˈʍĩŋ	WI-1				1			
1;08.11	swing	ˈswɪŋ	əˈɸwĩŋ	WI-1		1					
1;08.22	swing	ˈswɪŋ	ˈpʰɛg	WI-1							1
1;08.22	swing	ˈswɪŋ	ˈɸwĩŋ	WI-1		1					
1;09.11	a swing	əˈswɪŋ	ʌˈɸwĩŋʌ	WI-1		1					
1;09.11	...mommy's on the swing too	ˈmɑmijzɑnðəswɪŋˌtuw	mʌ̃mijʌvəˌfwĩŋəˈtʰu wə	WI-1		1					
1;11.08	duck swim	ˈdʌkˌswɪm	nowˈdʌkˌswɛ̃m	WI-1	1						
1;11.08	duck swim back	ˌdʌkswɪmˈbæk	ˌdʌkswejˈbækˀ	WI-1	1						
1;11.27	swimming	ˈswɪmɪŋ	ˈwĩmijnə	WI-1				1			
2;00.04	swing around	ˌswɪŋəˈɹawnd	ˈwĩŋəˌwawn	WI-1				1			
2;00.04	swimming	ˈswɪmɪŋ	ˈɸwɪmijɛ̃	WI-1		1					
2;00.04	the little one is swimming	ðəˌlɪtəɬwʌnɪzˈswɪmɪŋ	dəˈlɪɬwʌ̃nˌswĩmĩŋ	WI-1	1						
2;00.04	sweeping	ˈswijpɪŋ	fwɪˈpʰijdə	WI-1		1					
2;02.03	the horse don't swim	ðəˌhɔɹsdowntˈswɪm	dəˈhɔləˌfwĩm	WI-1		1					
2;02.03	she can't swim	ˈʃijkæntˌswɪm	ˈʃijkʰɑ̃ˌfwĩm	WI-1		1					
2;02.03	she can swim	ˈʃijkænˌswɪm	əˈʃijkʰəˌfwĩm	WI-1		1					
2;03.03	I'll swing on that slide	ajɬˌswɪŋɑnðætˈslajd	ʔejˈswĩŋɛ̃nˈðætˀˌslaj	WI-1	1						
2;03.17	swimming pool	ˈswɪmɪŋˌpuwɬ	ˈwĩmĩŋˌpʰiuwɬ	WI-1				1			
2;03.27	it's a swing	ɪtsəˈswɪŋ	ɪzəˈswĩŋ	WI-1	1						
2;04.29	swim	ˈswɪm	ˈwĩm	WI-1				1			

Appendix C - Onset Clusters
s+Glide

Age	Utterance	IPATarget	IPAActual	Position	TL	CCMod	C2Mod	C1Del	C2Del	CCDel	Oth
2;05.25	swimming swimming?	ˌswɪmɪŋˈswɪmɪŋ	ˌfwĩmĩnəˈfwĩmĩŋ	WI-1		1					
2;05.25	swimming swimming?	ˌswɪmɪŋˈswɪmɪŋ	ˌfwĩmĩnəˈfwĩmĩŋ	WI-1		1					
2;05.25	know how to swim	nowˌhawtuwˈswɪm	nowˈhawtʰuwˌfwĩm	WI-1		1					
2;05.25	I wanna go on the little swing	ajˌwɑnegowɑnðəˈlɪɾəɬˌ swɪŋ	ajˈwɑ̃nəgowĩnðəlɪɾəɬˌ fwĩŋ	WI-1		1					
2;05.25	and Eric swing me	ɛnˌdɛɹɪkˈswɪŋmij	ˈɛ̃nʔɛwkˈfwĩŋˌmij	WI-1		1					
2;05.25	a sweepy	əˈswijpij	əˈfwɪðbij	WI-1		1					
2;06.02	a swing	əˈswɪŋ	əˈfwĩŋ	WI-1		1					
2;06.02	just swim	ˌd͡ʒʌstˈswɪm	əˈd͡ʒɪɹfwĩːm	WI-1		1					
				30	5	19	0	5	0	0	1
					17%	63%	0%	17%	0%	0%	3%
				CC	80%						