Acquiring a Second Language during Childhood: A Case Study of the Acquisition of English by a Child Kazakh Speaker

by

© Anaer Nulahan

A dissertation submitted to the
School of Graduate Studies in partial fulfillment
of the requirements for the degree of

Doctor of Philosophy

Department of Linguistics
Memorial University of Newfoundland

May 2023

St. John's Newfoundland

Abstract

In this dissertation, we document a child Kazakh speaker's acquisition of English as her second language. In particular, we focus on this child's development of the English segments |f, v, θ, ð, ɹ, ʃ, ʧʃ|, and her acquisition of the English copula *be*, third person singular *-s*, and past tense *-ed*. We begin with detailed, longitudinal description of the developmental patterns that the child displayed through her acquisition of each of these segments and morphemes over an approximately two-year period.

Building on our data descriptions, we entertain a feature-based approach to analyze the patterns observed. We analyze the child's acquisition of English consonants by following the *Phonological Interference Hypothesis* by Brown (1998), as well as the feature redistribution and recombination theory by Martinez, Goad & Dow (2021).These models highlight the possibilities of maximal transfer of the L1 features, and the possibilities of feature recombination in the course of L2 acquisition. Similarly, we analyze the child's acquisition of inflectional morphology through the *Missing Surface Inflection Hypothesis* (MSIH) by Prévost & White (2000), which highlights both the presence of syntactic features in the child's interlanguage grammar and the difficulties inherent to the morphological expression of these features in speech.

As we will see, however, feature-based analyses do not enable an account for all of the facts. The data highlights the need to consider other factors, including language-specific 'surface' knowledge. Concerning segmental development, we show the need to consider phonetic features, which define the precise motor articulations required in the production of speech sounds. Likewise, concerning morphological development, we show the need to consider of language-specific aspects of morphological expressions in spoken forms, in relation to the underlying syntactic knowledge.

Keywords:
L2 Acquisition by Children; Kazakh; English; Phonological Interference; Missing Surface Inflection

Acknowledgements

This endeavour would not have been possible without the support and efforts from many people. First and foremost, I would like to express my deepest gratitude to my supervisor Dr. Yvan Rose for his consistent support and guidance throughout the research of this dissertation. I am forever grateful for his immense knowledge, high academic standards, tremendous patience, persistence, encouragement, accommodations, flexibility, and deep belief in me. All of this gave me strength and spirit to excel during the course of this research. Dr. Rose is not only an excellent instructor, at this stage I consider him as a lifelong mentor and caring friend.

I would like to thank all my professors at Linguistic Department at Memorial University, including Drs. Phil Branigan, Julie Brittain, Carrie Dyck, Sara Mackenzie, Douglas Wharram, Marguerite MacKenzie, and Paul DeDecker, for their high-quality lectures, workshops, and insightful discussions and conversations. They all have played a major role in polishing my academic and personal growth. Thank you all for making me feel welcomed, recognized, valued, and connected. I always consider the department as my family.

I am also deeply grateful to Rebecca Hobbs, Chantal Lamarche and many other data collection and transcription team members for their professional diligence. It wouldn't have been possible to conduct this research without their precious support and hard work.

I am also thankful to Dr. Rachel Hayes-Harb from the University of Utah, and Dr. Elena Nicoladis from the University of British Columbia for their thoughtful comments,

suggestions, interesting questions on my written work and oral defence, which have constructively improved the quality of the final version of this dissertation.

I would always remember my fellow course mates for their companionship, support and encouragement, and personal connections. Thank you Gladstone, Poo Ching, Keneilwe, and Parisa.

I’m extremely grateful to my parents, Okhan and Oraskhan, who nurtured me to become a faithful, persistent, courageous and positive person in life. I am also grateful to my four siblings who gave me strength, motivation, purpose and meaning in my professional and personal decisions.

I would like to express my deepest gratitude to my husband, and my children for their tremendous understanding, patience and love; it would have been impossible for me to complete this study without their support. Last but not least, special thanks to you, the subject participant in this research, my daughter Nura. It would have been impossible for me to conduct this study without you. Thank you for your very existence in my life.

Table of Contents

List of Tables

List of Figures

Chapter 1: General Introduction

Canada has long been, and continues to be, one of the internationally favoured countries for immigrant populations. Each year, hundreds of thousands of new immigrants from a wide variety of backgrounds land in the country. In 2018, Canada has welcomed 310,000 new permanent residents.[1] This population includes children entering the country with their immigrating parents; however, very little is known about how different factors (e.g. first language background; age-related effects; social factors) actually interact with one another to shape individual second language learning paths, for both these adults and their children (Paradis 2010; Paradis & Jia 2017; Ionin, Zubizarreta & Philippov 2009).

It is generally believed that children are able to learn their first languages (L1) quickly and effortlessly. As such, child learners of any of the world's languages typically become competent speakers of their native languages during their first few years, without the need of any explicit instruction or monitoring (Chomsky 1986; Fletcher & Garman 1986). The introduction of a second language during childhood however implies a series of fundamental questions, for example concerning potential inter-relations between the child's previously-acquired and likely still-developing first language (L1) knowledge and the type of knowledge required as part of the newly-introduced language (L2).

In this dissertation, we intend to address such general questions based on the systematic, longitudinal study of one Kazakh child acquiring English as her second language. We document this child's development from two different perspectives,

1. https://www.canada.ca/en/immigration-refugees-citizenship/news/notices/supplementary-immigration-levels-2018.html

namely, segmental and morpho-syntactic. At the level of phonology, we focus on the development of English consonants which are not part of the Kazakh phonemic inventory. At the level of morpho-syntax, we analyze the data from the perspective of the grammatical morphemes involved across different inflectional contexts, focusing primarily on verbal inflection. As we will see, a feature-based approach to both the phonological and morpho-syntactic behaviours observed in the developmental data offers reliable grounds for analysis. We will also see that the systems of overt expression of these features, namely that of speech phonetics concerning phonological features and that of morphology concerning syntactic features, also played a central role in the patterns observed.

To our knowledge, no such detailed study has ever been conducted to document the very first moments of a child entering a second language, especially not with a study that spans over two years of longitudinal observation. Further, this study is unique given the linguistic properties of Kazakh, an agglutinative language, which provides a starting point toward English morphosyntactic development that is quite remote. This language learning context is thus much different from that involving languages that are structurally closer to English, and thus offers a basis for comparison with other linguistically remote languages such as Arabic, Turkish, or Chinese, all of which, and the specific challenges each of these L1s might involve in the context of acquiring English (or any other European language) as an L2, are directly relevant to virtually all immigration countries of the ‘western’ world.

Within the realm of language acquisition research, given the relative dearth of longitudinal corpus studies on second language acquisition, each individual study such

as the one described here has the potential to yield significant observations about language acquisition, or to relativize current knowledge, both about language learners in general and concerning specific language learning contexts. This is particularly significant each time a study focuses on a previously under-documented language learning context, as both the speaker's background and the properties of the language being acquired may have an impact on the learning outcomes. In turn, as mentioned above, studies such as the current one may serve as a foundation for the improvement of our educational and health (language-related) public services, for the benefit of both the immigrant portion of our population and, by extension, our country as a whole.

Finally, in order to maximize the current contribution, we have published the full recorded corpus, including the audio tracks of our recordings, to the CHILDES and PhonBank online databases, where it is now available to researchers and students for future research (https://phon.talkbank.org/access/Biling/ChildL2.html). Data sharing, an increasingly common practice in the field, is necessary for a number of reasons. From a scientific perspective, it enables independent verifications of the data as well as additional analyses. From more practical perspectives, it also offers a means to optimize research resources and related funding. While only certain types of research are bound to take place at Memorial University based on these data, their availability through CHILDES and PhonBank will enable a much wider range of analyses, also testing a wider range of theoretical viewpoints.

The dissertation is organized as follows. In Chapter 2, we provide an overview of the background research on L2 development. In Chapter 3, we introduce the methodology and corpus data employed in the current study. In Chapter 4, we describe Nura's

acquisition of phonological properties of English. In Chapter 5, we describe Nura's acquisition of inflectional morphology in English. In Chapter 6, we offer analyses for the main patterns observed in Nura's phonological data. In Chapter 7, we provide analysis for Nura's morphological data. Finally, in Chapter 8, we summarize the thesis and offer potential extensions into future work.

Chapter 2: Background Literature

1. Introduction

In this chapter, we introduce concepts and hypotheses about L2 acquisition[2] as well as about *child* L2 acquisition more specifically.

2. L2 Acquisition

Different from L1 acquisition, L2 acquisition involves more than one language in the learner's environment and in their minds (Meisel 2011:9). The idea that an L2 learner already knows at least one other language is so fundamental that it is reasonable to think that previous language experience (L1 knowledge) will influence or shape the L2 acquisition process, and its outcome. Below, we summarize some of the most influential hypotheses and concepts relevant to L2 acquisition since the middle of the 20th Century.

2.1 Contrastive Analysis

Between the 1940s and 1960s, a pedagogical method known as *Contrastive Analysis* (CA) focused attention on linguistic behaviours between a learner's L1 and L2 (Fries 1945; Lado 1957). Influenced by behaviourism and structural linguistics, CA predicted learner problems based on structural similarities and differences between the L1 and the L2. For example, Fries (1963) claimed that learning an L2 constitutes a different task from learning the L1, with basic problems arising from language *habits* formed in the L1. The core assumptions of CA were that structural similarities between the L1 and the L2 imply ease, while differences cause difficulties in the course of L2 acquisition. CA thus

2. We define acquisition as the capacity to use certain linguistic rules, structures, and representations successfully and regularly, over at least half of the learner's attempts during a given period.

assumed L1 interference (influence) on L2 learning. More specifically, under this view, if certain elements in the L1 grammar facilitate L2 acquisition, L1 knowledge is positively transferred; in contrast to this, if certain elements in the L1 grammar hinder L2 acquisition, then L1 knowledge negatively affects aspects of the L2 acquisition process.

However, two main problems emerged with the CA approach. First, its research focus was more on *teaching* than on *learning*, and it basically repeated what L2 teachers already knew from class experience. Second, and more importantly, many types of errors made by the learners were not predicted by CA research. For example, Dušková (1969) showed that CA predictions were not validated by actual L2 learner behaviours. He showed that Czech learners of English do not encounter many of the problems predicted by L1/L2 differences between these two languages and, conversely, that similar patterns between these languages do not facilitate acquisition either.

2.2 Error Analysis

Driven by the key discovery that certain errors do not seem to be predictable from L1-L2 contrasts, as per the CA hypothesis, and by the general observation that L2 learners from various L1 backgrounds go through fairly similar stages in the course of L2 acquisition, researchers during the 1960s and early 1970s shifted their focus from surface structures to those puzzling errors. Various empirical studies offered support for the same common intuition that a learner's L1 plays some role in L2 acquisition, for example concerning trajectories and rates of acquisition (Thomas 2013). However, studies led researchers to rethink the influence of L1 background on L2 acquisition. For example, inspired by the study of L1 morphological acquisition by Brown (1973), Dulay

& Burt (1974a) documented the acquisition of grammatical morphemes by child learners whose L1 was either Spanish or Chinese, and found no influence of the native languages in the sequence of acquisition of L2 English morpho-syntax. In a follow-up study, Dulay & Burt (1974b) found a clear hierarchy for the acquisition of these morphemes, and certain types of errors which were produced by L2 learners regardless of their L1 backgrounds. Such empirical findings imply that the L2 acquisition process cannot be predicted solely on the basis of the learner's L1 background. Dulay & Burt hypothesized that L2 acquisition consists of a systematic, developmental process comparable to that of L1 acquisition.

2.3 The Interlanguage Approach

Already engaged in error analysis, scholars also began to see L2 learner errors as part of an ongoing learning process, as a reflection of the learner's language system during the course of development (Corder 1967). This explicitly suggests the same underlying mechanism for both L1 and L2 acquisition, encapsulated within the notion of *transitional competence* (Meisel 2011:8). For example, some of the acquisition patterns observed during L2 learning are unlike what can be expected based on the learner's L1 background, which suggests the existence of an intermediate state of a learner's developing language as it moves toward the L2. Selinker (1972) considered such system as a creative process, and emphasized the notion of *Interlanguage* (IL) as a separate language system in its own right, different from both the learner's L1 and L2. In this view, the L2 acquisition process, or the IL itself, reflects aspects of the human language faculty, which follows different acquisition paths in relation to the L1 and/or the L2. In addition, the IL consists of a series of grammars that emerge over time,

independent yet related to both the L1 and the L2. Thus, the influence of the L1 and the L2 is assessed in terms of both their superficial attributes (e.g. phonetic contrast; word order) and their underlying grammatical structure (e.g. phonological features; syntactic structures).

Under the Interlanguage approach to L2 acquisition, the IL is a natural, grammatical and dynamic system which reflects the speaker's competence at some point in development, and is governed by general (or universal, see below) properties of natural language learning. However, as this new view of L2 acquisition was establishing itself within the literature, analyses were performed mainly through a comparison with the L2's language norm, such that it could not explain, and sometimes could obscure, aspects of the interlanguage itself. In practice, it was difficult to understand the general characteristics of such a dynamic transitional system without expanding the empirical base to the extent possible (ideally to all human languages).

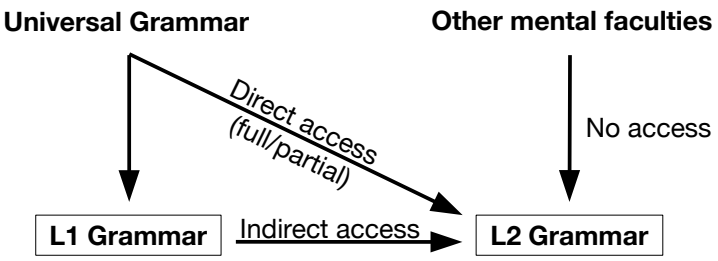
2.4 Universal Grammar

As stated by Mitchell & Myles (1998), one of the central hypotheses towards these observations articulates itself around the concept of *Universal Grammar* (UG) or the *Language Acquisition Device* (LAD), as originally proposed by Chomsky (1957). According the UG hypothesis, human beings are biologically endowed with some kind of cognitive blueprint for language that sets clear expectations about the possible shapes that languages can have, and thus makes language learning much easier for children. A central argument concerning the innateness of Universal Grammar in L1 acquisition is generally referred to as the *Poverty of the Stimulus* (PoS) argument (Chomsky 1980).

The original formulation of the PoS argument builds on the apparent mismatch between the input a child receives through his/her linguistic environment, often described as inherently spotty and incomplete, and the output of the grammatical system itself. In this view, children have the ability to build on impoverished language input to make grammatical generalizations and establish a rich and intricate language system within a short period of time. This suggests that children (and human beings, more generally) must have an incredible tool or device to help them. It is indeed virtually uncontroversial that human beings are well equipped for language learning, and also in ways that are quite unique within the animal kingdom. However, the literature offers no consensus on how to exactly capture the nature of this language learning faculty.

Under the universalist hypothesis, UG (or the LAD) is considered to be unique to the human species, and to provide an inventory of possible grammatical categories and features at each level of linguistic representation (i.e. phonological, morphological, syntactic and semantic structures). UG can thus be defined, in broad terms, as the initial predisposition or architecture that a child is equipped with in advance of any input. However, the question as to whether all the properties of UG remain available to the Interlanguage, toward L2 acquisition, and to what extent, has been difficult to investigate. Hypotheses vary considerably in L2 research. Four different claims exist in the literature concerning the status of UG in L2 acquisition, namely the *no access*, *full access*, *indirect access*, and *partial access* hypotheses, schematized in Figure 1.

Figure 1: Universal Grammar in L2 Acquisition (adapted from Cook 1985)



The *no access* hypothesis states that UG is only accessible to L1 but not to any other type of non-native language acquisition, and the L2 grammar is attained through other mental structures or processes (Meisel 1997); *full access* claims that UG remains fully active in both L1 and subsequent language acquisition (Dekydtspotter, Sprouse & Anderson 1997); *partial access* claims that some, but not all, principles and values of UG are directly accessible to L2 acquisition (Thomas 1991). *Indirect access* claims that only those properties of UG instantiated in the L1 are active in L2 acquisition (Leal Méndez & Slabakova 2014). This brings us to the notion of *transfer*, which we discuss next.

2.5 L1 Transfer

As already noted, it seems implausible to exclude L1 interference or transfer altogether in L2 development, the prediction being that L2 learners would find themselves in a situation similar to that of a *wild child* who did not acquire a first language before puberty (Meisel 2011). In this thesis, we make predictions based on the Full Transfer hypothesis (as mentioned earlier). However, considerable debate exists in the literature in terms of what can be transferred from the L1 grammar to that of the IL. Evidence suggests that

interference occurs at all levels of the grammar between the two languages, including their sound systems, morpho-syntax as well as semantics.[3]

Concerning phonology, segmental contrasts and how segments form permissible combinations (i.e. phonotactics) pose particular challenges to the learner. For example, English speakers have difficulty differentiating (in both perception and production) Hindi retroflex stops (/ʈ, ɖ/) which express phonological contrasts that do not exist in English (Polka 1991). Segmental contrasts and phonotactics relevant to the L1 are thus likely to be transferred to the IL.

A similar logic applies to prosodic aspects of L2 phonological development. For example, Goad and White (2004; 2006) proposed the *Prosodic Transfer Hypothesis* (PTH) in which L2 learners rely on their L1s to build interlanguage prosodic representations. Goad and White found that adult Turkish speakers adopt L1 prosodic representations in producing English articles by either stressing the articles, transferring independent prosodic word (PWd) representations, or adopting the PWd adjunction structures required for the Turkish indefinite article representations. In comparison, English articles require free clitic structures in which articles link directly to the Phonological Phrase (PPh).

In the domain of syntactic development, considerable disagreement also exists on the degree and the content of transfer from the L1 grammar to the IL. For example, Vainikka & Young-Scholten (1994, 1996) documented adult L2 speakers of English from various L1 backgrounds (Korean, Turkish, Italian and Spanish). These speakers initially

3. Cross-linguistic transfer also occurs in different structures, such as adjective-noun strings, deverbal compounds in child L2 population. See more details in Nicoladis (2006).

transferred headedness in lexical projections (such as VP projections), but not functional projections (such as CP and DP) from their native languages. Such *partial transfer* is also known as the *Minimal Trees Hypothesis* (or *Weak Continuity Hypothesis*) (Vainikka & Young-Scholten 1994). In contrast, Eubank (1993) proposed that both lexical and functional projections transfer from L1, but that morphology-driven values of features (such as strength of agreement) do not transfer in the initial phases of L2 development. For example, languages may have either *weak* or *strong* verb features which will not be transferred. L2 learners of English have to acquire the fact that English has *weak* verb features and, as a result, the grammar of English does not allow verbs to be *raised* over adverbs or negators, whereas L2 learners of French have to acquire its *strong* verb features which allow the long syntactic movement.

Finally, concerning linguistic meaning, Ionin et al. (2012) investigated L1 semantic transfer effect in the interpretation of English definite descriptions (i.e., the book) and demonstrative descriptions (i.e., that book) by Korean adult second language of English. Korean lacks definite markers, while it allows demonstrative markers. The results show that L2 learners do distinguish definite and demonstrative marking. In addition, the errors observed are precisely those expected under the L1 transfer of demonstrative semantics.

In addition to UG and L1, recall from above that age is another important factors in language acquisition. In the next section, we describe L2 acquisition among a specific age group.

3. Child L2 Acquisition

As mentioned just above, *age* may be of considerable significance to L2 acquisition in general, as most age-related L2 empirical studies confirm the intuition that when it comes to learning an L2, *the younger the better*. Indeed, age may have different impacts on the IL, or on different domains of the IL (Oliver & Azkarai 2017). More specifically, Seliger (1978) pointed out that age could have different effects on the acquisition of morphology versus the acquisition of phonology. Long (1990) documented that the ability to attain native-like phonological abilities in L2 learners begins to decline by age 6, but only by age 15 for morphology and syntax. Phonology would thus be the first domain to be affected by the learner's age. For example, Flege (1991) examined Voice Onset Time (VOT) productions in the acquisition of voicing contrasts among obstruent stop consonants by Spanish-English (successive) bilinguals. Flege reported that early L2 learners appear to have fewer difficulties than later L2 learners in acquiring the phonetic categories of the L2, especially for sounds in the L2 that acoustically overlap with 'similar' sounds in the native language; in a nutshell, this suggests an age advantage in the acquisition of the more subtle speech sound differences that may exist between the speaker's L1 and L2. In contrast to this, Paradis et al. (2017) showed that child L2 learners of English (age 5;10) are relatively proficient in the acquisition of complex syntax compared to younger L1 learners of English; L2 English learners use all types of complex sentences sooner than L1 children, and display low rates of syntactic errors. This was assessed from the age of first exposure, revealing a relative advantage of an older age of acquisition for syntactic development. In contrast, some experts argue that age effects on language acquisition are not only due to learners' physical maturation (such as younger or older), but rather assessed through taking consideration of learners'

L1 development (e.g. younger L2 learners may have not yet fully acquired their L1). Flege (1999) thus suggests that age difference is not only the result of maturation, it also implies the establishment and development of the learners' L1s. In this view, development of the L1 can positively contribute to the L2 acquisition process.

Child L2 acquisition in fact emerged as a sub-area of L2 research during the 1970s, with its research focus being driven by the tradition of CA (Herschensohn & Young-Scholten 2013). During the 1980s and 1990s, child L2 researchers began to be more and more interested in the learner's initial state. The term *initial state* is not about what a child does (or does not do) in language acquisition, but about the kind of knowledge available to him/her during very early phases of language acquisition. Recall that in L1 acquisition, UG as a cognitive blueprint for language is considered to represent the initial state for children learning their language. Prior knowledge of an L2 learner (both child and adult) must thus mean something very different because L2 learners already have previous linguistic (L1) and nonlinguistic (or general cognitive) experience and knowledge. Therefore, one of the obvious sources of knowledge for the L2 learner is his/her own language and knowledge background; the other potential source of knowledge is UG.[4]

Although researchers have debated the degree of L1 effects on L2 development, transfer is most evident at the initial state of child L2 development. For example, Splendido (2016) described the development of VOT and liaison in early L2 learners of French, as compared to simultaneous Swedish-French bilinguals and monolingual French children. Their results indicate that early child L2 productions are similar to those

4. There are many more sources of knowledge that can serve L2 development than what can possibly be addressed through the current study, for example the learner's own knowledge about the world.

reported for adult L2 learners (i.e. with more L1 characteristics). Zdorenko & Paradis (2007) studied the use of articles in L2 children from different L1 background, and found L2 children from L1s lacking articles use bare nouns more frequently than L2 children with articles in their L1 after 9 months of exposure to the L2. In a separate study, Unsworth (2013) compared the development of Dutch by three different types of second language children, simultaneous bilingual children, early successive bilingual children and L2 children (4-10 year old), to assess age of acquisition (AOA) effects in early child L2 acquisition. She found that L2 children at the initial state produced qualitatively different errors from the other two groups, and that these errors resulted from transfer from the children's L1, English.

On the other side of the debate, many observations suggest the relevance of UG in child L2 acquisition. In line with the documentation of adult L2 acquisition, researchers have documented that some aspects of the child L2 learners' interlanguage reflect a particular characteristics unlike either the L1 or the L2. For example, as mentioned above, Goad and White (2009) found that Turkish learners of English construct new prosodic representations which are not appropriate in either language but satisfy the requirements of vowel harmony in their L1. Consistent with other reports in the literature, Goad & White claim that there seems to be *competing grammar* in the learners' interlanguage representations.

Thus, UG and L1 transfer seem to be the two dominant sources of knowledge that an L2 learner (adult/child) can rely on at the initial state of L2 development. Of course, we have to take into consideration other potential sources of knowledge for L2 children, such as their knowledge of the world, their interactive skills, and so on. These additional

sources of knowledge are believed to influence the language acquisition process as well. Since these factors are outside of the scope of this thesis, we will mainly focus on the influence of L1 structure on the acquisition of the L2.

4. Current Study

In the previous section we have summarized the literature on child L2 acquisition, which suggests that transfer from L1 plays a vital role at the initial state of L2 development, as it may affect L2 phonological, morphological and syntactic development in different ways. Concerning typology more specifically, one of the issues currently affecting our understanding of child L2 acquisition concerns the lack of detailed studies based on populations whose L1 and L2 are genetically very different from one another. Indeed, many of the studies cited above are based on more or less *isolating* languages such as English or French. In comparison, there is a dearth of studies where the L1 and L2 differ drastically in such a respect. In addition, the comparative examination of child L2 acquisition from these less documented languages to other acquisition types (such as L1, adult L2 acquisition) has the potential to expand our knowledge base, and to also contribute to the refinement of models of linguistics and language acquisition more generally. It is with these considerations in mind that we conducted an in-depth, longitudinal study of one child native speaker of Kazakh acquiring English as a second language. The primary goals of this research is to document the child's patterns of language development, and to gain more insight into the theoretical issues discussed in the previous sections.

Toward these goals, we aim to study how cross-linguistic[5] differences between the child's L1 (Kazakh) and L2 (English) interact in the context of early childhood L2 acquisition. More explicitly, we propose the following general research questions for the dissertation:

(1) General research questions
    a. How does a child L2 learner develop the phonological system of her interlanguage?
    b. How does a child L2 learner develop the morphological knowledge relevant to the interlanguage?

5. We define cross-linguistic as the influence of knowledge of a learner's native language on his/her acquisition of a subsequent language.

Chapter 3: Methodology and Corpus Data

1. Introduction

In this chapter, we document the methodology we used for the current study. We also provide a general overview of our corpus data.

2. Empirical Focus

2.1 Phonological Acquisition

Concerning child L2 sound system development, our purpose is to uncover those phonological aspects of the L1 (Kazakh) that transferred into the L2 learner's interlanguage (English). To do so, we specifically focused on Nura' acquisition of the consonantal speech sounds of English |θ, ð, ɹ, f, v, ʃ, ʧ|.

Given the large similarities between Kazakh and English consonant inventories, as detailed in Table 1 and Table 2 below, we could superficially hypothesize that consonant acquisition should not pose too many issues to the learner. Indeed, at the phonological level, only the $/\theta \sim \eth/$ and $/\mathrm{f} \sim \mathrm{v}/$ consonants of English are missing from the Kazakh inventory. However, as we will see in Chapter 4, more similar phones (between the L1 and the L2) can yield some of the more intricate acquisition patterns. Nura's acquisition of interdental fricative offers a nice illustration of this, as we discuss below.

Table 1: Kazakh Consonants

	Bilabial	Alveolar	Alveo-palatal	Velar	Uvular	Laryngeal
Stop	p b	t d		k g		
Fricative (trill)		s z r	ʃ (ʒ)		χ ~ ʁ	h
Affricate (contour)			ʧ ʤ			
Nasal	m	n		ŋ		
Liquid		l				
Glide	w		j			

Table 2: English Consonants

	Bilabial	Labio-dental	Inter-dental	Alveolar	Alveo-palatal	Velar	Laryngeal
Stop	p b			t d		k g	
Fricative		f v	θ ð	s z	ʃ ʒ		h
Affricate					ʧ ʤ		
Nasal	m			n		ŋ	
Liquid				l	ɹ		
Glide	w				j		

We focus on how these consonant segments of English are acquired by the child learner. We are also interested in how the learner acquire knowledge about the language-specific implementations of phonological contrasts given that, for example, rhotics are phonologically present in both languages, but they present clear differences at the level of speech phonetics.

Toward this goal, we document Nura's productions of segments of English (which are absent in Kazakh consonant inventory) across positions within the syllable (onset vs. coda) and word (initial vs. final), and within heterosyllabic clusters. This documentation

in turn offer clues concerning the different factors at play during L2 segmental development.

2.2 Morphological Acquisition

Concerning morphological development, we focus in particular on the acquisition of verbal morphology, such as the regular past tense *-ed*, the third person singular present tense *-s,* and the copula *be*. Optional use of verbal morphology has been widely observed in the grammars of L2 learners; it is however not clear how robust this pattern is in childhood L2 acquisition in contrast to other language learning populations (e.g. L1; typically-developing L2; language impaired). Further, the development of verbal morphology can be influenced by similarities and differences between the child's L1 and L2 (Rezzonico et al. 2017). To our knowledge, such comparisons between Kazakh and English have never been documented in the context of L2 development. As we will see, this study will help us understand the influence of L1 functional categories on the L2 learners' grammar.

Kazakh has an arguably more complex verbal system than English, given that Kazakh verbs are inflected for not only tense, but also person, voice, and mood. The effects of such differences on acquisition are difficult to predict, yet the acquisition of English verbal morphology should be relatively straightforward for a Kazakh child, because an L1 Kazakh speaker has already acquired a complex system of verbal inflection, and should benefit from grammatical transfer of the relevant features of the L1 system into the English IL competence.

3. Methodology

3.1 Ethics Approval

Ethics approval for this work was obtained through the research project entitled *Factors influencing phonological development: A cross-linguistic, cross-learning context empirical study*, ICEHR #20170104-AR, under the direction of Dr. Yvan Rose, Department of Linguistics, Memorial University.

3.2 Participant

Our participant, named Nura, is a native speaker of Kazakh. She was three years and eleven months old (3;11) when the data collection began. Nura had virtually no experience with English prior to this, as her home language environment was very predominantly Kazakh until that point. Nura began directly interacting with native speaker of English as of her 2nd day after her arrival to Canada.[6] This case study is unique in a number of respects. First, it involves multimedia recordings of a child L2 learner of English that began within 10 days of the child's arrival to her new language environment, which provides a unique window into her earliest steps into multilingualism. Second, this study offers potential to understand subtle but important influences on early second language acquisition, for example concerning how the child began to piece together the linguistic units (e.g. sounds, words, phrases) that are relevant to English, her second language, and how this newly acquired knowledge translated into her spoken language.

6. Since the study have been undertaken in Newfoundland, Canada, we cannot exclude Nura's exposure to the varieties of English spoken in this province, which may have played in the child's linguistic development. However, we did not focus on dialectal influence on Nura's acquisition of English.

3.3 Data Collection

Nura was recorded in her own home, in the company of an English-speaking nanny/interviewer actively involved in the recordings, in order to document the data relevant to the development of her second language, English, as spoken by the interviewer and other speakers in the child's everyday environment. The recordings involved interactions between the child and the interviewer, while the parents were out of the house conducting their daily activities (studies, work). Initial data recording (Phase 1) took place every week. This relatively high density sampling was motivated by the observation from research that child second language learners between the ages of four and six move through early language acquisition milestones (e.g. acquisition of the system of sounds and sound combinations) very rapidly (Abrahamsson & Hyltenstam 2009). The study of this rapid development thus calls for higher-density sampling. Subsequent recordings (Phase 2) took place fortnightly, and enabled us to track how the child was able to attain more elaborate means of expression (e.g. morpho-syntactic constructions) throughout the remainder of the observation period.

During the recording sessions, the interviewer concentrated on two main points. The first consisted of encouraging spontaneous word production by the child, in order to obtain a sample maximally representative of the child’s phonological productive abilities. Second, while engaged in what were otherwise regular interactions with the child, the interviewer reproduced the child’s word productions using the adult forms, so as not to reinforce what could be erroneous productions, and to facilitate subsequent word identification. Both of these roles by the interviewer basically follow the types of interactions that

normally take place between a child and an adult, especially in contexts where the adult is focused on providing the child with a stimulating environment for language learning.

All recordings were done using a Zoom Q8 video recorder, a small recording device with a wide-range view and high-quality, built-in microphone. The device was part of the child's everyday environment. The person in charge of the recording on any particular day simply had to turn it on at an appropriate moment, when the child was engaged in playing with quiet toys or looking at picture books, in her typical setting (the living room). This method was both the least intrusive, in that it involved virtually no change to the child's everyday environment, and avoided potential disruptions or issues related to self-consciousness, which can occur given children's natural awareness of, and interest toward, electronic devices. In short, we did not want the child to move away from her normal activities to play with the camera, which would have undermined the overall ecological validity of our empirical observations. The recording sessions normally lasted a maximum of 90 minutes, a few of them shorter due to intervening factors (e.g. unexpected visitor) or occasional fussiness. Likewise, the intervals between recording sessions were at times disrupted by factors such as illness or family holidays, which of course always had precedence over the needs for regular data sampling. It is indeed the case that naturalistic studies often present gaps in data sampling; this is an inherent limitation of this approach to the study of child language. The following table shows Nura’s ages, and the duration of each corresponding recording.

Table 3: Summary of the recordings

Age	Minutes	Age	Minutes	Age	Minutes	Age	Minutes
03;11.11	49	04;04.18	49	04;09.19	71	05;07.25	68
03;11.28	63	04;05.02	67	04;10.19	61	05;08.22	59
04;00.19	74	04;05.16	69	04;11.21	63	05;09.19	65
04;00.30	69	04;05.30	62	05;00.07	57	05;10.05	91
04;01.16	58	04;06.18	99	05;00.28	62	05;10.26	61
04;02.02	67	04;07.09	62	05;02.16	57	05;11.16	63
04;02.16	68	04;07.30	64	05;04.11	91	06;00.07	75
04;03.04	59	04;08.13	77	05;05.09	96	06;00.28	77
04;03.08	63	04;08.29	87	05;06.06	72	06;01.11	78
04;04.02	63	04;09.12	67	05;06.27	86	06;01.25	64

The raw recordings were stored on a secure server in the *Speech Science and Language Acquisition Laboratory* at Memorial University, where we engaged in their orthographic and phonetic transcription[7] using Phon, a specialized software program designed for the building and analysis of linguistic databases (https://www.phon.ca). All of the steps described next follow standard procedures in the field: Identification of each participant involved in the recording; identification of the time intervals on the recorded media which are relevant for research (i.e. speech turns, for each participant involved in the recording); orthographic transcription of the child's and adult's productions; phonetic transcription of the child's productions.

The analyses followed two basic analytical methods: Inventories of linguistic units produced by the child, and comparisons between the 'adult' linguistic units attempted by the child (i.e. the target/model forms) and those actually produced by the child. We then

7. While we do not have systematic inter-transcriber reliability scores, we can attest that all the data utilized in a subset of the current study (Cooze 2020) were fully validated by an independent speaker of English. Because we found no noticeable differences between the data from these transcripts and the remainder of our dataset, we believe that our data provide firm grounds for all intents and purposes.

interpreted the data primarily based on the linguistic profile and language learning context specific to the child. Further, because this study is not about the child's social or psychological development, the database transcriptions and annotations are limited to descriptions of the child's linguistic productions.

Chapter 4: Nura's Patterns of Segmental Development

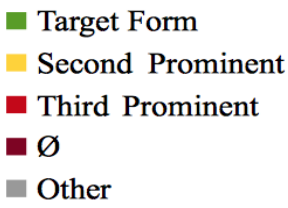
1. Introduction

In this chapter, we describe Nura's acquisition of English L2 consonants identified based on the differences between the Kazakh and English phonological systems described in Chapter 3, section 2. These consonants are |θ, ð, ɹ, f, v, ʃ, ʧ|, as we leave |ʒ| aside due to a lack of data.[8]

Throughout the descriptions to follow, the legend in Figure 2 is used by default to identify general segmental behaviours depicted as part of barred graphs. Depending on specific situations, additional patterns are at times added to the legend. The top category always represents the target form. It is followed by the second (and third) most prominent production pattern(s). The sign 'Ø' is used to represent when the target sound is deleted from the child's production. 'Other' encompasses all the other remaining errors (inaccurate productions) observed, representing idiosyncratic or otherwise marginal productions, none of which worth further discussion given the scope of the current research.

8. Throughout this dissertation, we use "|" to denote target forms which the child is attempting to produce (i.e., |form|); "/" to denote phonological forms (i.e., /form/); and "[ ]" to denote the child's actual speech productions (i.e., [form]).

Figure 2: Default Chart Legend



In the following sub-sections, we describe Nura's acquisition of individual consonants in singleton onset and coda positions, highlighting Nura's acquisition patterns such as substitutions of the target segments, production gaps (if applicable), mastery of each segment (the consistent and accurate production of the target segment) in each developmental stage. These descriptions offer the necessary foundations to our subsequent description of Nura's development of consonant clusters.

2. The Acquisition of Consonants in Singleton Onsets

For each phone we focus on the patterns of segmental development observed in singleton onset and coda. We begin with Nura's acquisition of the interdental fricative consonants |θ, ð|. For singleton onsets, we describe Nura's acquisition of word-initial and word-medial productions. For singleton codas, we describe Nura's acquisition of word-medial and word-final productions. The rational behind this is to describe and analyze Nura' s segmental acquisition in all phonological positions to understand her development of English in a comprehensive and systematic way. As we will see, Nura

generally mastered segments in syllable onsets faster than in codas, also with differences in her substitution patterns between these two positions.

2.1 |θ| in Singleton Onset

Throughout the 40 sessions of the corpus, Nura attempted the consonant |θ| 1042 times, the vast majority of which (83%) she produced in a target-like fashion, especially if we ignore voicing distinctions (i.e. whether the phones were produced as [θ] or [ð]). Nura also exhibited noticeable patterns of stopping (9%), and [s] production (6%), but virtually no deletions (only a single instance). The remaining 2% of the data consists of idiosyncratic substitutions.

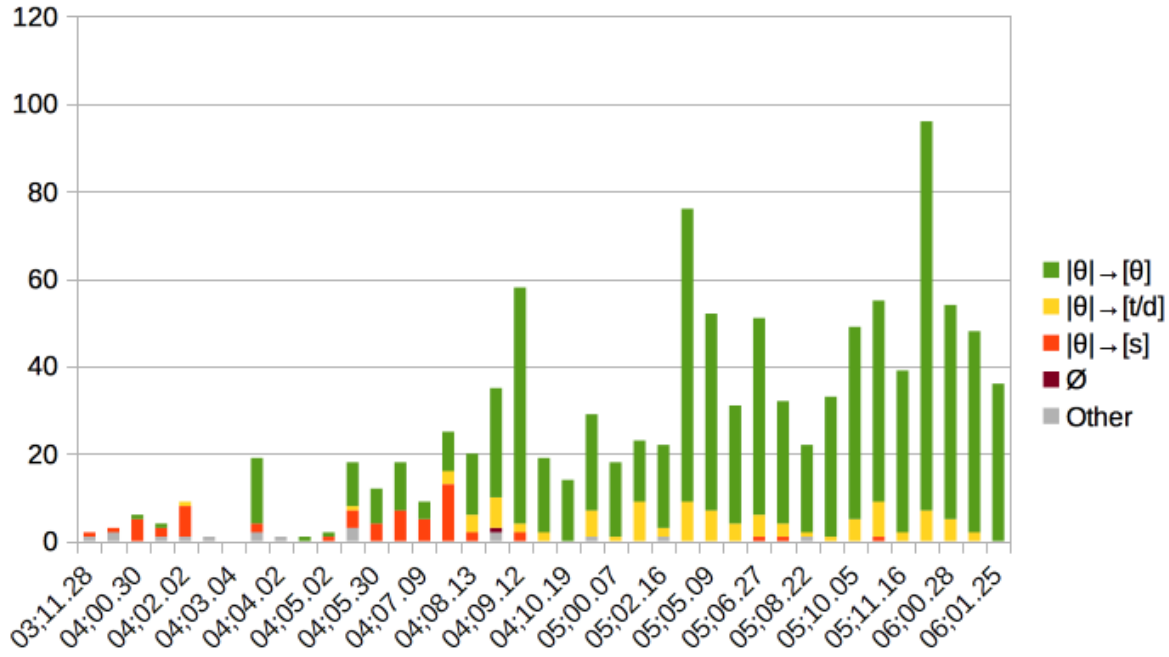
Table 4: Acquisition of |θ| in Singleton Onset

Target production [θ ~ ð]	868	83%
Stopping [t ~ d]	97	9%
Substitution by [s]	59	6%
Ø	1	≈0%
Other	17	2%
Total	1042	100%

From a developmental perspective, the data suggest that Nura went through one general substitution stage before she attained mastery of this phone. As we can see from Figure 3 below, Nura initially replaced the target sound |θ| with [s] (a sound of Kazakh) from 3;11 to 4;03. Nura then began to produce target |θ| in singleton onsets along with [s] substitution until she was 4;08.13. From 4;08, she was able to produce the target phone |θ| in a much more accurate fashion, in spite of noticeable productions

of stops ([t, d]). We provide more detail about Nura's development of this phone in the next paragraphs.

Figure 3: Acquisition of |θ| in Singleton Onset



2.1.1 Stage 1: |θ| → [s] (3;11.11 to 4;03.04)

During this initial stage, Nura's productions predominantly consisted of [s] substitution for |θ|. As we can see from Table 5, 64% of Nura's attempted productions underwent [s] substitution.

Table 5: |θ| Productions during Stage 1 (3;11 to 4;03.04)

	All contexts	Percentage %
Number of attempts	25	
Accurate production	2	8%
[s] production	16	64%
[t/d] production	1	
Ø	0	
Other	6	

We give representative examples of this substitution in (2).

(2) |θ| → [s] in Singleton Onsets

a. *thank you* |ˈθæŋk ˈjuː| → [ˈsjæŋk ˈtjaʊ] 3;11.28

b. *thank you* |ˈθæŋk ˈjuː| → [ˈsæŋk ˈjuː] 4;02.02

2.1.2 Stage 2: Positional Variation Affecting |θ| and [s] (4;03.08 to 4;08.13)

As noted above, Nura started to produce the target phone at 4;03.08, but till showed variable [s] substitution for |θ|, this pattern lasted until she was 4;08.13. During this period, as we can see in Table 6, 74% of accurate productions of |θ| occurred in word-initial contexts, while 53% of [s] substitutions occurred in word-medial contexts.

Table 6: |θ| Productions during Stage 2 (4;03.08 to 4;08.13)

	Initial	%	Medial	%
Number of attempts	78		47	
Accurate production	58	74%	15	32%
[s] production	13	17%	25	53%
[t/d] production	2		6	
Ø				
Other	5		1	

The following examples illustrate this pattern: (3a) shows accurate productions of |θ| in word-initial position; (3b) shows that Nura substituted [s] for |θ| word-medially.

(3) Contextual Substitutions for |θ| during Stage 2 (4;03.08 to 4;08.13)

a. Word-initial Context (Accurate Productions)

i. ***thanks*** |ˈθæŋks| → [ˈθæŋks] 4;06.18

ii. *I don't* ***think*** *so* |ˈθɪŋk| → [ˈθɪŋkˀ] 4;08.13

b. Word-medial Context (Substitution for [s])

i. *I'm not see* ***anything*** |ˈɛniːˌθɪŋ|ˈ→ [ˈɛniːˌsɪŋ] 4;07.09

ii. ***everything*** *is frozen* |ˈɛvɹiːˌθɪŋ|ˈ→ [ˈævɹiːˌsɪŋ] 4;07.30

2.1.3 Stage 3: Positional Variation Affecting |θ| (4;08.29 to 6;01.25)

Starting at 4;08.29, Nura was able to accurately produce |θ| in word-initial singleton onsets in a relatively consistent manner. As we can see from Figure 3, the data remain variable throughout this later period, this time with optional stopping of the target interdental in word-medial position.

As summarized in Table 7, between 4;08.29 and 6;01.25, the accurate production rate for word-initial |θ| is higher than for word-medial |θ|. Nura's 98% of the attempted word-initial |θ| were accurate; in contrast, 73% of her attempted word-medial |θ| were accurate. Table 7 also shows that 26% of the attempted word-medial |θ| were stopped, which represents 92% of the all the stop productions (81 out of 88) observed across all contexts.

Table 7: |θ| Productions during Stage 3 (4;08.29 to 6;01.25)

	Initial	%	Medial	%
Number of attempts	578		314	
Accurate production	564	98%	229	73%
[s] production	5		0	
[t/d] production	7		81	26%
Ø	1		0	
Other	1		4	

(4) Contextual Substitutions for |θ| during Stage 3 (4;08.29 to 6;01.25)

a. Word-initial Context (Accurate Productions)

i. ***thirteen*** *fourteen* |ˈθʌɹtiːn| → [ˈθʌɹtiːn] 4;09.12

ii. *he was* ***thinking*** |ˈθɪŋkɪŋ| → [ˈθɪŋkɪŋ] 6;01.25

b. Word-medial Context (Substitution for [t/d])

i. *said* ***everything*** |ˈɛvɹiːˌθɪŋ| → [ˈɛvɹiːˌdɪŋ] 5;00.28

ii. *eat* ***something*** |sʌmθɪŋ| → [ˈsʌmdɪŋ] 6;00.28

2.1.4 Interim Summary: |θ| in Singleton Onsets

At the initial stage of acquisition of |θ| in singleton onset, Nura consistently replaced the target phone |θ| by [s]. From there, we observed positional differences in Nura's acquisition of |θ|. Word-initial |θ| was acquired earlier than word-medial |θ|; word-medial

|θ| was variably replaced by [s] and, at a later stage, for stops. Note finally the virtual absence of |θ| deletion across the dataset.

2.2 |ð| in Singleton Onsets

Compared to the acquisition of |θ|, Nura attempted at |ð| in singleton onsets more frequently, with 9247 attempts throughout the corpus. As illustrated in Table 8, target-like productions constitute the most prominent pattern (60% of all productions); the other significant pattern is stopping (38% of all productions). The remaining 2% of the data consists of idiosyncratic patterns.[9]

Table 8: Acquisition of |ð| in Singleton Onset

Target production [ð ~ θ]	5509	60%
Stopping [t ~ d]	3572	38%
Other	166	2%
Total	9247	100%

Figure 4 illustrates Nura's development of |ð| in singleton onsets. She substituted a stop for |ð| from the very earliest sessions, a pattern that gradually weakened toward the end of the recording sessions (6;01.25). Nura did start to produce the target phone as early as 4;01.16, but it is not until 5;05.09 that she was able to consistently reach the target.

9. This includes five instances of substitution by [z] (0.1%); and 30 instances of deletion (0.3%).

Figure 4: Acquisition of |ð| in Singleton Onset

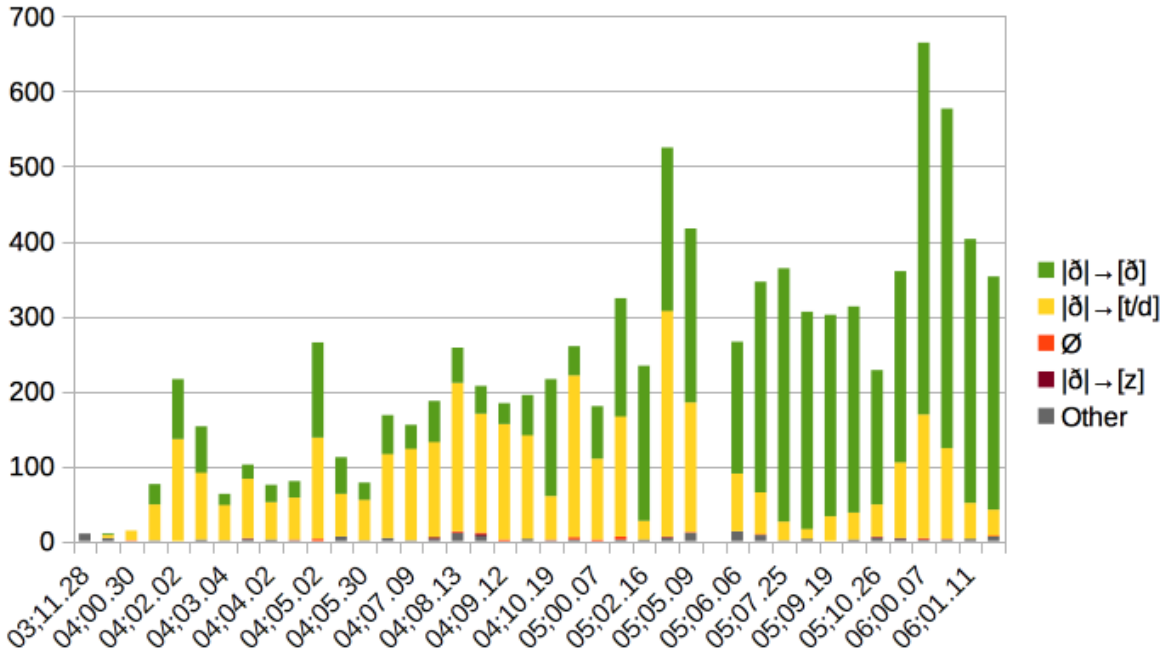


Figure 4 however hinders a pattern of variation. While the vast majority of Nura's accurate productions were in word-initial position, stopping manifested itself mainly word-initially. This is different from what we observed in the acquisition of |θ| in singleton onsets. We provide more detail in the following sub-sections.

2.2.1 Stage 1: |ð| → stops (3;11 to 5;05.09)

At this initial stage, Nura produced more instances of stops than accurate productions of |ð|, especially in word-initial position. As illustrated in Table 9, 38% of her attempted productions were accurate, while 60% underwent substitution to stops.

Table 9: |ð| Productions during Stage 1 (3;11 to 5;05.09)

	Initial	%	Medial	%
Number of attempts	4595		169	
Accurate production	1765	38%	69	41%
[t/d] production	2746	60%	73	43%
Other				

The following examples illustrate this pattern: (7a) shows accurate productions of |ð| in word-initial position; (7b) shows substitution for stops in the same position.

(5) Substitutions for |ð| during Stage 1 (3;11 to 5;05.09)

a. Word-initial Context (Accurate Productions)

i.	***this*** *one*	|ˈðɪs| → [ˈðɪs]	4;01.16
ii.	***the*** *big one*	|ˈðʌ| → [ˈðʌ]	5;04.11

b. Word-initial Context (Substitution for [t/d])

i.	***the*** *bunny*	|ˈðʌ| → [ˈdʌ]	4;03.08
ii.	*I first time see* ***that*** *too*	|ˈðæt| → [ˈdæt]	5;04.11

2.2.2 Stage 2: |ð| Mastery (5;05.09)

From 5;05.09 onward, Nura began to display a higher accuracy rate for the target phone. As noted above, her accurate productions of |ð| occurred mainly in word-initial contexts, where Nura substituted stops for |ð|, something she virtually never did in medial positions. Table 10 shows 83% of her attempted production was accurate in word-initial positions. 17% of her attempted productions was stopped word-initially.

Table 10: |ð| Productions during Stage 2 (5;05.09 to 6;01.25)

	Initial	%	Medial	%
Number of attempts	4376		107	
Accurate production	3620	83%	55	51%
[t/d] production	749	17%	4	4%
Other				

We list some examples for word-initial and word-medial productions. (6) represents Nura's acquisition patterns for |ð| in word-initial contexts. (7) represents Nura's acquisition patterns for |ð| in word-medial contexts.

(6) |ð| in Word-initial Context (5;05.09 to 6;01.25)

a. Accurate Productions

i. *can we leave it there* |ˈðɛɹ| → [ˈðɛɹ] 5;05.09

ii. *this is my mommy's earrings* |ˈðɪs| → [ˈðɪs] 6;01.25

b. Substitution for [t/d]

i. *do you know the secret* |ˈðʌ| → [ˈdʌ] 5;05.09

ii. *I first time see that too* |ˈðæt| → [ˈdæt] 5;04.11

(7) |ð| in Word-medial Context (5;05.09 to 6;01.25)

a. Accurate Productions

i. *another blue* |əˈnʌðəɹ | → [əˈnʌðəɹ] 5;06.27

ii. *eat it together* |təˈgɛðəɹ| → [təˈgɛðəɹ] 5;06.06

b. Substitution for [t/d]

i. *I have big brother* |ˈbɹʌðəɹ| → [ˈbʌdəːɹ] 06;00.28

ii. *other piece* |ˈʌðəɹ| → [ˈʌdəɹ] 06;01.11

2.2.3 Word-Initial Stopping

Recall from 2.1.3 that we observed positional differences in Nura's acquisition of |θ|, where word-medial |θ| was produced as stops. Contrary to this, Nura substituted stops for |ð| word-initially. Some of the most frequent lexical items we have found are listed

below in Table 11. One common feature about these lexical items is that they are all function words. Note as well that these words were all variably affected by stopping. For example, 57% of the attempts at the lexical item *this* underwent stopping (|ˈðɪs| → [ˈdɪs]); 55% of the *those* underwent stopping.

Table 11: Lexical Items of Word-initial |ð| → [t/d] (4;11.21 to 5;05.09)

Lexical items	Attempted total	Stopping	%
this	787	448	57%
those	55	30	55%
there/there's/ there're)	116	62	53%
these	43	22	51%
the	429	159	37%
that/that's	259	143	55%

2.2.4 Interim Summary: |ð| in Singleton Onsets

At the initial stage of the acquisition of |ð| in singleton onset, Nura consistently substituted stops for |ð|. This pattern continued throughout the observed period. Stopping was also restricted to word-initial positions. Finally, similar to |θ|, we observed only very marginal cases of deletion[10] in the data.

2.3 |ɹ| in Singleton Onsets

Nura attempted the target rhotic |ɹ| in singleton onset 2006 times in our dataset. As shown in Table 12, 89% of the total attempted productions were produced accurately. The only truly noticeable error pattern we observe is that of gliding, which affected 7% of

10. 30 instances of deletion in the total attempted number of 9247, which is only a negligible 0.3%.

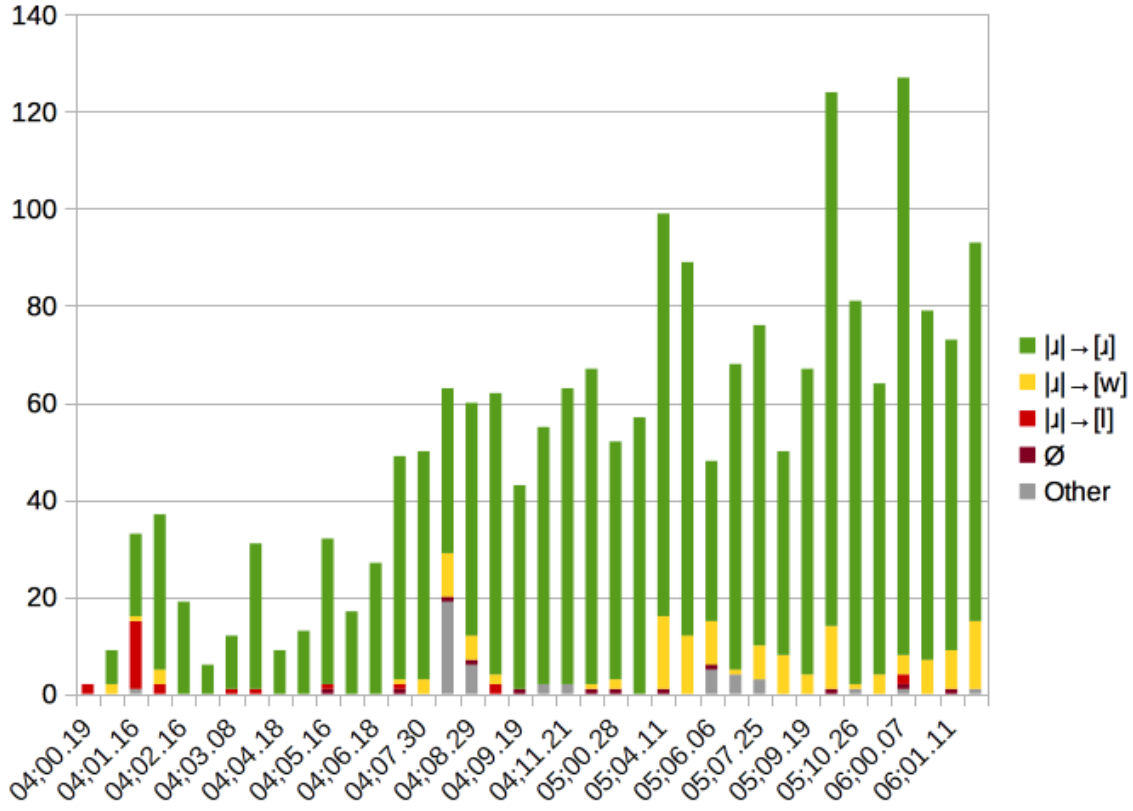
the total attempted productions. 1% of [l] production, 1% of deletion, along with 2% of other marginal productions are also attested.

Table 12: Acquisition of |ɹ| in Singleton Onset

Target production [ɹ]	1787	89%
Gliding [w]	136	7%
[l]	26	1%
Ø	12	1%
Other	45	2%
Total	2006	100%

Figure 5 illustrates Nura's acquisition of |ɹ| in singleton onsets. We can see that, initially, Nura replaced |ɹ| by [l]. Very quickly, starting at 4;00.30, she was able to articulate [ɹ], and maintained a strong accuracy rate until 5;00.28. Finally, Nura was prone to gliding |ɹ| to [w] during the latter stage of development (from 4;07.30). We discuss these two developmental periods respectively below.

Figure 5: Acquisition of |ɹ| in Singleton Onset



2.3.1 Stage 1: Positional Variation Affecting [ɹ] (4;00.19 to 5;02.16)

During the initial developmental period, Nura's attempts at |ɹ| in singleton onsets revealed positional differences as shown in Table 13. Nura's accuracy rate for |ɹ| in word-medial contexts (97%) are higher than that of in the word-initial contexts (89%), the only context where [w] substitution is attested word-initially, even if only marginally.

Table 13: |ɹ| Productions during Stage 1 (4;00.19 to 5;02.16)

	Initial	%	Medial	%
Number of attempts	588		280	
Accurate production	525	89%	272	97%
[w] production	29	5%	0	0%
[l] production	4	1%	1	
Ø	1		6	
Other	29		1	

We list representative examples of substitution to [w] and accurate production in word-medial contexts in (8).

(8) Variable Trends in |ɹ| Acquisition during Stage 1 (4;00.19 to 5;02.16)

a. Word-initial Context (Substitution for [w])

i. *rock* |ˈɹɑk| → [ˈwɑːk] 4;00.30

ii. *rainbow* |ˈɹeɪnˌboʊ| → [ˈwɪnˌbɔ] 4;08.13

b. Word-medial Context (Accurate Production)

i. *colouring* |ˈkʌləɹɪŋ| → [ˈkʌləːɹːɪŋ] 4;04.02

ii. *library* |ˈlaɪˌbɹɛɹiː| → [ˈlaɪˌbɛɹiː] 5;00.28

2.3.2 Stage 2: |ɹ| Mastery (5;04.11)

Consistent with the initial stage, Nura maintained a better performance in word-medial contexts, compared to the word-initial contexts throughout the reminder of the dataset. As shown in Table 14, between 5;04.11 and 6;01.11, we observed an 85% accuracy rate for |ɹ| word-initially, while it is 95% word-medially.

Similarly, gliding occurred mainly in word-initial environment. During this period, we observed 13% [w] substitution in word-initial contexts and 4% word-medially.

Table 14: |ɹ| Productions during Stage 2 (5;04.11 to 6;01.11)

	Initial	%	Medial	%
Number of attempts	690		448	
Accurate production	586	85%	425	95%
[w] production	89	13%	18	4%
[l] production	0		0	
Ø	2		3	
Other	13		2	

(9) Contextual Differences of |ɹ| during Stage 2 (5;04.11 to 6;01.11)

a. Word-initial Context (Substitution for [w])

i. *really* |ˈɹɪliː| → [ˈwɛɹi] 5;04.11

ii. *ready* |ˈɹɛɾiː | → [ˈɹɪliː] 5;10.05

b. Word-medial Context (Accurate Production)

i. *very* |ˈvɛɹi| → [ˈwɛɹi] 5;05.09

ii. *alright* |ˌɑlˈɹaɪt → [ɑlˈɹaɪt] 6;01.25

As we observed in the above section, almost all cases of [w] substitution occurred in word-initial positions. Only 18 cases of [w] substitution happened in word-medial contexts, all during the latter stage of acquisition (from 5;04.11 to 6;01.11). Among these 18 cases, 17 come from the word *already*. This suggests a lexical, as opposed to a phonological issue, where it is also possible that [lɹ] cluster present in the word might have influenced this outcome.

2.3.3 Interim Summary: |ɹ| in Singleton Onsets

Nura acquired |ɹ| in singleton onsets very rapidly, especially in word-medial positions, where she presented a higher accuracy rate compared to word-initial contexts. Consistent with previous observations, Nura presented virtually no deletions.

However, we also note a subtle dip in performance during the second developmental stage, which was unexpected. However, we do not have any explanation for this except that both her vocabulary and productivity increased during this second period, which may have caused this effect in the data.

2.4 |f| in Singleton Onsets

Nura attempted a total of 2033 productions of |f| in singleton onset in our database. As we can see from Table 15, Nura presented a 99% accuracy rate for this consonant, with also virtually no deletions, the remaining 1% consisting of idiosyncratic productions.

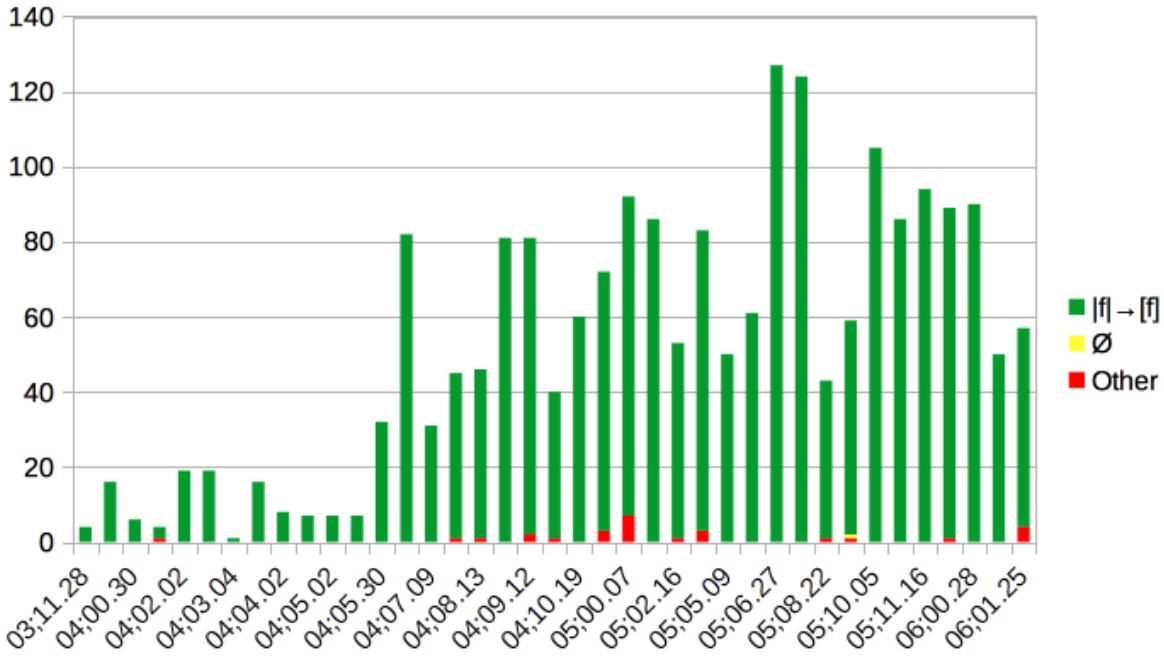
Table 15: Acquisition of |f| in Singleton Onset

Target production [f ~ v]	2007[11]	99%
Ø	1	0%
Other	25	1%
Total	2033	100%

Developmentally, Nura thus displayed virtually no problem with the acquisition of |f| in singleton onsets. As we notice from Figure 6, Nura had acquired the target phone from the very beginning (3;11.28).

11. The total number of substitution to [v] is 31.

Figure 6: Acquisition of |f| in Singleton Onset



2.5 |v| in Singleton Onsets

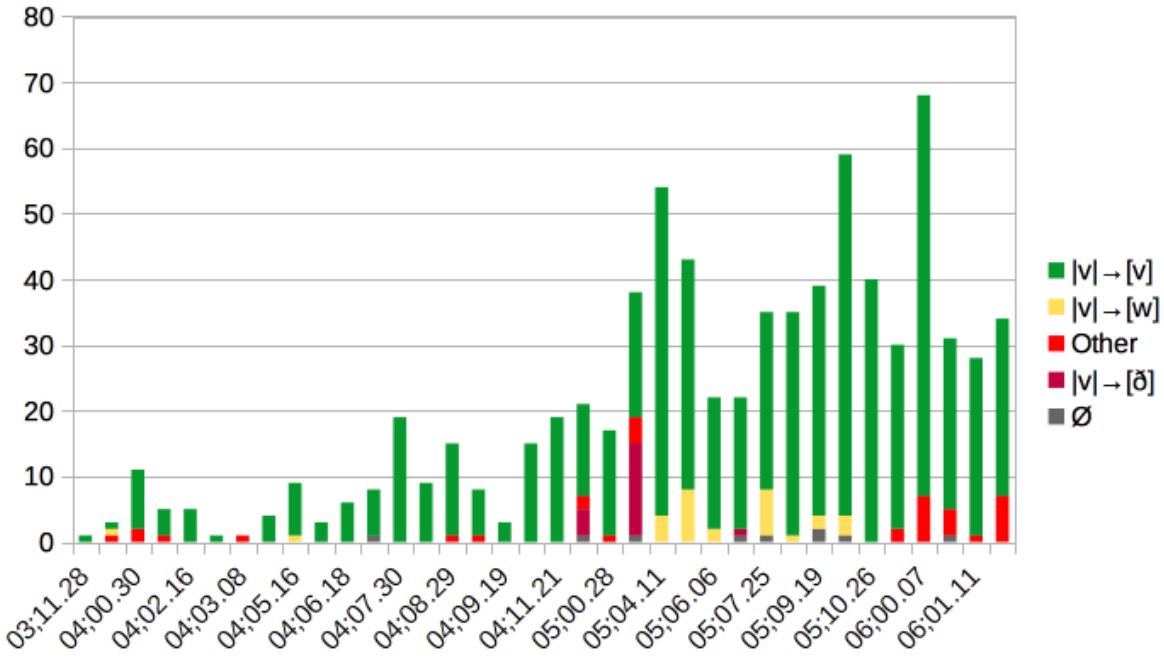
Nura had markedly fewer attempts at |v| in singleton onset, compared to its voiceless counterpart |f|. As we can see in Table 16, Nura attempted only 761 instances of |v| in the entire database. We also note in Table 16 that Nura was not as accurate in her attempts at |v| which underwent substitutions to [w] (4%) (which exists in Kazakh inventory), and to [ð] (3%).

Table 16: Acquisition of |v| in Singleton Onset

Target production [v]	669	88%
[w]	29	4%
[ð]	19	3%
Ø	9	1%
Other	35	4%
Total	761	100%

Figure 7 illustrates Nura's development of |v| in singleton onset. She performed quite well at the beginning of the observation period. However, she displayed more variable patterns between 5;00.07 and 5;10.05, where substitutions to [w] and [ð] are more noticeable. Nura then settled into a more stable performance at |v| in singleton onset from 5;10.26 onward. We describe these three acquisition periods in more detail in the following sub-sections.

Figure 7: Acquisition of |v| in Singleton Onset



2.5.1 Stage 1: Accurate Productions (3;11.28 to 4;11.21)

From 3;11.28 to 4;11.21, Nura displayed equivalent rates of accurate production for |v| in word-initial and medial singleton onsets, at 93% and 95%, respectively.

Table 17: |v| Productions during Stage 1 (3;11.28 to 4;11.21)

	Initial	%	Medial	%
Number of attempts	14		129	
Accurate production	13	93%	122	95%
[w] production			1	1%
Ø			1	1%
Other	1	7%	5	3%

The examples in (10) illustrate Nura's performance during Stage 1.

(10) Accurate Production of |v| during Stage 1 (3;11.28 to 4;11.21)

a. Word-initial Context (Accurate Production)

i. *violin* |vaɪəˈlɪn| → [viɔɹˈlʌn] 4;00.30

ii. *very good* |ˈvɛɹiː | → [ˈvɛɹiː] 4;09.19

b. Word-medial Context (Accurate Production)

i. *never* |ˈnɛvəɹ| → [ˈnɛvəɹ] 4;02.16

ii. *seven* |ˈsɛvəːn| → [ˈsɛvəːn] 4;10.19

2.5.2 Stage 2: |v| → [w] / [ð] (5;00.07 to 5;10.05)

During the second period of acquisition, Nura kept displaying ceiling accuracy in word-medial contexts (97%). However, in word-initial contexts, her accuracy rate dropped to 52%, along with 25% of substitutions to [w] and 17% of substitutions to [ð].

Table 18: |v| Productions during Stage 2 (5;00.07 to 5;10.05)

	Initial	%	Medial	%
Number of attempts	110		275	
Accurate production	57	52%	268	97%
[w] production	27	25%		
[ð] substitution	19	17%		
Ø			7	3%
Other	7	6%	0	

However, as we can see from the representative examples in (11), all of the [w] and [ð] substitutions come from the word *very*.

(11) Representative Examples of Positional Variation

a. Word-initial Contexts ([w], [ð] Substitutions)

i. *very*	| ˈvɛɹiː| → [ˈðɛɹi]	5;02.16
ii. *very*	| vɛɹiː | → [ˈwɪɹi]	5;10.05

b. Word-medial Context (Accurate Production)

i. *oven*	|ˈʌvən | → [ˈʌvən]	5;02.16
ii. *never mind*	|ˈnɛvəɹˌmaɪnd| → [ˈnɛvəɹˌmaɪnd]	5;09.19

This observation is further supported in Table 19 below, which reveals that the child substituted [w] or [ð] for |v| in about two thirds of her all attempts at *very*. This strongly suggests a lexical effect, as opposed to anything more general about Nura's phonological system.

Table 19: Lexical Exception to |v| Productions during Stage 2 (5;00.07 to 5;10.05)

Lexical item	Total attempted number	Substitution	Number	%
very	82	[w]	27	33%
		[ð]	29	35%

2.5.3 Stage 3: |v| (5;10.26)

During the last developmental period for |v|, as shown in Table 20, we record 100% accurate productions in word-initial contexts as well as 88% accuracy in word-medial contexts, along with 1% of deletion and 11% of other idiosyncratic productions.

Table 20: |v| Productions during Stage 3 (5;10.26 to 6;01.25)

	Initial	%	Medial	%
Number of attempts	44		187	
Accurate production	44	100%	165	88%
[w] production				
[ð] substitution				
Deletion			1	1%
Other			21[12]	11%

2.5.4 Interim Summary: |v| in Singleton Onsets

Similar to |f|, and in spite of her relatively fewer attempts at |v|, Nura's development of |v| in singleton onset was extremely rapid. Also despite the adjective *very*, which she often mispronounced between 5;00.07 and 5;10.05, we can conclude that Nura mastered |v| very early on.

2.6 |ʃ| in Singleton Onsets

Nura made a noticeable amount of attempts at |ʃ| in singleton onset, with a high accuracy rate. As we can see from Table 21, Nura attempted 1410 instances of |ʃ| throughout the observation period, 88% of which resulted in accurate productions. The second most important pattern consists of variable substitutions to [s ~ z], at 9%. Substitution to [ʧ] represents 2% of the attempts, and other marginal productions cover the remaining 1%.

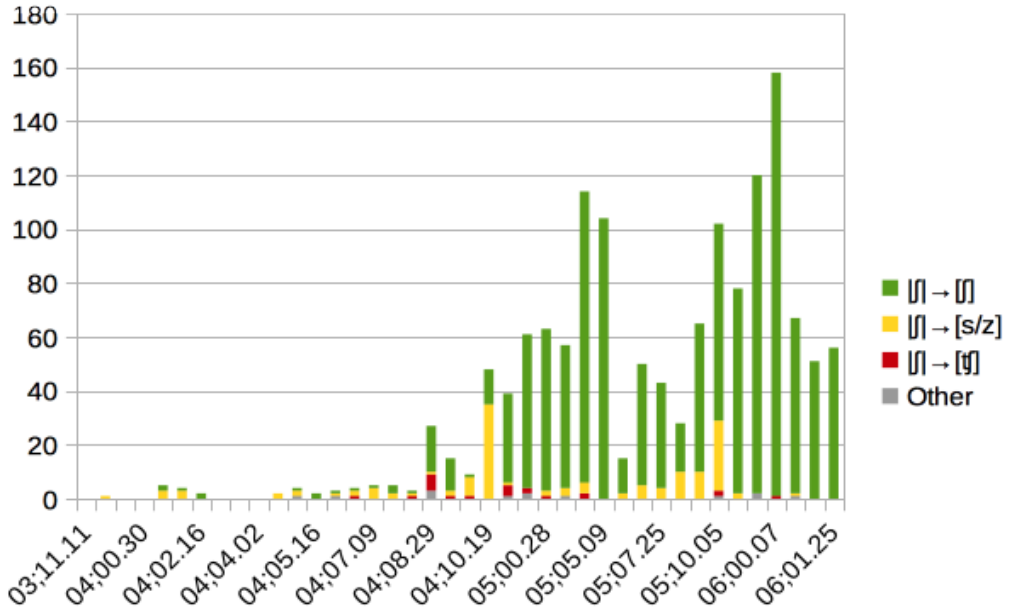
12. 20 out of the 21 marginal productions were substitution to [m].

Table 21: Acquisition of |ʃ| in Singleton Onset

Target production [ʃ]	1239	88%
Substitution by [s ~ z]	136	9%
Substitution to [ʧ]	22	2%
Other	13	1%
Total	1410	100%

We can see the developmental picture of |ʃ| in Figure 8. As this figure illustrates, Nura attempted relatively few tokens of |ʃ| between 3;11.28 to 4;10.19, a period during which her production were mainly characterized by substitution to [s] and [ʧ]. After 4;10.19, Nura transitioned to predominantly accurate productions of |ʃ|. We illustrate these two developmental periods in more detail below.

Figure 8: Acquisition of |ʃ| in Singleton Onset



2.6.1 Stage 1: /ʃ/ → [s] (3;11.28 to 4;10.19)

As shown in Table 22, during the initial stage of production, Nura showed a 54% accuracy rate in word-initial contexts. The most noticeable substitution pattern is to [s], with 26% of attempted productions in word-initial position. In addition, 13% of word-initial /ʃ/ attempts were replaced by [ʧ]. This pattern may in fact related to the fact that, in Kazakh, [ʧ] is in free variation with [ʃ] word-initially.

Table 22: /ʃ/ Productions during Stage 1 (3;11.28 to 4;10.19)

	Initial	%	Medial	%
Number of attempts	80		59	
Accurate production	43	54	15	25
Substitution by [s]	22	26	44	75
Substitution by [ʧ][13]	10	13	0	
Other	5	7	0	

In word-medial onsets, substitution to [s] represents the most prominent pattern, accounting for 75% of all attempted productions. The remaining 25% of attempts resulted in accurate productions. We provide specific examples in (12) in order to illustrate this contextual variation.

13. Substitution to [ʧ] could be included in the 'other' category. However, word-initial [ʧ] in Kazakh is in free variation with [ʃ]. We listed it as a separate item to assess the impact of this variation in Nura's L1 on her acquisition pattern of the target phone.

(12) Representative Productions of Positional Variation

a. Word-initial Contexts

i. *show* |ˈʃoʊ| → [ˈʃoʊ] 4;09.19

ii. *show* |ˈʃou| → [ˈsou] 4;07.30

b. Word-medial Contexts (Substitution to [s])

i. *swing pusher* |ˈpʊʃəɹ| → [ˈpʌsəɹ] 4;02.02

ii. *Michelle* |mɪˈʃɛl| → [mɪˈsɛl] 4;07.09

2.6.2 Stage 2: Word-medial |ʃ| → [s] (4;11. 21 to 6;01.25)

During the following stage (4;11.21 to 6;01.25), we observe the rapid development of accurate productions for the target phone [ʃ]. As we can see in Table 23, Nura achieved a 98% accuracy rate in the word-initial context, and 77% accuracy word-medially.

Compared to the previous stage, substitution to [s] decreased both in word-initial and word-medial contexts. Nevertheless, substitution in word-medial contexts is still prominent.

Table 23: |ʃ| Productions during Stage 2 (4;11.21 to 6;01.25)

	Initial	%	Medial	%
Number of attempts	985		289	
Accurate production [ʃ]	962	98	219	77
Substitution by [s]	5	<1	65	22
Substitution by [ʧ]	12		0	
Other	6		2	1

However, upon closer examination of the data, we note that virtually all of the substitutions to [s] in the word-medial context came from the single word *actually*, as

shown in Table 24. Again here, we can conclude that the variation is largely driven by a lexical effect.

Table 24: Lexical Exceptions to |ʃ| Productions in Word-medial Contexts

Lexical items	Total attempted number	substitution to [s]	%
actually	65	60	92%
Michelle		2	
ocean		1	
special		1	
finishing		1	

Representative examples from both the word-initial and word-medial contexts are given below in (13).

(13) Representative Productions of Positional Variation

a. Word-initial Contexts (Accurate Production)

i. *shy* |ˈʃaɪ| → [ˈʃaɪ] 5;10.05

ii. *shoes* |ˈʃuːz| → [ˈʃuːz] 5;10.05

b. Word-medial Contexts (Substitution to [s])

i. *actually* |ˈækʃəli | → [ˈæksəliː] 5;04.11

ii. *actually* | ˈækʃəli | → [ˈækʰsəli] 5;10.05

2.6.3 Interim Summary: |ʃ| in Singleton Onsets

In summary, Nura mastered |ʃ| in singleton onsets at 4;11.21. Substitution to [s] was the main substitution pattern throughout the observation period. It was more prominent during the initial stage, from 3;11.28 to 4;10.19. In addition, it is more noticeable in word-medial contexts. From 4;10.19 onward, and in spite of lexically-influenced variation, Nura displayed drastically more accurate productions for |ʃ|.

2.7 |ʒ| in Singleton Onsets

Throughout the entire 40 sessions of the dataset, Nura attempted virtually no instances of |ʒ| in singleton onset, which also reflects the relative rarity of this phone in English. No data were recorded for word-initial onsets, and only one instance of |ʒ| in word-medial positions. We supply this example in Table 25 but will not discuss it further below.

Table 25: Acquisition of |ʒ| in Singleton Onset

Positions	Data	Example	IPA actual	Session #
Word-initial	No data			
Word-medial	One instance	treasures	[ˈtɹɛʒəɹz]	5;09.19

2.8 |ʧ| in Singleton Onsets

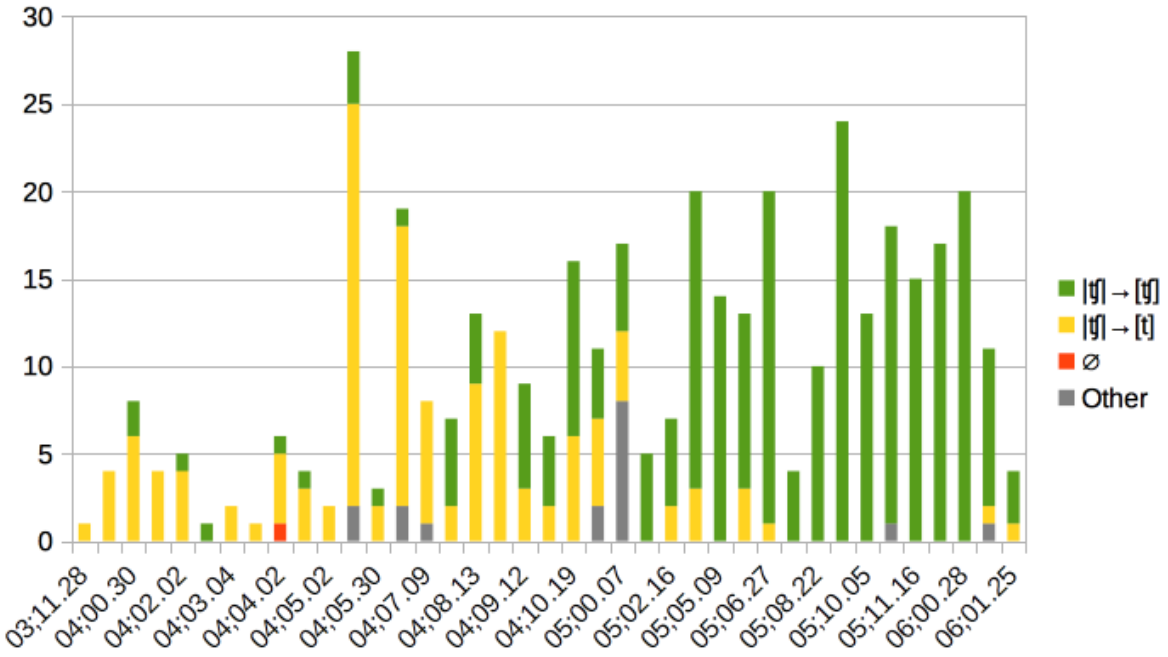
In comparison to most consonants discussed so far, Nura had rather fewer attempts at |ʧ| in singleton onset. Among the 40 sessions of the dataset, only 402 instances are found, as we can see from Table 26. Of these, target productions represent 62% of all attempts while stopping, the most prominent substitution pattern, represents 34% of the attempts. Virtually no deletion were attested in our dataset, while marginal productions were noted in the remaining 4% of the data.

Table 26: Acquisition of |ʧ| in Singleton Onset

Accurate production [ʧ]	251	62%
Stopping	133	34%
Ø	1	
Other	17	4%
Total	402	

Figure 9 presents Nura's general development of /ʧ/ in singleton onset. From 3;11.28 to 5;02.16, Nura predominantly replaced the target phone by stops. After 5;02.16, she began to produce /ʧ/ in singleton onsets more consistently and accurately. We discuss these two developmental stages below in more detail.

Figure 9: Acquisition of /ʧ/ in Singleton Onset



2.8.1 Stage 1: /ʧ/ → stops (3;11.28 to 5;02.16)

During the initial stage of /ʧ/ in singleton onset, from 3;11.28 to 5;02.16, Nura replaced /ʧ/ by stops at a significant rate, and across both initial and medial positions. As we can see from Table 27, 63% of her attempted productions (79 instances) in word initial position underwent stopping, so did 62% of attempts at /ʧ/ in word-medial position, making stopping the dominant production pattern at this stage.

Table 27**:** |ʧ| Productions during Stage 1 (3;11.28 to 5;02.16)

	Initial	%	Medial	%
Number of attempts	79		120	
Accurate production [ʧ]	28	36	31	26
Stopping	50	63	74	62
Ø	1	1	0	
Other	0		15	12

We provide representative examples of this substitution pattern in (14).

(14) Representative Productions of Positional Variation

a. Word-initial Contexts (Substitutions to Stops)

i. *chair* |ˈʧɛɹ| → [ˈteɪɑɹ] 4;09.19

ii. *chocolate* |ˈʧɑklət| → [ˈtɑklət] 5;02.16

b. Word-medial Contexts (Substitution to Stops)

i. *teacher* |ˈtiːʧəɹ| → [tʰitʰʌɹ] 4;00.19

ii. *picture* |ˈpɪkʧəɹ| → [ˈpɪktəɹ] 4;09.19

2.8.2 Stage 2: |ʧ| Mastery (5;04.11)

Nura's production with |ʧ| in singleton onsets improved drastically by 5;04.11, when she began to produce the target phone accurately in a consistent manner. As we can see from Table 28, from 5;04.11 onward, overall accuracy in the word-initial context is 98%, and 90% in word-medial contexts, where stopping still variably occurred. No cases of deletion were attested.

Table 28: |ʧ| Productions during Stage 2 (5;04.11 to 6;01.25)

	Initial	%	Medial	%
Number of attempts	121		82	
Accurate production [ʧ]	118	98	74	90
Stopping	3	2	6	7
∅	0		0	
Other			2	3

We provide specific examples of substitution to stopping in (15).

(15) Representative Productions of Positional Variation

a. Word-initial Contexts (Accurate Production)

i. *chair* |ˈʧɛɹ| →[ˈʧɛɹ] 5;06.06

ii. *cheese* |ˈʧiːz| →[ˈʧiːz] 5;08.22

b. Word-medial Contexts (Accurate Production)

i. *picture* |ˈpɪkʧəɹ| →[pɪkʧəɹ] 5;10.26

ii. *teacher* |ˈtiːʧəɹ| → [ˈtiːtəɹ] 6;01.11

Note as well that while stopping marginally manifested itself until the end of the observation period, this pattern applied to a variety of different words in word-medical position (shown in Table 29), suggesting no lexical influence.

Table 29: Acquisition of |ʧ| in Word-medial Contexts (No Lexical Effect)

Lexical item	Total attempted number	Stopping	%
teacher	44	37	84
picture	63	6	
touching	2	2	100
Achoo@o choocho@o[14]	45	35	(excluded)

14. @o in orthography *Achoo* and *choocho* refers to onomatopoeic imitation of a sound, which we excluded from all analyses.

2.8.3 Interim Summary: |ʧ| in Singleton Onsets

Nura mastered |ʧ| in singleton onset at 5;04.11. Substitution to stopping was one of the most prominent pattern in Nura's acquisition of |ʧ| in singleton onset. This observation is unexpected given |ʧ| and |ʃ| are in free variation in Kazakh, we would expect [ʃ] substitution. However, stopping was active especially at the initial stage of acquisition. It also occurred across positions, both word-initially and word-medially. We did not find any patterns in Nura's substitution of |ʧ| to stopping at word-initial positions. However, the data did suggest some sort of lexical item (and/or assimilation process) in word-medial contexts.

2.9 General Summary of the Acquisition of Consonants in Singleton Onsets

Nura's acquisition of consonants in singleton onset display several characteristics: First, very few cases of deletion were attested in Nura's acquisition of English singleton onsets. This suggests that Nura was able to perceive these phones even if they do not exist in her first language.

Second, Nura's early stages of acquisition present more variable substitution patterns, such as |θ|→[s], |ð|→[t/d], |ʃ|→[s], |ʧ|→[t/d], |ɹ|→[w]. We also noted lexically-influenced variation in the data each time we were to identify such effects. Third, Nura at times displayed positional differences in her acquisition of singleton onsets, as her word-initial and word-medial productions presented different patterns. Word-initial consonants were generally acquired earlier and presented higher accuracy rate overall. Fourth, we did not observe strong L1 effects in our data. For example, while |ʃ ~ ʧ| are in free variation in Kazakh, we did not see any substitution between these two phones, but

rather observed |ʃ|→[s], and |ʧ|→[t/d] in our data. In addition, while |v| and |f| do not exist in Kazakh phonemic system, Nura mastered these two phones very early on.

Keeping these general observations in mind, we now turn to our descriptions of the same consonants in syllable codas.

3. The Acquisition of Consonants in Singleton Codas

In this section we discuss Nura's acquisition of consonants in singleton coda for all the English phones we described in section 2. Consistent with previous descriptions, we start with a quantitative overview of Nura's development of singleton codas, followed by a more qualitative description of the patterns observed, including comparisons of these phones in singleton coda in word-medial versus work-final positions.

3.1 |θ| in Singleton Codas

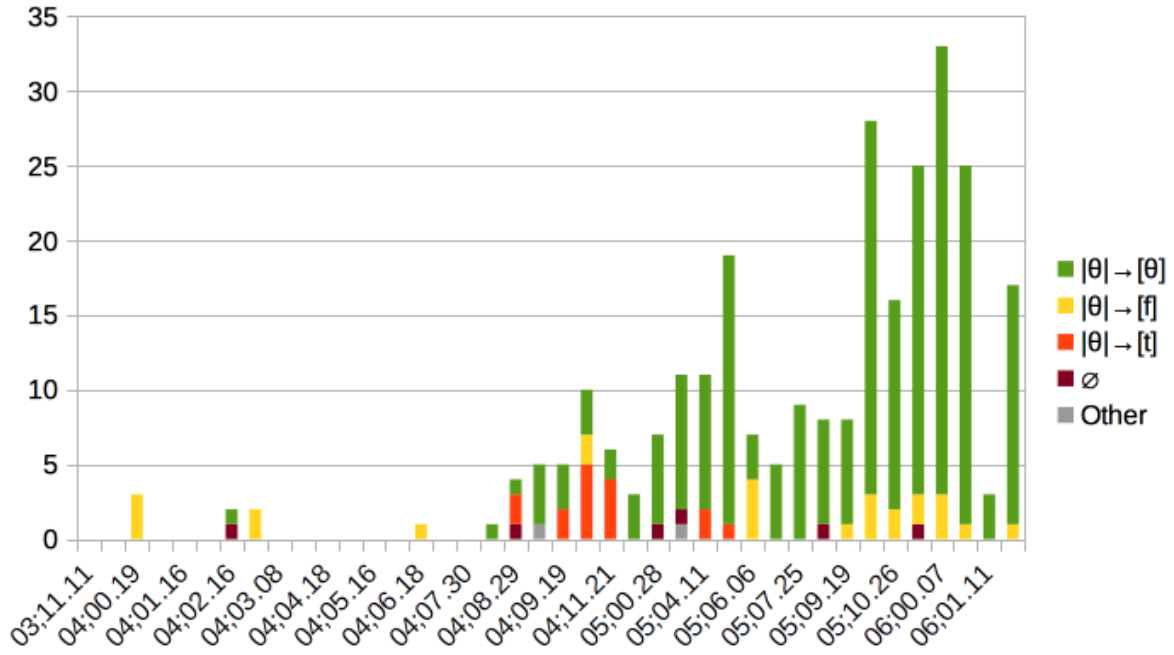
Table 30 offers an overview of Nura's development of |θ| in singleton coda. It presents the overall pattern observed both in word-final and word-medial positions. As we can see, Nura made relatively few attempts at |θ| in singleton coda, with a total of 274. Out of them, accurate productions constitute the dominant pattern, with 82% of all cases. We also note 9% of substitution to [f], 6% to stops, as well as a 2% deletion rate.

Table 30: Acquisition of |θ| in Singleton Coda

Accurate production [θ ~ ð]	225	82%
Substitution by [f]	25	9%
Substitution by stops	16	6%
Ø	6	2%
Other	2	1%
Total	274	100%

As we can see from Figure 10, Nura's development of |θ| in singleton coda took place along three identifiable stages. In her few early attempts during the initial stage (from 3;11.11 to 4;07.30), Nura displayed substitutions to [f]. The subsequent stage (from 4;07.30 to 4;11.21) was characterized by substitution to stops, followed by the mastery stage.

Figure 10: Acquisition of |θ| in Singleton Coda



3.1.1 Stage 1: |θ| → [f] (3;11.11 to 4;07.30)

During the initial stage, Nura did not attempt |θ| in word-medial codas, and made very few attempts in word-final codas. Substitution to [f] was the leading pattern affecting word-final attempts. As we can see from Table 31, out of the 8 word-final attempts, 75% of them were replaced by [f].

Table 31: |θ| Productions during Stage 1 (3;11.11 to 4;07.30)

	Medial	%	Final	%
Number of attempts	0		8	
Accurate production	0		1	15%
Substitution by [f]	0		6	75%
Substitution by stops	0		0	
Ø	0		1	
Other	0		0	

Note that all examples of [f] substitution come from a single word, *mouth*. We provide specific examples of substitution to [f] in (16).

(16) Representative productions of positional variation
- a. Word-medial Contexts (Not Attested)
- b. Word-final Contexts (Substitution to [f])
  - i. *mouth* |ˈmaʊθ| → [mɛˈwʊf] 4;00.19
  - ii. *mouth* |ˈmaʊθ| → [ˈmaːʊːf] 4;03.04

3.1.2 Stage 2: |θ| → Stops (4;08.13 to 4;11.21)

During the second period, Nura's productions of |θ| in singleton coda displayed positional variation, as shown in Table 32. Nura had fewer attempts but 100% accuracy rate for word-medial |θ| in singleton coda. While accurate productions do emerge in word-final position, |θ| still underwent substitution by stops in this position. As we can see in Table 32, Nura replaced 50% of her word-final productions by stops.

Table 32: |θ| Productions during Stage 2 (4;08.13 to 4;11.21)

	Medial	%	Final	%
Number of attempts	5		26	
Accurate production	5	100%	9	35%
Substitution by [f]	0		2	
Substitution by stops			13	50%
Ø			1	
Other			1	

Similar to the initial stage, the few examples attested in the corpus came from very few words: all of the 5 word-medial accurate productions came from the word *bathroom*, while all of the 13 cases of substitution to stops originated from the word *with*, out of 16 total attempts at this word (81%), as shown in Table 33.

Table 33: Lexical Exception to |θ| Productions in Word-final Contexts

Lexical item	Total attempted number	Stopping	%
with	16	13	81%

We list representative examples of word-medial accurate productions(in (17a)) as well as word-final substitution to stops (in (17b)).

(17) Representative productions of positional variation

a. Word-medial Contexts (Accurate Productions)

i. *bathroom* |ˈbæθˌɹuːm| → [ˈbæθˌɹuːm] 4;10.19

ii. *bathroom* |ˈbæθˌɹuːm| → [ˈbæðˌɾuːm] 4;09.12

b. Word-final Contexts (Substitution to Stops)

i. *with* |ˈwɪθ|[15] → [ˈvɪtʰ] 4;08.29

ii. *with* |ˈwɪθ| →[wɪd] 4;11.21

3.1.3 Stage 3: |θ| Mastery (5;00.07)

As we can see from Table 34, Nura's productions of |θ| in singleton coda during the last stage observed showed a high accuracy rate both in word-medial and word-final contexts. This stage marks Nura's mastery of |θ| in singleton coda.

Table 34: |θ| Productions during Stage 3 (5;00.07 to 6;01.25)

	Medial	%	Final	%
Number of attempts	18		217	
Accurate production	17	94%	193	89%
Substitution by [f]	1	6%	16	7%
Substitution by stops			3	
Ø			4	
Other			1	

Among the 17 cases of accurate production in word-medial position, 16 came form the word *bathroom*, the other one came from the word *bathtub*. Finally, the few remaining

15. The preposition *with* was transcribed by a native speaker of English as |ˈwɪθ| in this case. Later we will see it was transcribed as |ˈwɪð| in (19). This may be because of dialectal differences. In each case, the target phone was replaced by a stop.

cases of substitution to [f] in word-final position came from words such as *tooth, teeth, truth* and *mouth*, which were also variably affected by the substitution, suggesting no particular lexical effect, as shown in Table 35.

Table 35: |θ|→[f] Patterns in Word-final Contexts (No Lexical Effect)

Lexical item	Total attempted number	[f] Substitution	%
truth	4	3	75%
mouth	17	5	29%
teeth	18	5	28%
tooth	9	3	33%

We offer representative examples for each pattern below.

(18) Representative productions of positional variation

a. Word-medial Contexts (Accurate Productions)

i. *bathroom* |ˈbæθˌɹuːm| → [ˈbæθˌɹʌm] 5;05.09

ii. *bathtub* |ˈbæθtəb| → [ˈbæθtəb] 6;00.28

b. Word-final Contexts (Substitution to [f])

i. *teeth* |ˈtiːθ| → [ˈtiːf] 5;06.06

ii. *truth* |ˈtɹuːθ| → [ˈtɹuːf] 5;09.19

3.1.4 Interim Summary: |θ| in Singleton Codas

Overall, Nura did not attempt very many word-medial |θ| in singleton coda position (n=23), and these few attempts also come from very few words. However, she displayed consistent patterns of production across these attempts. Nura's acquisition of word-final |θ| in singleton coda went through three separate stages, namely, substitution to [f] at the initial stage, followed by substitution to stops, and finally mastery stage. However,

substitution to [f] at the initial stage resulted from her attempts at a single word, while her substitution to stops come from the preposition *with*.

3.2 |ð| in Singleton Codas

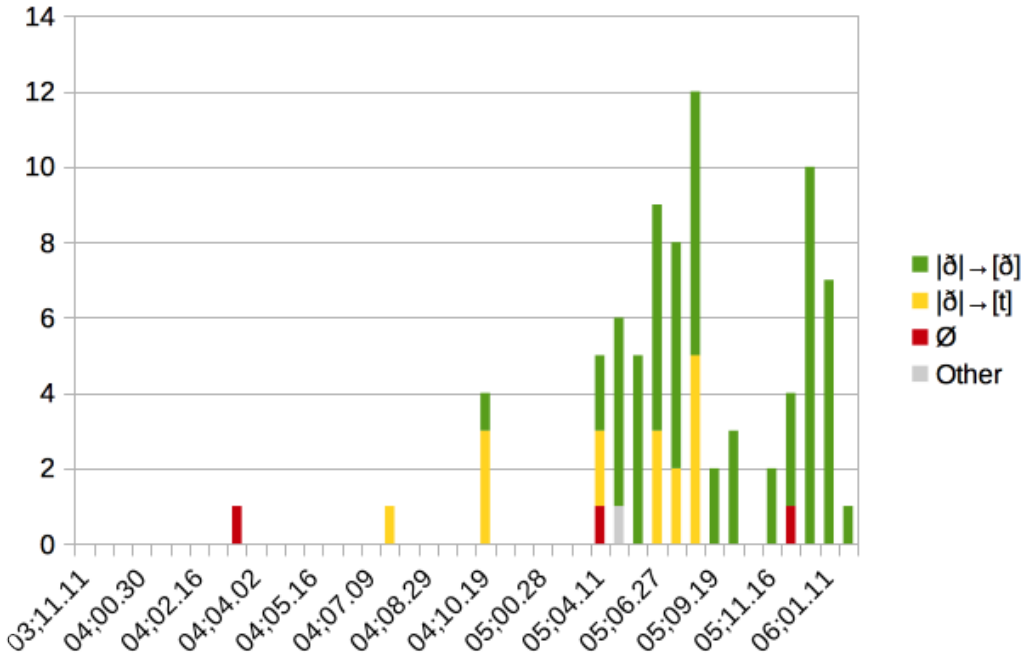
Nura only made 80 attempts at |ð| in singleton coda, all of which were in word-final positions. As we can see from Table 36, 75% of her attempted productions were accurate, alongside 20% substitution to stops, and 4% deletion.

Table 36: Acquisition of |ð| in Singleton Coda

Accurate productions	60	75%
Substitution by stops	16	20%
Ø	3	4%
Other	1	1%
Total	80	100%

Based on Figure 11, we can see that Nura had a few deletion and substitution to stops at the beginning of her acquisition of |ð| in singleton coda. From 5;05.09 onward, she had mastered the target phone, in spite of a few exceptional productions.

Figure 11: Acquisition of |ð| in Singleton Coda (Word-Final)



3.2.1 Word-Final |ð| in Singleton Codas

Since we do not have any data for the word-medial context, we only describe Nura's acquisition of word-final |ð| across two observable stages: a substitution stage (3;11.11 to 4;10.19), and the mastery stage (5;04.11)

As we can see in Table 37, Nura substituted a stop for |ð| in singleton coda in four of her six attempts during the first stage, in addition to one case of deletion and one accurate production. During the subsequent stage, starting at 5;04.11, her rate of accurate

production is 80%. We also notice that substitution to stops and deletion remained marginally present during this stage.

Table 37: |ð| in Singleton Coda (Positional Differences)

	Stage 1	%	Stage 2	%
Number of attempts	6		74	
Accurate production	1	17%	59	80%
Substitution by stops	4	66%	12	16%
Ø	1	17%	2	3%
Other	0		1	1%

Note that all of the accurate productions (60), and the substitutions to stops observed throughout the dataset (n=16) originated from the single word *with*, as shown in Table 38. This word was however variable in its behaviour, given that these 16 cases of stopping represent only 21% of the total number of attempts (n=76).

Table 38: Lexical Exception to |ð| Productions in Word-final Contexts

Lexical item	Total attempted number	Substitution to stops	%
with	76	16	21%

We list a few examples of substitution to stops and accurate productions in (19). (19a) illustrates substitution by stops; (19b) illustrates accurate production.

(19) Representative examples for substitution to stops at word-final contexts

a. Substitution by Stops

i. *with* |ˈwɪð| → [ˈvɪt] 4;07.30

ii. *with* |ˈwɪð| → [ˈvɪt] 5;06.27

b. Accurate Production (Later Stage)

i. *with* |ˈwɪð| → [ˈwɪð] 5;06.27

ii. *with* |ˈwɪð| → [ˈwɪð] 5;10.05

3.2.2 Interim Summary: |ð| in Singleton Codas

Nura mastered |ð| in singleton coda at 5;04.11 in word-final positions. No data was available to describe in word-medial singleton coda. She also displayed a substantial amount of substitution to stops, more prominent at the initial stage of her acquisition, which variably affected Nura's productions of the word *with*.

3.3 |ɹ| in Singleton Codas

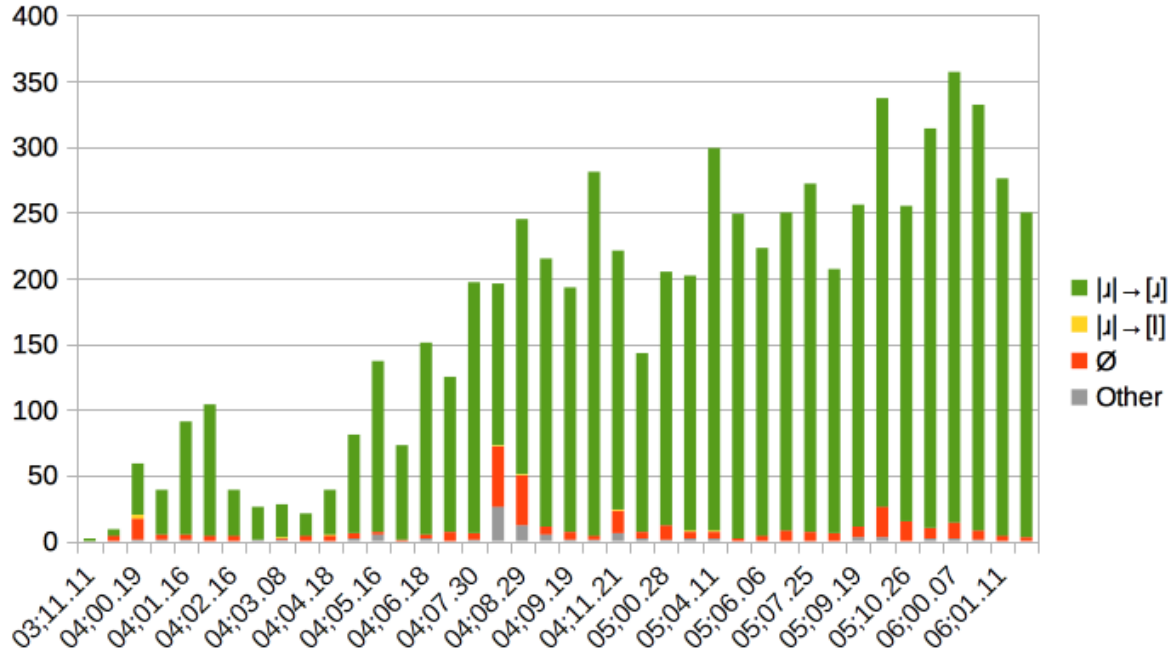
From a quantitative point of view, Nura had far more attempts at the target phone |ɹ| in singleton coda than at any other consonants. As shown in Table 39, she made 6999 attempts at this consonant, 94% of which were produced accurately. The data also show a 5% rate of deletion, and a few marginal instances of substitution to [l] (n=10) and even fewer to [w] (n=4), which were included within the other productions in the following table.

Table 39: Acquisition of |ɹ| in Singleton Coda

Target production	6589	94%
Substitution by [l]	10	<1%
Ø	316	5%
Other (including [w])	84	1%
Total	6999	

We can see from Figure 12 that Nura presented a very stable and accurate behaviour in her production of |ɹ| in singleton coda. The data indeed suggest that Nura already had mastered the target phone in this position by the beginning of the documented period, in spite of the few cases of deletion found during the early sessions.

Figure 12: Acquisition of |ɹ| in Singleton Coda



Deletions in fact only sporadically occurred throughout the period documented by the corpus, from the very early recorded sessions to the end. As shown in Table 40, Nura had a slightly higher accuracy rate for word-medial |ɹ| in singleton coda, yet displayed slightly more deletions in this position.

Finally, we documented a relatively high number of marginal substitutions.

Table 40: |ɹ| in Singleton Coda (Positional Differences)

	Word-medial	%	Word-final	%
Number of attempts	978		6021	
Accurate production	902	92%	5087	85%
Ø	70	7%	246	4%
Substitution by [l]	2		8	
Other	4		80	

Out of the 84 marginal substitutions, 30 were substitutions by [j], and 27 were substitutions by vowels (such as [ə, ɪ, ʊ, o]). The remaining 27 cases were of random outcomes (such as [v, w, m, n, z, h, s, ʒ]). Together, these cases arise from more or less vocalized outcomes of target |ɹ|, as examples in (20).

(20) Marginal Productions: |ɹ| Substitutions

a.	*hair*	|ˈhɛɹ| → [ˈhejə]	4;08.13
b.	*ear*	|ˈiːɹ| → [ˈdiːjə]	4;08.29
c.	*here*	|ˈhɪɹ| → [ˈhɪːə]	5;09.19

In summary, the evidence suggests that Nura had already acquired |ɹ| in singleton coda by the beginning of the observation period. Presumably she had mastered the sound in

her first language. Although the rhotic trill |ɾ| of Kazakh and the rhotic approximant |ɹ| of English are phonetically different, Kazakh does allow for degrees of positional variation. However, they are not documented comprehensively in the existing literature.

3.4 |f| in Singleton Codas

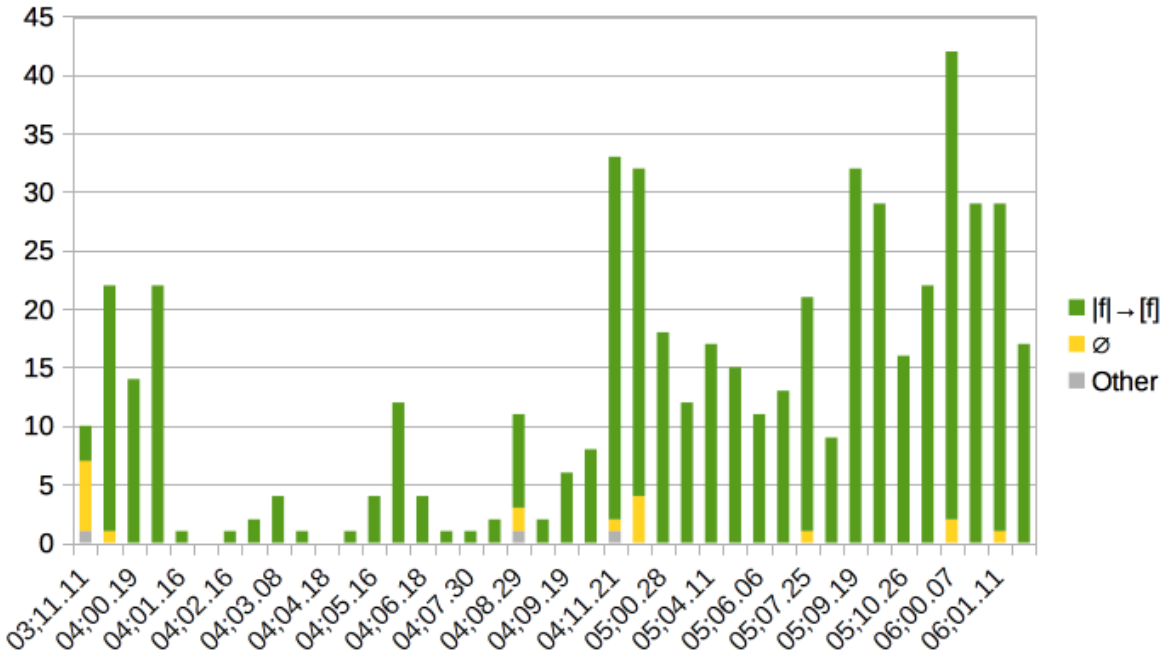
Similar to |ɹ|, Nura was able to produce |f| in singleton coda accurately and consistently from the beginning of the observation period. As shown in Table 41, her overall accuracy rate for |f| production in this context is 96%. The remainder of the data is made up of 3% deletion, and 1% marginal productions.

Table 41: Acquisition of |f| in Singleton Coda

Accurate production	505	96%
Ø	18	3%
Other	3	1%
Total	526	100%

As Figure 13 below illustrates, Nura produced |f| consistently from the very beginning of the documented period, in spite of a few instances of deletion. We can claim that Nura had already mastered |f| in singleton coda by 3;11.11, similar to other observations of her productive abilities for this consonant in syllable onsets, as we saw in section 2.4.

Figure 13: Acquisition of |f| in Singleton Coda



As we can see in Table 42, this was particularly true in word-medial position, where Nura's accurate production was 100%, while her word-final accuracy rate was also quite high (96%).

Table 42: Acquisition of |f| in Singleton Coda (Positional Differences)

	Word-medial	%	Word-final	%
Number of attempts	54		472	
Accurate production	54	100%	451	96%
Ø			18	3%
Other			3	1%

In summary, we can claim from our data that Nura had already mastered |f| in singleton coda before the beginning of our documentation. She was 100% accurate in word-medial positions, her word-final position also showed high accuracy rate in spite of marginal deletions.

3.5 |v| in Singleton Codas

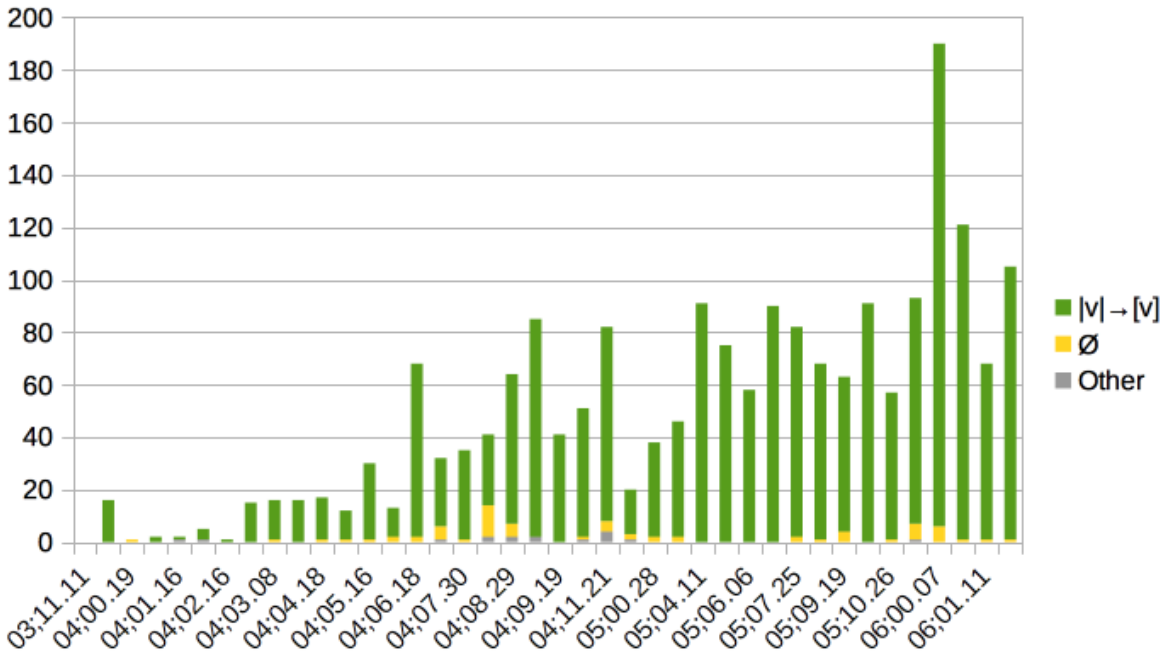
Consistent with the acquisition of |f| in singleton coda, Nura presented a high accuracy rate in her acquisition of |v| in this position, as shown in Table 43. Her accurate productions represent 96% of all attempts, with only 3% deletion and 1% marginal productions. We can say that she had already mastered |v| in singleton coda by the beginning of the observation period.

Table 43: Acquisition of |v| in Singleton Coda

Accurate production	1919	96%
Ø	66	3%
Other	16	1%
Total	2001	100%

This claim is also supported by Figure 14, which shows that Nura's performance of |v| in singleton coda was consistently accurate and stable, in spite of the few cases of deletion observed across the observation period.

Figure 14: Acquisition of |v| in Singleton Coda (Word-Final)



The following chart shows that almost all instances of |v| in singleton coda occurred word-finally. It is thus not possible to determine whether Nura's production patterns may have been influenced by position.

Table 44: Acquisition of |v| in Singleton Coda (Positional Differences)

	Word-medial	%	Word-final	%
Number of attempts	2		1999	
Accurate production	1	50%	1918	96%
Ø	1	50%	65	3%
Other			16	1%

In summary, consistent with her acquisition of |f| in singleton coda, Nura had already mastered |v| in singleton coda before the beginning of our documentation.

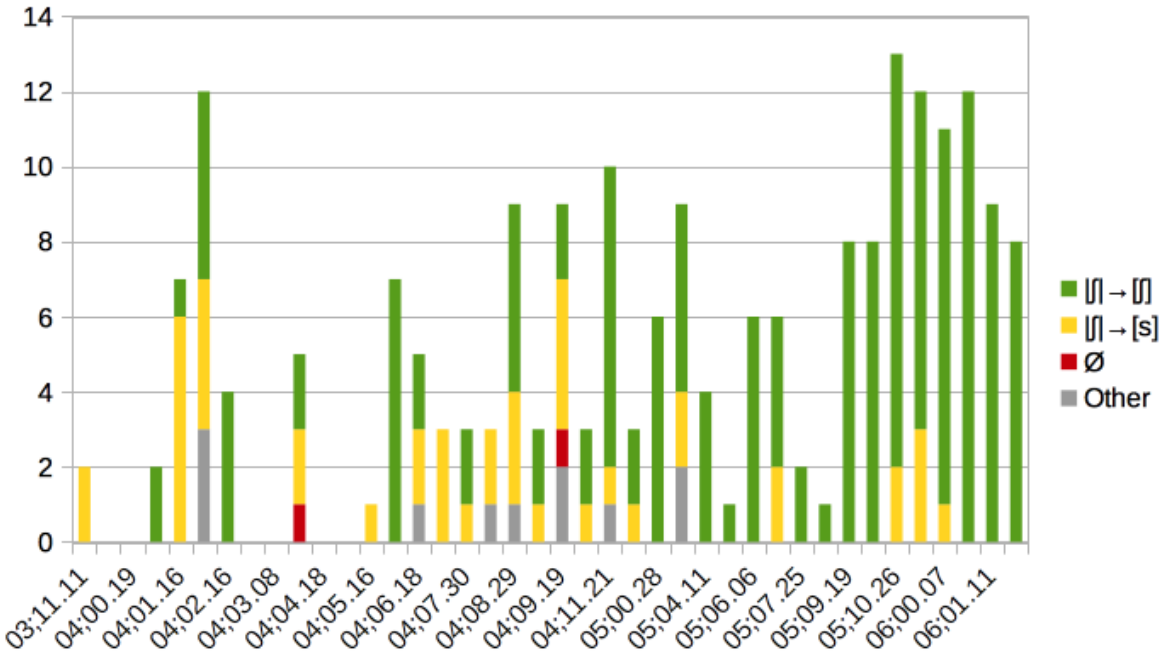
3.6 |ʃ| in Singleton Codas

Similar to |ɹ, f, v|, although to a lesser extent, the most prominent pattern found in Nura's acquisition of |ʃ| in singleton codas consists of accurate productions. The second observable pattern is substitution to [s]. As we can see from Table 45, 73% of her attempted productions were accurate, while 21% underwent substitution to [s], with only 1% deletion and 5% marginal substitutions.

Table 45: Acquisition of |ʃ| in Singleton Coda

Accurate production	150	73%
Substitution by [s]	44	21%
Ø	2	1%
Other	11	5%
Total	207	100%

Figure 15: Acquisition of |ʃ| in Singleton Coda



We observe in Figure 15 that Nura substituted [s] for |ʃ| in singleton coda during the initial portion of her development of the phone in spite of a noticeable number of accurate productions. By 5;04.11, she had mastered |ʃ| in singleton coda. We describe these two stages in more detail in the next subsections.

3.6.1 Stage 1: |ʃ| → [s] (3;11.11 to 5;02.16)

As we can see from Table 46, Nura only attempted |ʃ| in word-final codas, of which 54% were produced accurately, and 40% were replaced by [s].

Table 46: |ʃ| Productions during Stage 1 (3;11.11 to 5;02.16)

	Word-medial	%	Word-final	%
Number of attempts	0		106	100%
Accurate production	0		57	54%
Substitution to [s][16]	0		42	40%
Ø	0		2	2%
Other	0		5	4%

Out of the 42 substitution to [s] productions, 20 came from the word *English*, while the remaining were from other lexical items such as *push, squish, wash, goldfish*. This pattern of substitution was thus not lexical; it was in fact similar to that observed in onsets in section 2.6.

Representative examples are given in (21).

(21) Word-final Contexts

a. Accurate Productions

i. *fish* |ˈfɪʃ| →[ˈfɪʃ] 4;02.02

ii. *wash* |ˈwɑʃ| →[ˈwɑʃ] 4;06.18

b. Substitution to [s]

i. *English* |ˈɪŋˌglɪʃˈ| → [ˈjɪŋˌgəɹɪs] 4;01.16

ii. *push* |ˈpʊʃ| → [ˈpʊs] 4;08.29

3.6.2 Stage 2: |ʃ| Mastery (5;04.11)

During the second stage, Nura had mastered word-final |ʃ| in singleton coda. As shown in Table 47, she displayed 92% accuracy rate for this phone during this latter stage. In

16. The category also includes voiced fricative [z] (n=6), substitution to [s] (n=36). The number in the chart ignores voicing difference (total n=42).

addition, her substitution to [s] decreased noticeably from 40% to 8%. Again here, the vast majority of examples were found in word-final codas.

Table 47: |ʃ| Productions during Stage 2 (5;04.11 to 6;01.11)

	Word-medial	%	Word-final	%
Number of attempts	1		100	
Accurate production	1	100%	92	92%
Substitution to [s]			8	8%
Ø			0	
Other			0	

Representative examples of this mastery stage are reported in example (22).

(22) Word-final Contexts (Accurate Production)

a. *wash* |ˈwɑʃ| → [ˈwɑʃ] 5;00.28

b. *push* |ˈpʊʃ| → [ˈpʊʃ] 5;02.16

3.6.3 Interim Summary for |ʃ| in Singleton Codas

Nura had fewer attempts at |ʃ| in singleton coda than at many of the other consonants. She presented two developmental stages for this phone, namely, substitution to [s] in her early productions, followed by the mastery stage.

3.7 |ʒ| in Singleton Codas

Consistent with her acquisition of |ʒ| in singleton onset, no data was attested for the target phone in our dataset, thus no analysis will be provided for Nura's acquisition of |ʒ|.

3.8 |ʧ| in Singleton Codas

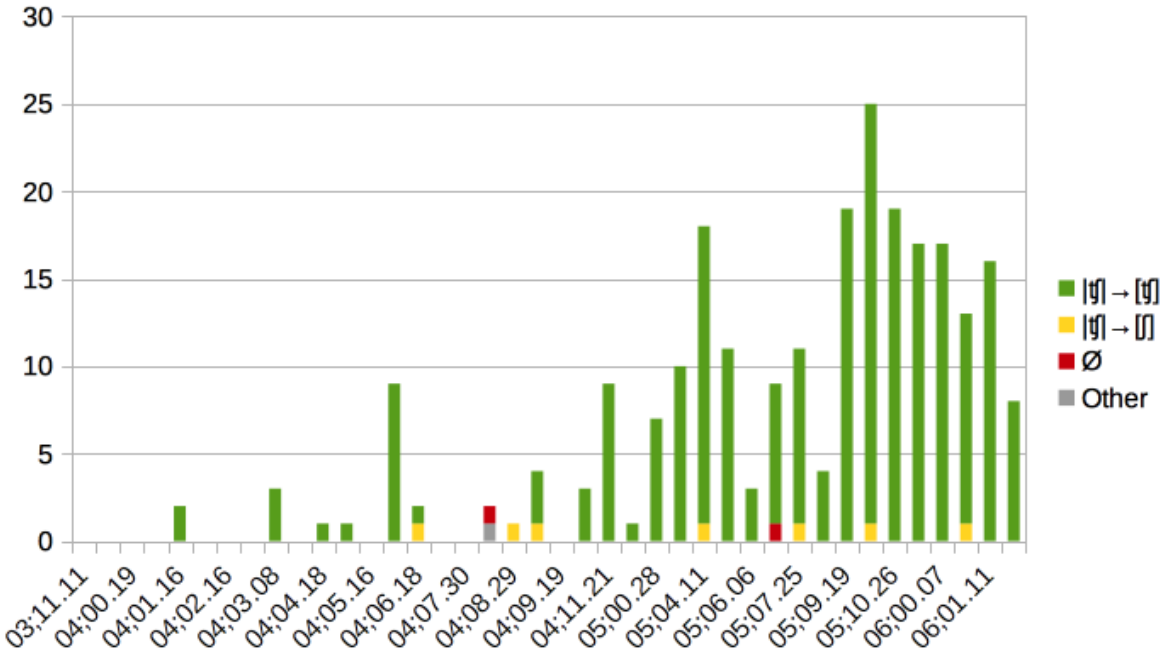
As we can see from Table 48, Nura's productions of |ʧ| in singleton coda was 96% accurate across both contexts. Other acquisition patterns such as substitution to [ʃ] and deletion were marginal in comparison.

Table 48: Acquisition of |ʧ| in Singleton Coda

Accurate production	235	96%
Substitution by [ʃ]	7	3%
Ø	2	1%
Other	1	<1%
Total	245	100%

The consistent and accurate production of |ʧ| in singleton coda are also illustrated in Figure 16. As we can see, in spite of the few attempts recorded during the early sessions, Nura's productions were mostly accurate. Based on these data, we can claim that she had acquired this phone by the beginning of the recorded period.

Figure 16: Acquisition of |ʧ| in Singleton Coda



3.9 General Summary of the Acquisition of Consonants in Singleton Codas

In summary, Nura displayed noticeable positional differences in her acquisition of singleton codas, while she also had very few word-medial attempts at the consonants |θ, ð, v, f, ʒ| in this position.

This completes our description of Nura's segmental acquisition of the sounds of English which are not part of the Kazakh consonantal inventory. In the next section, we turn our focus to Nura's development of onset clusters.

4. The Acquisition of Complex Onsets

In this section we discuss Nura's acquisition of complex onsets in English. There are four types of onset clusters that Nura has to acquire in her English L2 acquisition,

namely, consonant+lateral (Cl) clusters, consonant+rhotic (Cɹ) clusters, consonant+glide (Cg) clusters, s+consonant (sC) clusters, as well as s+consonant+approximant (sCapp) clusters.

4.1 Cl Clusters

We begin with Cl clusters, which include |bl, pl, kl, gl| and |fl|. Consistent with the description of Nura's singletons, for each cluster type, we begin with an overview of Nura's attempts at these clusters, followed by a more qualitative assessment of the data.

4.1.1 |bl| and |pl| Clusters

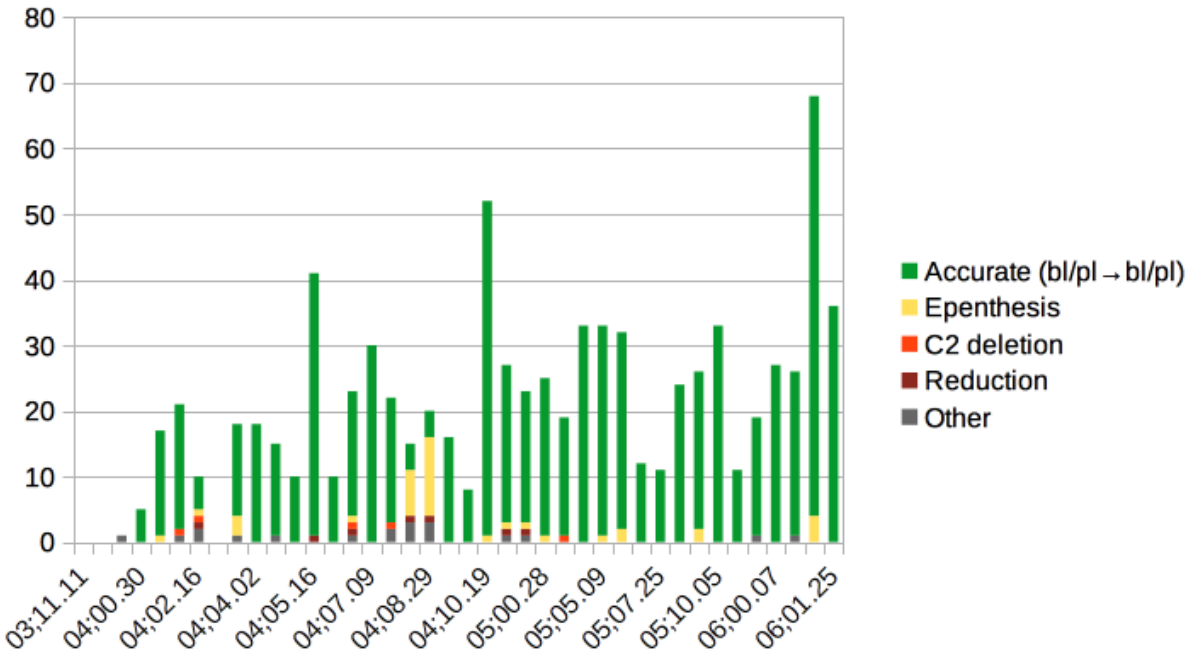
The majority of Nura's attempts at |bl| and |pl| resulted in accurate productions. As we can see in Table 49, out of the total 837 attempts at these clusters, 92% resulted in accurate productions. In addition, we observe an overall 5% rate of vowel epenthesis between the two consonants of the target cluster, 1% of cluster reduction, as well as 2% of other marginal productions.

Table 49: Acquisitions of |bl| and |pl| Clusters (Word-Initial)

Accurate production	768	92%
Epenthesis	38	5%
C2 deletion	5	<1%
Reduction	7	<1%
Other	19	2%
Total attempted	837	100%

Figure 17 illustrates these patterns. Nura acquired |bl| and |pl| clusters quickly, although she did not attempt word containing these clusters during the very early few recording sessions (from 3;11.11 to 4;00.19). After that, she had little to no difficulty producing these clusters, from 4;00.30 onward. Note as well a resurgence in epenthesis cases at 4;08.13 and 4;08.29; we discuss this observation below.

Figure 17: Acquisition of |bl| and |pl|



As reported in Table 50, the data on |bl| and |pl| clusters almost entirely come from the word-initial context, given that Nura attempted only five |pl| or |bl| onset clusters in non-initial position.

Table 50: |bl| and |pl| (3;11.11 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	832		5	
Accurate production	763	92%	5	100%
Epenthesis	38	5%		
C2 deletion	5	<1%		
Reduction	7	<1%		
Other	19	2%		

Representative examples are given below with accurate and epenthesized word-initial productions in (23), and accurate productions in word-medial position in (24).

(23) Word-initial Context

a. Accurate Production

i. *play* |ˈpleɪ| → [ˈplɛ] 4;08.13

ii. *please* |ˈpliːz| → [ˈpliːz] 4;03.08

b. Epenthesis

i. *blew* |ˈbluː| → [bəˈluː] 4;08.13

ii. *blue* |ˈbluː| → [bəˈluː| 4;08.13

(24) Word-medial Contexts (Accurate Productions)

airplane |ˈɛɹˌpleɪn| →[ˈɛɹˌpleɪn] 5;00.28

problem |ˈpɹɑbləm| → [ˈpɹɑbləm| 5;11.16

Because the word-medial productions started to emerge at a later age within the dataset, there is no way to know if Nura would have epenthesized a vowel within these clusters during subsequent stages.

As illustrated in Figure 17, there is a spike in vowel epenthesis between 4;08.13 to 4;08.29. As we can see from Table 51, Nura epenthesized more than half of her target clusters during this period, all of which were attempted in word-initial position, in words such as *play, please, blue, blow, blew, bless*. Note that most of these cases of epenthesis came from Nura's attempts at |bl| (13 out of 23).

Table 51: |bl| and |pl| (4;08.13 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	35		0	
Accurate production	8	23%		
Epenthesis	23	66%		
Other	4	11%		

In sum, Nura acquired the ability to product |bl| and |pl| clusters very early, by 4;00.30. However, her productions were sporadically affected by vowel epenthesis between the two consonants of the target cluster, a trend that mostly affected |bl| clusters throughout the dataset.

4.1.2 |kl| and |gl| Clusters

Consistent with Nura's acquisition of |bl| and |pl|, the vast majority of her attempts at |kl| and |gl| clusters resulted in accurate productions. As we can see in Table 52, out of the total 424 attempted productions, 347 (82%) were accurate. We also observe 12% epenthesis, 3% C2 substitution, and 2% C2 deletion as well as 2% of other production variants scattered across the dataset.

Table 52: Acquisition of |kl| and |gl| Clusters

Accurate production	347	82%
Epenthesis	49	12%
C2 Substitution	12	3%
C2 Deletion	7	2%
Other	9	2%
Total attempted	424	100%

As we can see in Figure 18, Nura began to accurately produce these clusters very early on, and seemingly without difficulty, in spite of some variations during the early recording sessions, including vowel epenthesis. However, at 4;08.13 and 4;08.29, similar to what we saw for |bl| and |pl| clusters, we observe a resurgence of epenthesis cases. We describe these two stages in more detail below.

Figure 18: Acquisition of |kl| and |gl|

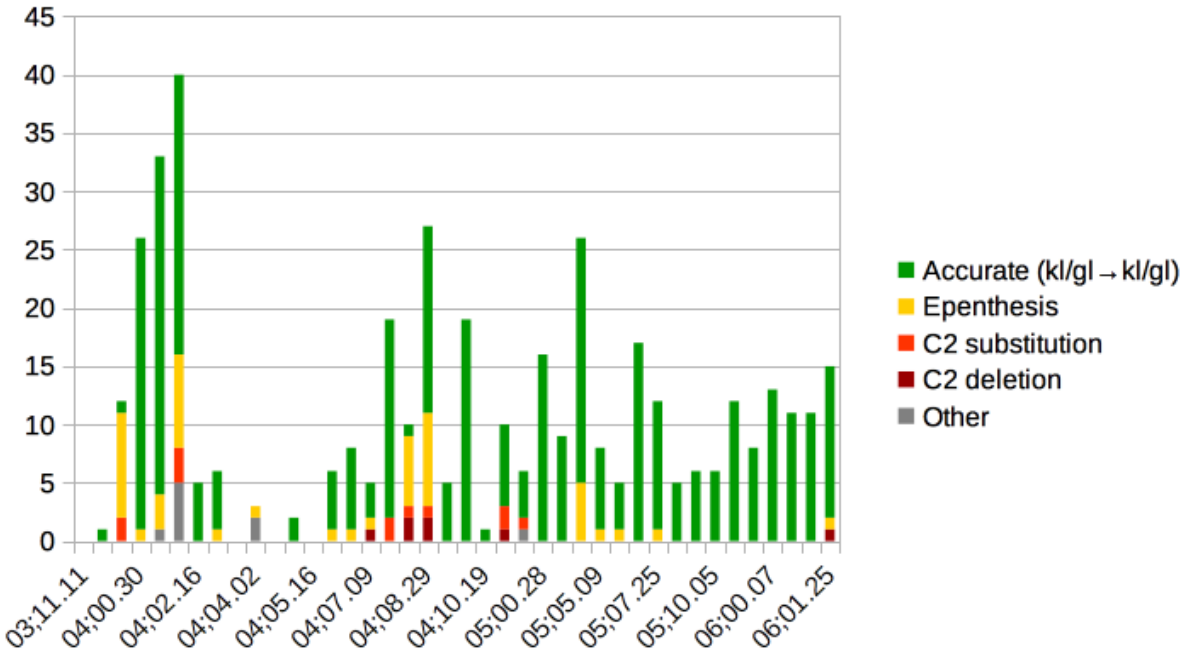


Table 53 breaks down these data across the word-initial and word-medial contexts. As we can see, between 3;11.11 to 4;08.29, 80% of Nura's attempts at word-initial |kl| and |gl| were accurate with little variability in her productions, in addition to 13% of epenthesis, less than 1% of C2 substitution, 4% of C2 deletion, as well as 3% of other productions. In contrast to this, Nura's accuracy rate in word-medial context was as low as 19%, and vowel epenthesis as the main pattern of her productions. We can see that Nura attempted more clusters in word-initial position, but very few attempts word-medially.

Table 53: |kl| and |gl| (3;11.11 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	176		32	
Accurate production	140	80%	6	19%
Epenthesis	23	13%	17	53%
C2 substitution	1	<1%	2	6%
C2 deletion	7	4%	4	13%
Other	5	3%	3	9%

Representative examples are given in below. Example (25) illustrates the main (accurate) pattern in word-initial context. Example (26) illustrates the more variable patterns in word-medial context, marked by variation between accurate production and epenthesis.

(25) Word-initial Context (Accurate Production)

a. *close* |ˈklouz| → [ˈklouz] 4;02.02

b. *glasses* |ˈglæsəz| → [ˈglæs] 4;07.30

(26) Word-medial Contexts

a. Accurate Production

i. *chocolate* |ˈʧɑklət| →[ˈtɑklət] 4;06.18

ii. *likely* |ˈlaikli| →[ˈlaikli] 5;02.16

b. Epenthesis

i. *necklace* |ˈnɛkləs|→[ˈnɛkolɛtʰ] 4;08.13

ii. *igloo* |ˈɪglu|→[ˈɪgəluː] 5;04.11

As we mentioned earlier, the spike in epenthesis between 4;08.13 and 4;08.29 is one of the evident patterns in Figure 18, consistent with what we saw for |bl| and |pl|.

Epenthesis also occurred in both initial and medial positions, and was not related to particular words.

Table 54: |kl| and |gl| (4;08.13 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	24		13	
Accurate production	17	71%	0	
Epenthesis	6	25%	8	62%
C2 substitution	1	4%	4	31%
C2 deletion	0		1	7%

Nura mastered |kl| and |gl| by 4;09.19, as shown in Table 55 below, where Nura's word-initial productions clearly settled. Similarly, word-medial epenthesis rate was much below 20% during this stage.

Table 55: |kl| and |gl| Mastery Stage (4;09.19 onward)

	Word-initial	%	Word-medial	%
Number of attempts	176		40	
Accurate production	173	98%	28	70%
Epenthesis	1	1%	8	20%
C2 substitution	2	1%	3	8%
C2 deletion	0		0	
Other	0		1	2%

4.1.3 /fl/ Clusters

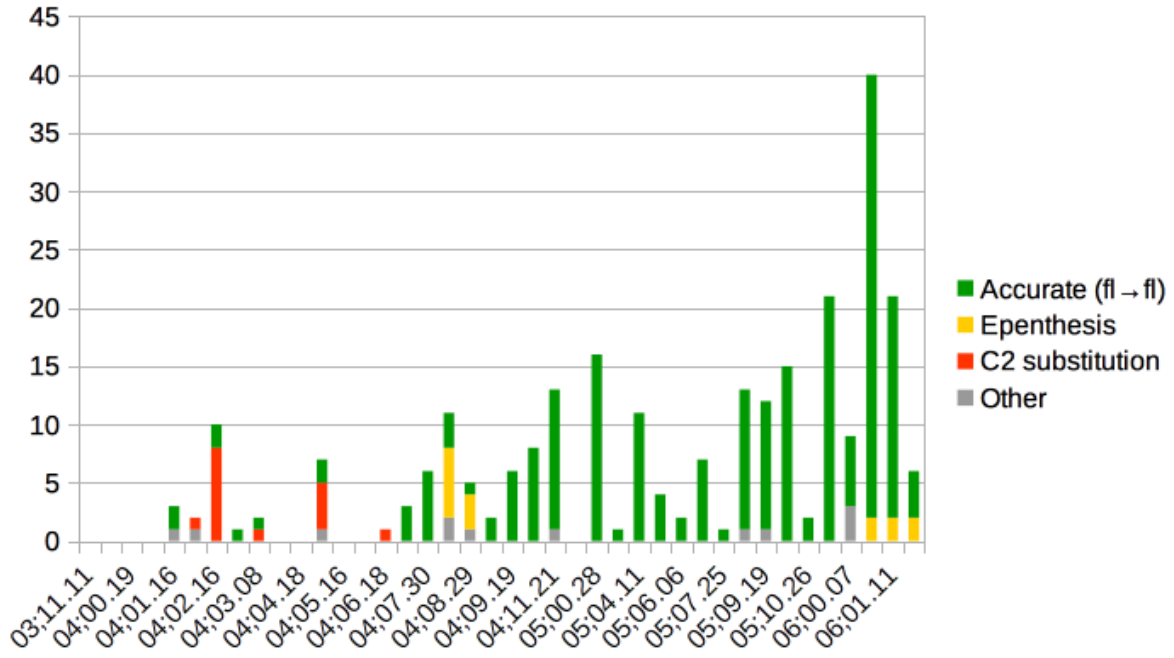
As we can see from Table 56, Nura's overall accuracy in her productions of /fl/ is 84%. In addition, we note 6% epenthesis, 6% C2 substitution in addition to 4% marginal productions.

Table 56: Acquisition of /fl/ Clusters

Accurate production	219	84%
Epenthesis	15	6%
C2 Substitution	15	6%
Other	12	4%
Total attempted	261	100%

Nura' s developmental timeline for /fl/ is provided in Figure 19, where we can see variability from the very early sessions until 4;08.29. After that, Nura was able to produce the target cluster in a consistent and accurate manner.

Figure 19: Acquisition of |fl|



Consistent with other C+lateral clusters, Nura attempted mainly |fl| in word-initial positions. As shown in Table 57, between 4;01 and 4;08.29, Nura's accuracy rate is 47% in word-initial position, and epenthesis is 22%. In contrast, the accuracy rate is 27% in word-medial position. Note, however, the general scarcity of attempts, especially in word-medial position.

Table 57: |fl| (4;01 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	36		15	
Accurate production	17	47%	4	27%
Epenthesis	8	22%	1	7%
C2 substitution	7	20%	8	53%
Other	4	11%	2	13%

Representative examples are given below, with accurate productions and epenthesized productions in word-initial context in (27), while (28) illustrates C2 substitution in the word-medial context observed during the initial stage.

(27) Word-initial Context

a. Accurate Production

i. *flower* |ˈflaʊər| →[ˈflɑʊəɹ] 4;08.13

ii. *flying* |ˈflaɪŋ| →[ˈflaɪjɪ] 4;08.13

b. Epenthesis

i. *flying* |ˈflaɪŋ| →[ˈfəˈlaɪːje] 4;08.13

ii. *flying* |ˈflaɪŋ| →[fəˈlaɪdɪ] 4;08.13

(28) Word-medial Contexts (C2 substitution)

a. *butterfly* |ˈbʌɾəɹˌflaɪ| →[ˈbɑɹˌfɹaɪ] 4;02.16

b. *butterfly* |ˈbʌɾəɹˌflaɪ| →[ˈˈbʌɾəɹˌfɹaɪː] 4;02.16

We also notice in Figure 19 a spike in epenthesis between 4;08.13 and 4;08.29, as we have seen with previous C+lateral clusters, as detailed in Table 58, again in spite of the low number of attempts overall.

Table 58: |fl| (4;08.13 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	12		4	
Accurate production	3	25%	1	25%
Epenthesis	6	50%	1	25%
C2 substitution				
Other	3	25%	2	50%

Nura thus mastered the |fl| cluster by 4;08.29. As we can see from Table 59, during the mastery stage, she was 92% accurate in word-initial context, and 100% accurate in word-medial contexts.

Table 59: |fl| Mastery Stage (4;08.29 to 6;01.25)

	Word-initial	%	Word-medial	%
Number of attempts	153		57	
Accurate production	141	92%	57	100%
Epenthesis	6	4%	0	
C2 substitution	0		0	
Other	6	4%	0	

Representative examples from this mastery stage are given below.

(29) Word-initial Context (Accurate Production)

a. *flower* |ˈflaʊər| →[ˈflɑʊəɹ] 4;09.19

b. *floor* |ˈflɔɹ| →[ˈflɔɹ] 6;00.28

(30) Word-medial Context (Accurate Production)

a. *butterfly* |ˈbʌɾəɹˌflaɪ| →[ˈbʌɹˌflaɪ] 5;00.28

b. *dragonfly* |ˈdɹægənˌflaɪ| →[ˈdɹægəˌflaɪ] 6;00. 28

4.1.4 Summary of C+lateral Clusters

In summary, Nura acquired C+lateral cluster very rapidly. She however displayed a variable pattern of epenthesis, which created a U-shaped effect in her development of Cl clusters. Epenthesis was indeed one of the most prominent patterns observed, in

particular between 4;08.13 and 4;08.29, across all cluster types. Accuracy in cluster productions spiked across all Cl cluster types after that age.

4.2 Cɹ Clusters

Similar to her acquisition of Cl cluster, Nura displayed variable patterns in her development of Cɹ clusters. However, she did not display the type of epenthesis pattern we saw above. At the segmental level, her productions were also in line with her acquisition of |ɹ| in singleton onsets, as Nura variably replaced |ɹ| by |l| and |w| during the initial stage of acquisition. As we will also see, cases of cluster reduction also tended to occur later on during the observed period.

4.2.1 |pɹ| and |bɹ| Clusters

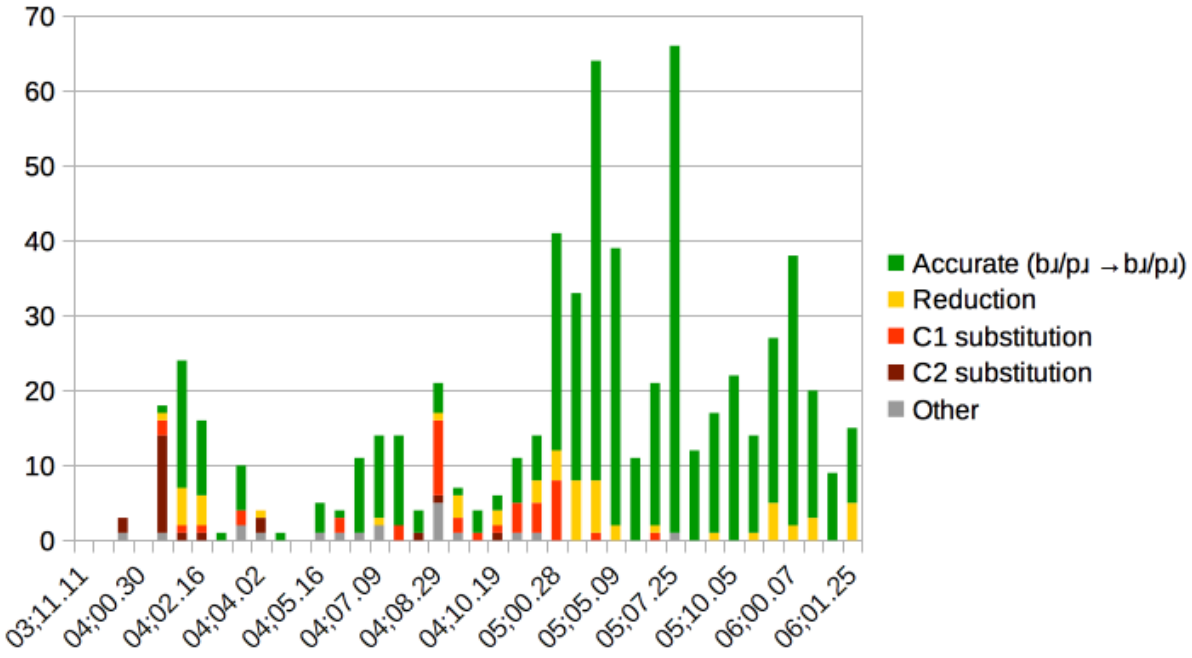
Nura displayed a number of variable patterns in her acquisition of |pɹ| and |bɹ| clusters. As we can see in Table 60, Nura attempted at |pɹ| and |bɹ| 641 times throughout the documented period, of which 78% resulted in accurate productions. We also observe a 9% rate of reduction, 7% of C1 substitution, 3% C2 substitutions, as well as 3% of other marginal forms. In contrast to what we saw for Cl clusters, epenthesis was not a prominent pattern for Cɹ clusters.

Table 60: Acquisition of |pɹ| and |bɹ| Clusters

Accurate production	498	78%
Reduction	60	9%
C1 substitution	42	7%
C2 substitution	22	3%
Other	19	3%
Total Attempted	641	100%

Nura's early attempts at |pɹ| and |bɹ| clusters displayed a large amount of variability, as illustrated in Figure 20, especially between 4;00 and 5;00.28. C1 substitution was also substantial between 4;08.29 and 5;00.28, followed by a stage marked by variable patterns of cluster reduction observed until 5;05.09.

Figure 20: Acquisition of |pɹ| and |bɹ|



As shown in Table 61, Nura attempted these clusters more often in word-initial position during the initial stage (3;11.11 to 5;00.28), where we also observe the largest range of variable outcomes.

Table 61: |pɹ| and |bɹ| (3;11.11 to 5;00.28)

	Word-initial	%	Word-medial	%
Number of attempts	216		17	
Accurate Production	120	56%	7	41%
Reduction	22	10%	6	35%
C2 substitution	21	10%	0	
C1 substitution	38	18%	4	24%
Other	15	6%	0	

As we saw in Figure 20, C2 substitution was very prominent at 4;01.16, where all of the 13 instances of |ɹ| were replaced by either |l| or |w|, consistent with the developmental pattern of |ɹ| in singleton onsets (see section 2.3).

Between 4;08.29 to 5;00.28, 17 out of the total 24 C1 substitutions came from only two two words, namely *princess* and *pretty*, with initial |pɹ| produced as |ɸ| or |f|.

Reduction then became the most prominent source of variations during the next two recording sessions, especially in word-medial position. However, because these reductions all came from a unique word (*library*), they cannot be taken as generally representative of Nura's phonology.

We exemplify these patterns in (31), showing the word-initial context, and the word-medial context in (32).

(31) Word-initial Context

a. Accurate Production

i. *brown* |ˈbɹaʊn| →[ˈbɹaʊn] 4;02.02

ii. *broken* |ˈbɹoʊkən| → [ˈbɹoʊkən] 4;07.09

b. C1 Substitution

i. *princess* |ˈpɹɪnsɛs| →[ˈfɹɪnsɛs] 4;11.21

ii. *pretty* |ˈpɹɪtiː| →[ˈfɹɪt̰iː] 5;00.07

(32) Word-medial Context

a. *surprise* |səˈpɹaɪz| → [səˈpɹaɪz] 5;00.28 (accurate)

b. *library* |ˈlaɪˌbɹɛɹiː| → [ˈlaɪˌbɛɹiː] 5;00.07 (reduction)

From there, Nura mastered |pɹ| and |bɹ| clusters in both word-initial and word-medial contexts, as we can see from Table 62. Apart from accurate productions, reduction was the only noticeable pattern at this stage. However, because 81% of the cases of reduction (25 out of 31) came from the single word *pretend/pretending* as in example (33b) below, we cannot consider this to be representative of Nura's phonology at this stage.

Table 62: |pɹ| and |bɹ| (5;00.28 to 6;01.25)

	Word-initial	%	Word-medial	%
Number of attempts	372		36	
Accurate Production	339	91%	31	86%
Reduction	31	8%	4	11%
C2 substitution	0		0	
C1 substitution	1	<1%	1	3%
Other	1	<1%	0	

We provide illustrative examples of the patterns described above in (33) and (34).

(33) Word-initial positions

a. Accurate Productions

i.	*brush*	|ˈbɹʌʃ| →[ˈbɹʌθ]	5;02.16
ii.	*pretend*	|pɹiːˈtɛnd| →[pɹiːˈtɛnd]	5;04.11

b. Reduction

i.	*pretend*	|pɹiːˈtɛnd| →[pɹiːˈtɛnd]	5;04.11
ii.	*broke<n>*	|ˈbɹoʊk| →[ˈboʊk]	5;04.11

The same logic applied to the word-medial context, still with the word *library* yielding all of the four cases of reduction in this position, as illustrated in (34b).

(34) Word-medial Productions

a. Accurate Productions

i.	*surprise*	|səˈpɹaɪz| → [səˈpɹaːɪːz]	6;00.28
ii.	*celebrate*	|ˈsɛləˌbɹeɪt| → [ˈsɛləˌbɹeɪt]	5;11.16

b. Reduction

library	|ˈlaɪˌbɹɛɹiː| → [ˈlaɪˌbɛɹiː]	5;05, 09

This concludes our description of Nura's acquisition of |pɹ| and |bɹ|. Overall, Nura's substitution pattern is in line with her acquisition of |ɹ| in singleton onsets. Different from Cl clusters, we did not observe epenthesis in her acquisition.

4.2.2 |tɹ| and |dɹ|

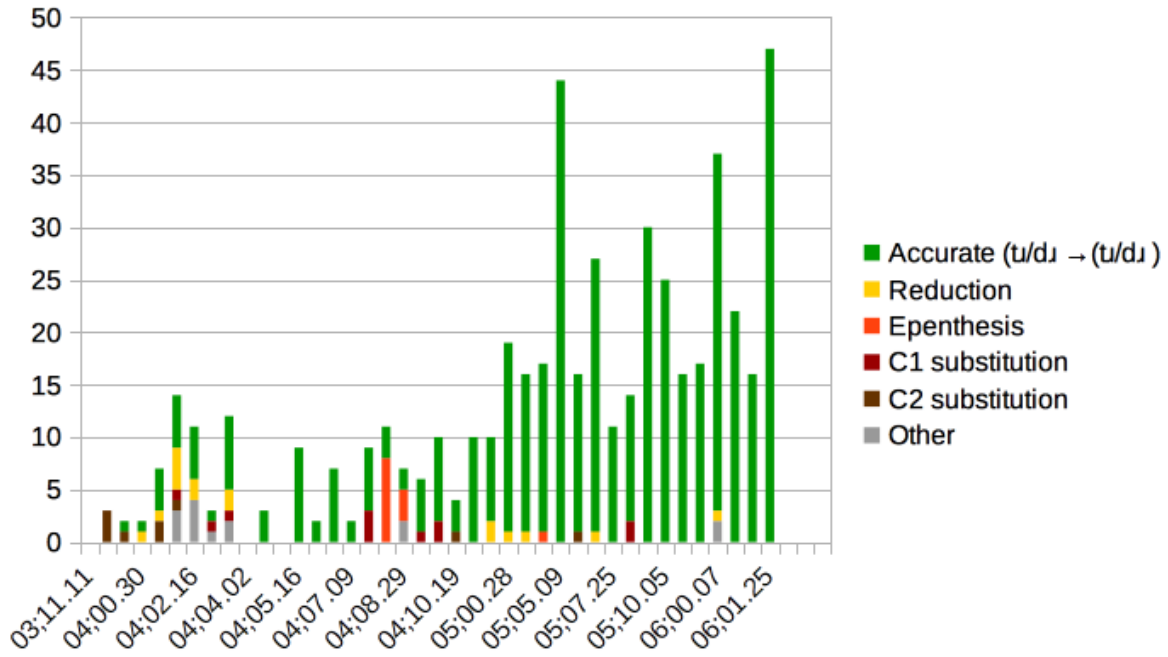
As we can see in Table 63, Nura made a total of 518 attempts at |tɹ| and |dɹ| clusters. Accuracy rate across the data is 88%, with marginal patterns of reduction (3%), epenthesis (2%), C1 substitution (2%), C2 substitution (2%), and other marginal productions (3%) observed across the dataset.

Table 63: Acquisition of |tɹ| and |dɹ| Clusters

Accurate production	456	88%
Reduction	16	3%
Epenthesis	12	2%
C1 substitution	11	2%
C2 substitution	9	2%
Other	14	3%
Total Attempted	518	100%

As we can see from Figure 21, Nura displayed variable patterns between 3;11.25 and 4;04.02, in particular, cluster reduction and C2 substitution. After that, she mastered |tɹ| and |dɹ|, despite some epenthesis patterns between 4;08.13 and 4;08.29, similar to those observed for Cl clusters above.

Figure 21: Acquisition of |tɹ| and |dɹ|



Reduction and C2 substitution were thus the dominant patterns between 3;11.11 to 4;04.02, with the majority of all examples occurring in the word-initial contexts, as shown in Table 64.

Table 64: |tɹ| and |dɹ| (3;11.11 to 4;04.02)

	Word-initial	%	Word-medial	%
Number of attempts	26		2	
Accurate Production	10	38%	1	
Reduction	6	23%		
C2 substitution	7	27%		
C1 Substitution	1			
Other	2		1	

Nura substituted [w] for |ɹ| in all of the C2 substitution cases. This is consistent with what we observed for |ɹ| in singleton onset. Similarly, cluster reduction also only occurred in word-initial context at this initial stage. Representative examples are given below.

(35) C2 Substitution

a. *tree* |ˈtɹiː| →[ˈtʰwiː] 3;11.28

b. *dress* |ˈdɹɛs| →[ˈdwɛːs] 4;02.02

(36) Reduction

a. *triangle* |ˈtɹaɪˌæŋgəl| →[ˈtaɪˌæŋgoʊ] 4;01.16

b. *tree* |ˈtɹiː| →[ˈtiː] 4;02.02

One of the most prominent pattern illustrated in Figure 21 is epenthesis, especially between 4;08.13 and 4;08.29. The 11 cases of epenthesis observed occurred in the word-initial context, and all involved the cluster |dɹ|, not its voiceless counterpart |tɹ|. This is resemblance of what we observed above in Nura's development of |bl| and |pl|.

(37) Epenthesis

a.	*dress*	|ˈdɹɛs| →[dəˈɹɛs]	4;08.29
b.	*draw*	|ˈdɹɑ| →[dəˈɹɑ]	4;08.13

In summary, Nura's acquisition of |tɹ| and |dɹ| also presented a similar pattern with other consonant clusters we have described earlier. Nura also replaced |ɹ| by [w] in her early attempts at the cluster, consistent with her acquisition of |ɹ| in singleton onsets.

4.2.3 |kɹ| and |gɹ| Clusters

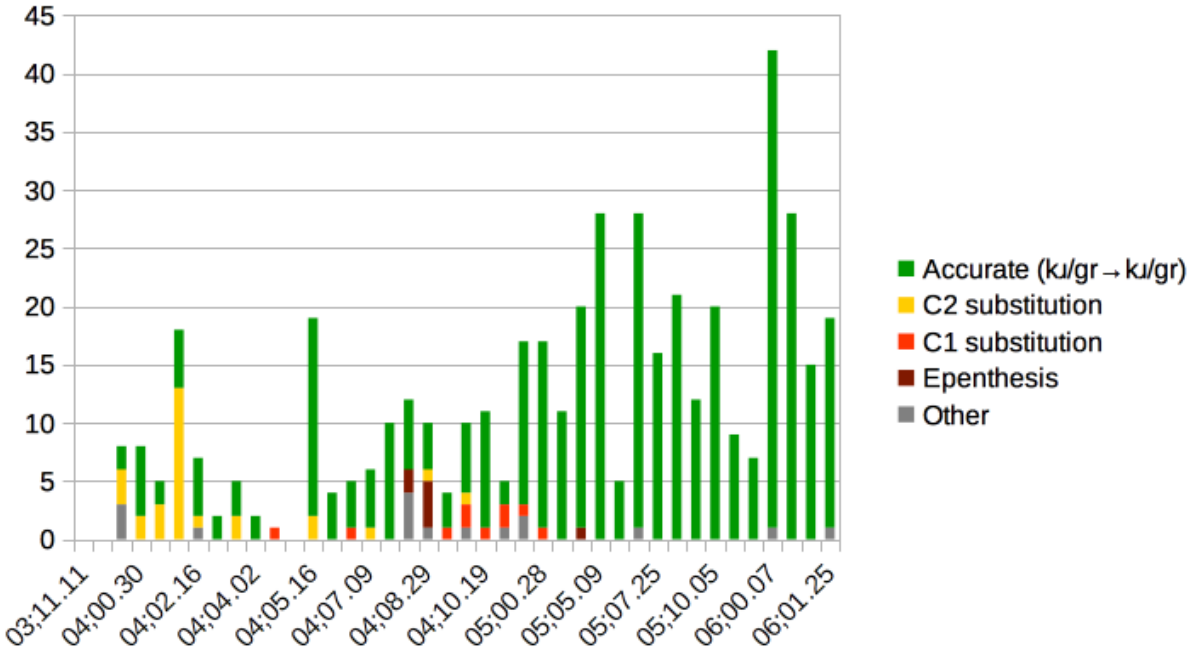
Out of 467 attempts at |kɹ| and |gɹ| clusters, Nura's overall accuracy rate was 88%. C2 substitution, which consisted of 6% of the total number of attempts, was the most prominent pattern overall.

Table 65: Acquisition of |kɹ| and |gɹ| Clusters

Accurate production	405	88%
C2 substitution	29	6%
C1 substitution	10	2%
Epenthesis	7	1%
Other	16	3%
Total Attempted	467	100%

Nura acquired these clusters at around 4;05.16, as illustrated in Figure 22. Before that, she went through the stage of C2 substitution, as we noted above for |tɹ| and |dɹ|. After 4;05.16, Nura was able to produce these target productions consistently in spite of some minor declinations from the norm mostly attested between 4;07.09 and 5;00.28.

Figure 22: Acquisition of |kɹ| and |gɹ|



As we can see from Table 66, C2 substitutions to [w] occurred between 3;11.11 to 4;05.16, again with virtually all examples from the word-initial position. Note, however, that out of the 26 |ɹ| → [w] substitutions, 23 came from a single word; *green* |ˈgɹiːn|.

Table 66: |kɹ| and |gɹ| (3;11.11 to 4;05.16)

	Word-initial	%	Word-medial	%
Number of attempts	74		1	
Accurate production	43	58%	1	
C2 substitution	26	35%		
C1 substitution	1			
Epenthesis	0			
Other	4			

Representative examples are given in example (38).

(38) Word-initial Context

a. Accurate Productions

i. *crown* |ˈkɹaʊn| → [ˈkɹʌːŋ] 4;02.02

ii. *crayons* |ˈkɹeɪˌɑnz| → [ˈkɹaɪn] 4;03.08

b. C2 Substitution

i. *green* |ˈgɹiːn| →[ˈgwiːn] 4;00.30

ii. *Kristoff* |ˈkɹɪstɑf| →[ˈkwɪstaf] 4;00.19

Similarly, Nura's acquisition of |kɹ| and |gɹ| at the later stage showed similar patterns, and mainly occurred word-initially. As we can see from Table 67, Nura made 332 word-initial attempts and 60 word-medial attempts at the target clusters.

Table 67: |kɹ| and |gɹ| (4;05.16 to 6;01.25)

	Word-initial	%	Word-medial	%
Number of attempts	332		60	
Accurate production	302	91%	59	98%
C2 substitution	4			
C1 substitution	9	3%		
Epenthesis	7			
Other	10		1	

Representative examples are provided below.

(39) Word-initial Productions

a. Accurate Productions

i. *cream* |ˈkɹiːm| → [ˈkɹiːn] 4;09.12

ii. *crying* |ˈkɹaɪɪŋ| → [ˈkɹaɪɪŋ] 6;01.11

b. C1 substitution

i. *cracker* |ˈkɹækəɹ| → [ˈfɹɛkəːɹ] 4;09.12

ii. *grey* |ˈgɹeɪ| → [ˈvɹeɪ] 4;11.21

4.2.4 |fɹ| and |vɹ|

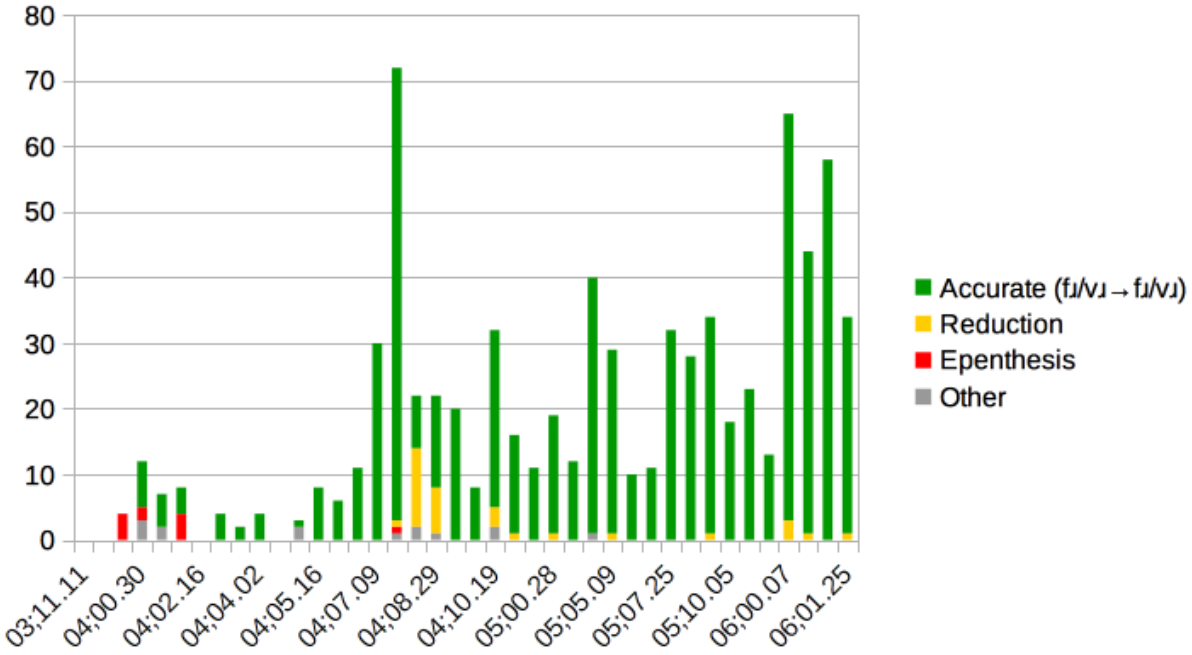
As we can see in Table 68, Nura made 772 attempts at |fɹ| and |vɹ| clusters, 93% of which resulted in accurate productions. The overall data also contains 4% of cluster reduction and 3% of marginal productions.

Table 68: Acquisition of |fɹ| and |vɹ| Clusters

Accurate production	715	93%
Reduction	32	4%
Other	25	3%
Total Attempted	772	100%

Similar to the acquisition of singleton onset |f|, Nura acquired |fɹ| very early on, as shown in Figure 23. She mastered |fɹ| at 4;00.30. While she did not have any difficulties in the acquisition of this onset cluster, Nura produced a few cases of epenthesis early on although not during the same time period during which she produced the bulk of epenthesis cases, affecting other clusters. We however observe a noticeable pattern of cluster reduction, the timing of which is overlapping with that of epenthesis affecting other clusters between 4;08.13 and 4;08.29.

Figure 23: Acquisition of |fɹ| and |vɹ|



As shown in Table 69, epenthesis during the initial stage of acquisition of |fɹ| and |vɹ| only occurred in word-initial positions. Of Nura's 31 attempts at the target clusters, 32% resulted in epenthesis, all of which coming from target |fɹ| clusters.

Table 69: Epenthesis in |fɹ| and |vɹ| (3;11.11 to 4;02,16)

	Word-initial	%	Word-medial	%
Number of attempts	31		0	
Accurate production	16	52%		
Reduction	0			
Epenthesis	10	32%		
Other	5	16%		

We provide representative example of these early productions in (40).

(40) Word-initial |fɹ|

a. Accurate Productions

i. *frog* |ˈfɹɑg| → [ˈfɹɑg] 4;00.30

ii. *frozen* |ˈfɹoʊzən| → [ˈfɹoʊzən] 4;01.16

b. Epenthesis

i. *fridge* |ˈfɹɪʤ | → [ˈfʌɹʌt] 4;02.02

ii. *frog* |ˈfɹɑg| → [ˈfʌɹlɑg] 4;00.30

As we can also see in Figure 23, Nura display accurate productions between 4;01 and 4;07. After that, Nura went through a stage marked by sporadic cluster reductions, with a spike between 4;08.13 and 4;08.29. However, we observed that 16 out of the 17 reduction cases attested during this spike stage came from the word *every* and its derivatives (e.g. *everything, everybody, everyone, everyday*).

Table 70 breaks down these observations between the word-initial and word-medial contexts.

Table 70: Reduction in |fɹ| and |vɹ| (4;07.30 to 6;01.25)

	Word-initial |fɹ|	%	Word-medial	%
Number of attempts	275		337	
Accurate production	256	93%	312	93%
Reduction	10	4%	21	6%
Epenthesis	1		0	
Other	8		4	

We give some examples for both word-initial and word-medial contexts below.

(41) Word-initial
- a. Accurate Productions
  - i. *frog* |ˈfɹɑg| → [ˈfɹɑg] 4;00.30
  - ii. *frozen* |ˈfɹoʊzən| → [ˈfɹoʊzən] 4;01.16
- b. Reduction
  - i. *friends* |ˈfɹɛnz| → [ˈfɛɹnz] 4;10.19
  - ii. *frozen* |ˈfɹoʊzən| → [ˈfoʊzɪn] 4;08.13

(42) Word-medial
- a. Accurate Production
  - i. *favourite* |ˈfeɪvɹət| → [ˈfeɪvɹət] 5;05.09
  - ii. *different* |ˈdɪfɹənt| → [ˈdɪfɹənt] 5;10;05
- b. Reduction (Lexical Effect)
  - i. *everyone* |ˈɛvɹiːˌwʌn| → [ˈævəˌwʌ] 4;08.13
  - ii. *everything* |ˈɛvɹiːˌθɪŋ| → [ˈaviːˌθɪŋ] 4;08.29

4.2.5 |θɹ| Cluster

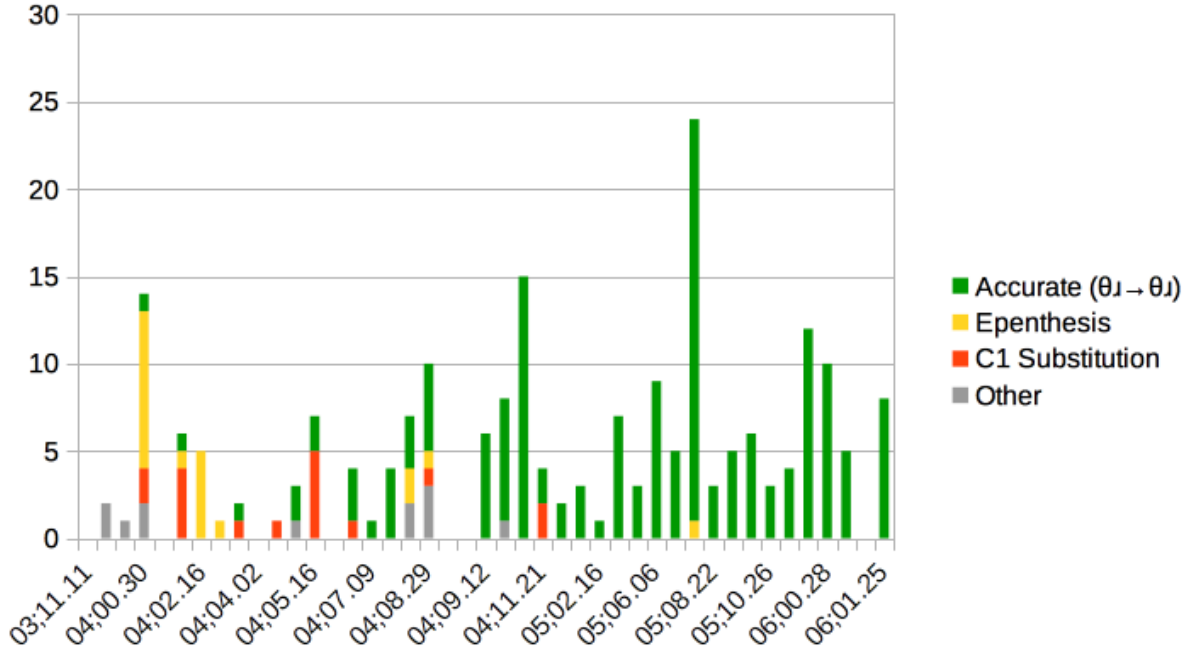
Nura only attempted |θɹ| 211 times in our dataset. As we can see from Table 71, the majority of these attempts resulted in accurate productions (77%). 9% displayed vowel epenthesis, 8% C1 substitution, with the remaining 6% other idiosyncratic productions across the data.

Table 71: Acquisition of |θɹ| Clusters

Accurate production	162	77%
Epenthesis	20	9%
C1 Substitution	17	8%
Other	12	6%
Total Attempted	211	100%

Figure 24 represents Nura's developmental patterns for |θɹ| across the observation period. We observe a lot of variation in her early attempts, which mostly consisted of epenthesis and C1 substitution. Nura mastered |θɹ| at 4;08.29, after which she produced the target phone accurately and in a consistent manner.

Figure 24: Acquisition of |θɹ|



Nura's productions during the early stage are detailed in Table 72.

Table 72: |θɹ| (3;11.11 to 4;08.29)

	Word-initial	%	Word-medial	%
Number of attempts	67		2	
Accurate production	22	33%	2	100%
C1 substitution	14	21%		
Epenthesis	20	30%		
Other	11			

Epenthesis came the word *three* in 19 out of the total 20 cases. This same word also accounts for 14 cases of C1 substitution, where |θ| was mainly replaced by [s], in

addition to [z, f, ʃ]. These patterns are consistent with the acquisition of |θ| in singleton onsets described in 2.1.

(43) Word-initial Context

a. Accurate Productions

i. *throw* |ˈθɹoʊ| → [ˈθɹoʊ] 4;08.29

ii. *three* |ˈθɹiː| → [ˈθɹiː] 4;07.30

b. Epenthesis

i. *three* |ˈθɹiː| → [ˈsəliː] 4;02.16

ii. *three* |ˈθɹiː| → [θəˈwɪ] 4;08.13

c. C1 substitution

i. *three* |ˈθɹiː| → [ˈsɹiː] 4;03.08

ii. *three* |ˈθɹiː| → [ˈzɹiː] 4;05.16

After 4;08.29, Nura consistently produced target-like productions. As we can see from Table 73, her accuracy rate is 97% during this second (mastery) stage.

Table 73: |θɹ| Mastery (4;08.29 to 6;01.25)

	Word-initial	%	Word-medial	%
Number of attempts	142		0	
Accurate production	138	97%		
C1 substitution	2			
Epenthesis	1			
Other	1			

Note as well that all of Nura's accurate productions of |θɹ| during the mastery stage also came from the world *three*.

(44) Accurate Production (word-initial)

three |ˈθɹiː| → [ˈθɹiː] 5;04.11

In sum, Nura acquired |θɹ| relatively late, at around 4;08.29. Nura replaced |θ| by |s|, and |ɹ| by |l| or [w], in line with her development of these consonants in singleton onsets. Nura also epenthesized a vowel to break up this cluster during the earliest stage.

4.3 Consonant+Glide Clusters

In this section, we describe Nura's acquisition of consonant+glide clusters. Nura attempted various consonant+glide combination, such as |kw, gw|, |tw, dw|, and |mw|. However, |kw, gw| and |tw, dw| were by far the most frequently attempted of these clusters (159 out of 171 tokens). We do not have sufficient data for other clusters. We thus decided to only describe Nura's acquisition of |kw, gw|,and |tw, dw|.

4.3.1 |kw| and |gw| Clusters

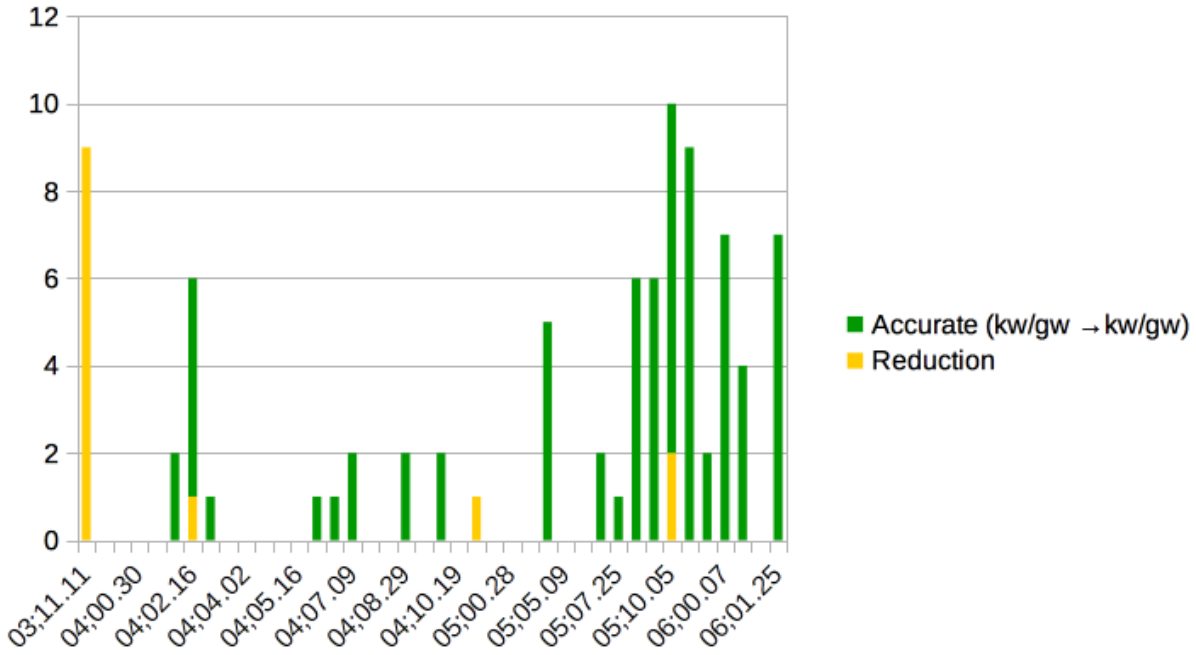
As reported in Table 74, Nura attempted |kw| and |gw| clusters a total of 86 times throughout the observation period, all of which were observed in word-initial position. The majority of these productions resulted in accurate productions (85%), the remaining 15% of Nura's attempts resulting in cluster reduction.

Table 74: Acquisition of |kw| and |gw| Clusters

Accurate production	73	85%
Reduction	13	15%
Total Attempted	86	100%

Nura mastered the |kw| cluster early at 4;01.09, as we can see from Figure 25. She displayed cluster reduction very early on, but was quickly able to consistently produce the target cluster.

Figure 25: Acquisition of |kw| and |gw|



As we can in Table 75, all of the reduction pattern occurred in word-initial positions, 75% of which came from the word *quack*.

Table 75: |kw| and |gw| (Word-initial vs. Word-medial)

	Word-initial	%	Word-medial	%
Number of attempts	69		17	
Accurate production	57	83%	16	94%
Reduction	12	17%	1	6%

Below are representative examples of these patterns.

(45) Word-initial

a. Accurate Productions

i.	*quick*	|ˈkwɪk| →[ˈkwɪk]	5;08.22
ii.	*question*	|ˈkwɛstʃən| →[ˈkwɛstʃən]	5;10.05

b. Reduction

i.	*quack*	|ˈkwæk| → [ˈgæk]	3;11.11
ii.	*queen*	|ˈkwiːn| → [ˈkaɪːn]	4;02.16

(46) Word-medial (Accurate Production)

aqua	|ˈɑkwə| → [ˈɑkwə]	5;08.22
backwards	|ˈbækwəɹdz|→ [ˈbækwəɹdz]	6;00.28

4.3.2 |tw| and |dw| Clusters

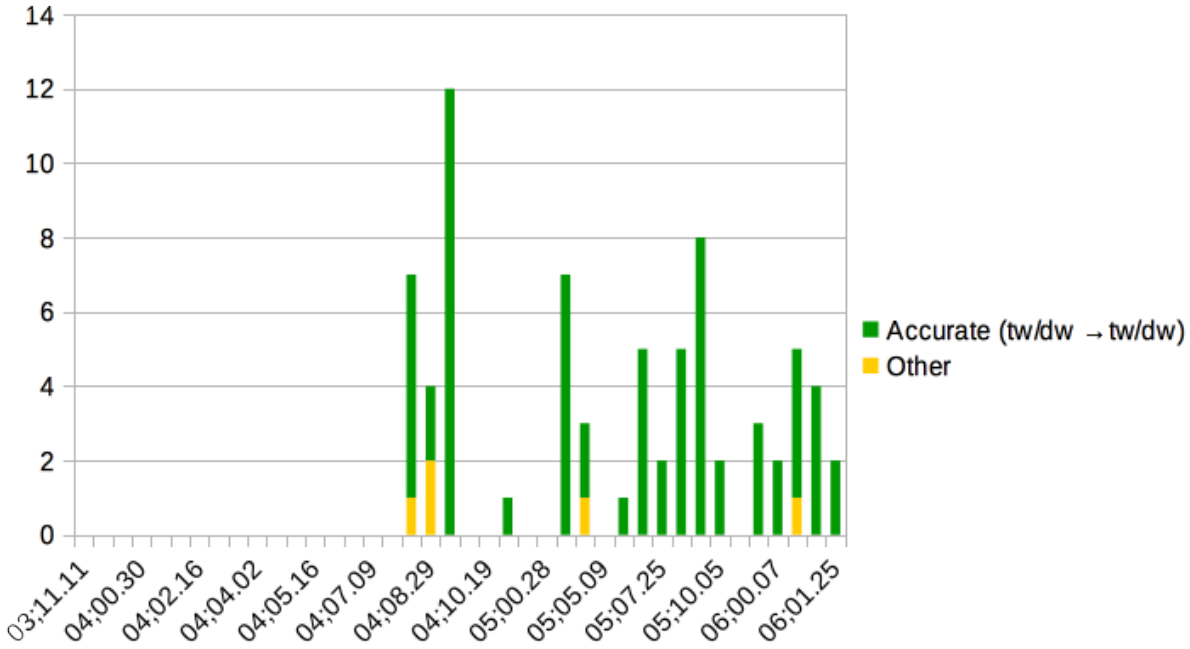
Nura also made very few attempts at |tw| and |dw|, with a total of 73 tokens, as we can see from Table 76. 93% of these attempts resulted in accurate productions, and 7% in other, unsystematic productions.

Table 76: Acquisition of |tw| and |dw| Clusters

Accurate production	68	93%
Other	5	7%
Total Attempted	73	100%

We do not have any data for |tw| and |dw| prior to 4;08. However, Nura was able to produce these clusters from her first recorded attempts.

Figure 26: Acquisition of |tw| and |dw|



Similar to all other consonant clusters, the vast majority of the data come from the word-initial context, as reported in Table 77.

Table 77: |tw| and |dw| (Word-initial vs. Word-medial)

	Word-initial	%	Word-medial	%
Number of attempts	71		2	
Accurate production	68	96%		
Other	3	4%	2	100%

We give representative examples of these contexts below.

(47) Word-initial (Accurate Productions)

a. *twilight* |ˈtwaɪˌlaɪt| → [ˈtwaɪˌjɪtʰ] 4;08.13

b. *twelve* |ˈtwɛlv| → [ˈtwɛl] 4;09.12

This concludes Nura's acquisition of C+glide clusters. Compared to all other consonant clusters, Nura had fewer attempts at these clusters, and mastered them at a relatively late stage, later than she mastered Cɹ clusters but during a period similar to Cl clusters.

4.4 s+Consonant Clusters

In this section, we will see that Nura mastered all sC clusters very early on. Throughout the data descriptions, we will highlight cases of difficulty that manifested themselves across different contexts.

4.4.1 |sp| Cluster

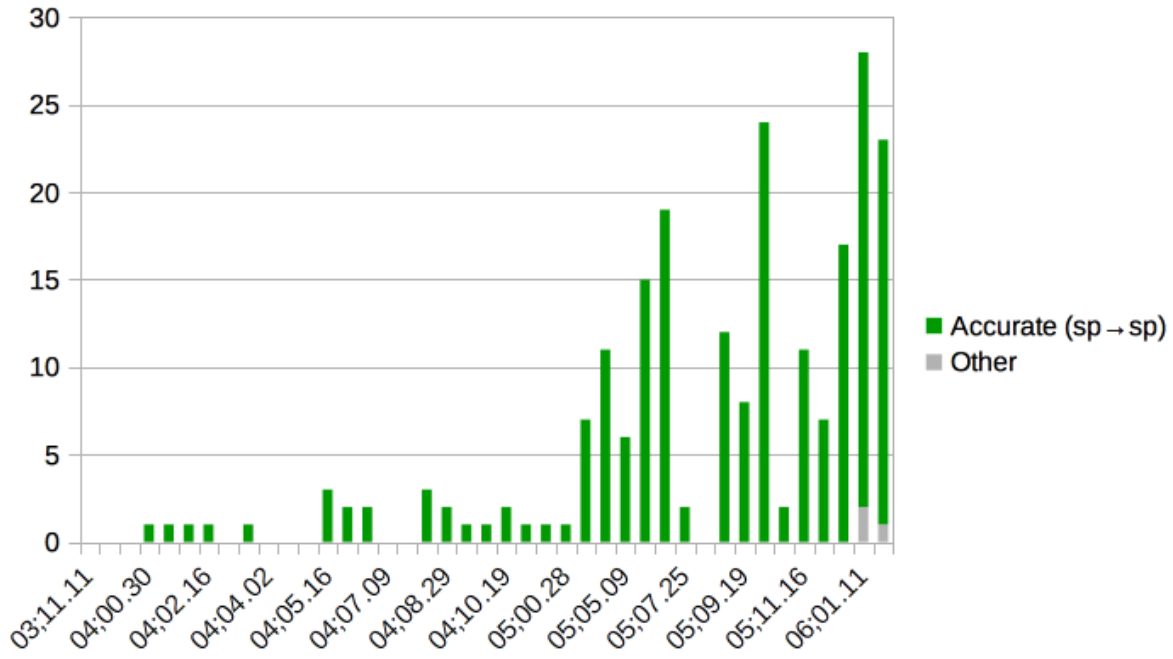
Nura made a total of 216 attempts at |sp| clusters, as reported in Table 78. As we can also see in this table, Nura's overall accuracy rate for this cluster was extremely high, at 99%.

Table 78: Acquisition of |sp| Clusters

	Word-initial	%	Word-medial	%
Number of attempts	216	100%	0	
Accurate production	213	99%		
Other	3	1%		

Indeed, Nura was already able to produce this cluster from her earliest attempts at it, as illustrated in Figure 27. We can claim that she had mastered this cluster already by 4;00.30.

Figure 27: Acquisition of |sp|



Representative examples are given below.

(48) Word-initial (Accurate Productions)

a.	*spoon*	|ˈspuːn| → [ˈspuːn]	4;02.02
b.	*sparkle*	|ˈspɑɹkəl| → [ˈspɑɹkə]	4;08.29

4.4.2 |st| Cluster

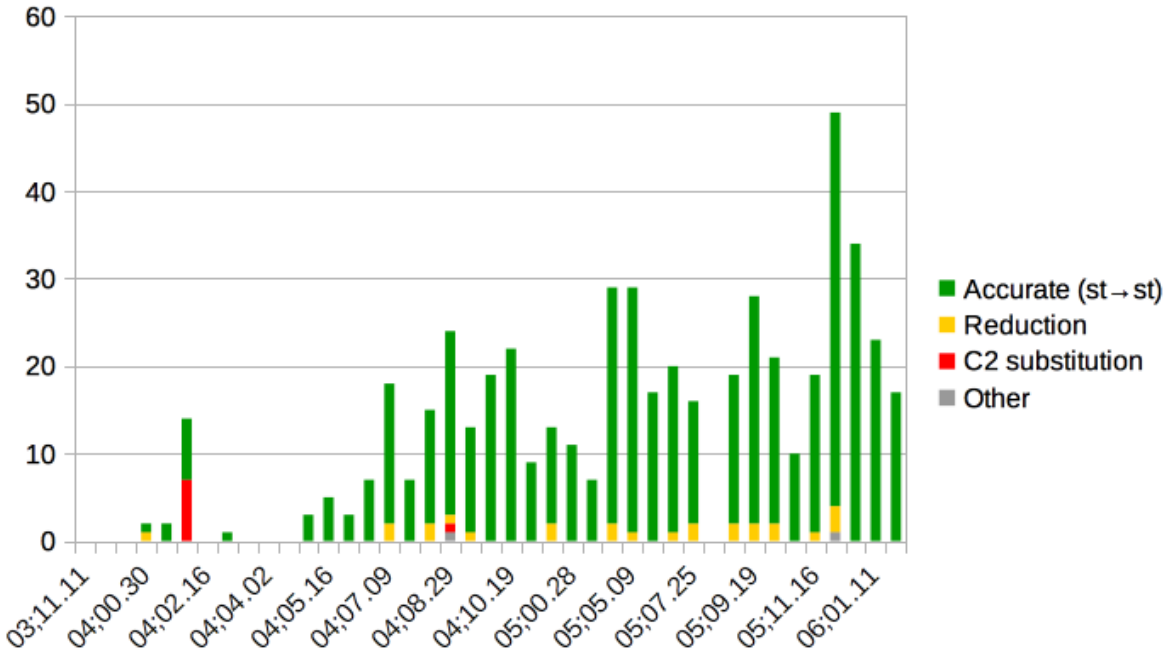
Nura made 526 attempts at |st|, of which 93% resulted in accurate productions, as we can see in Table 79. The remainder of her attempts resulted in cases of reduction and C2 substitution.

Table 79: Acquisition of |st| Clusters

Accurate production	491	93%
Reduction	25	5%
C2 substitution	8	2%
Other	2	<1%
Total attempted	526	100%

Similar to |sp|, Nura acquired |st| very early, almost from earliest attempts, at around 4;00.30, and she was able to consistently produce the target cluster afterwards, in spite of some C2 substitution (4;01), and a handful of cluster reductions observed from 4;07.09 onward.

Figure 28: Acquisition of |st|



As we can see from Table 80, Nura had 472 times of word-initial target cluster, but only 54 in in word-medial positions. Accurate production was the leading pattern in both positions, with a 93% accuracy rate in both cases.

Table 80: |st| (Word-initial vs. Word-medial)

	Word-initial	%	Word-medial	%
Number of attempts	472		54	
Accurate production	440	93%	50	93%
Reduction	22	5%		
C2 substitution	8	2%		
Other	2		4	7%

We list representative examples for each position below.

(49) Word-initial
  a. Accurate Productions
    i. *stop* |ˈstɑp| → [ˈstɑp] 4;05.16
    ii. *star* |ˈstɑɹ| →[ˈstɑɹ] 4;01.16
  b. Reduction
    i. *story* |ˈstɔɹiː| → [ˈsɔɹiː] 5;09.19
    ii. *start* |ˈstɑɹt|→[ˈsɑɹt] 5;08.22

(50) Word-medial (Accurate Productions)
monster |ˈmɑnstəɹz| →[ˈmʌnstəɹ] 4;08.13
Kazakhstan |ˌkɑzɑkˈstɑn|→ [ˌkɑzɑkˈstɑn] 4;05.02

4.4.3 |sk| Cluster

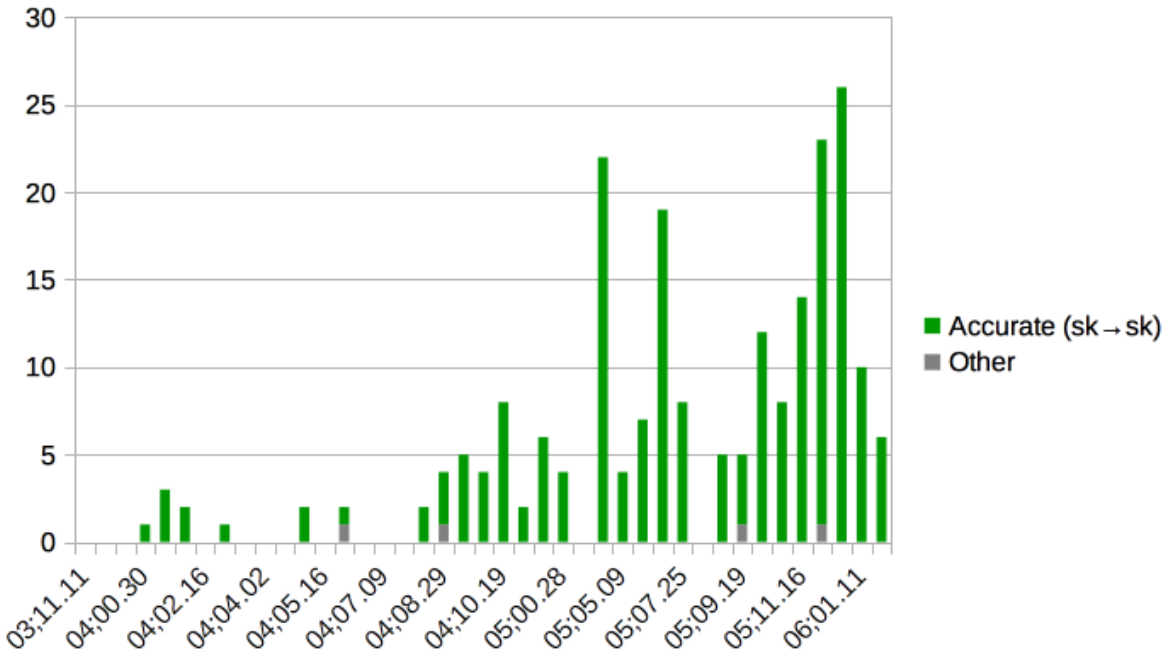
Nura made a total of 215 attempts at the target consonant cluster |sk|, with the vast majority of them resulting in accurate productions.

Table 81: Acquisition of |sk| Clusters

Accurate production	211	98%
Other	4	2%
Total attempted	215	100%

Figure 29 shows that Nura had mastered |sk| by 4;00.30, and that she could produce accurately in a consistent manner from then on.

Figure 29: Acquisition of |sk|



As we can see in Table 82, this observation holds true across both initial and medial onsets.

Table 82: |sk| (Word-initial vs. Word-medial)

	Word-initial	%	Word-medial	%
Number of attempts	207		8	
Accurate production	203	98%	8	100%
Other	4	2%		

We list a few examples below, including that from the word *excuse*, which accounts for all eight attempts at |sk| word-medially.

(51) Word-initial (Accurate Productions)

a. *sky* |ˈskaɪ| →[ˈskaɪ] 4;01.16
b. *skate* |ˈskeɪt| → [ˈskeɪt] 4;05, 30
c. *excuse* |ɪkˈskjuːs| → [ɪtˈskjuːːs] 4;09.19

4.4.4 |sm| Cluster

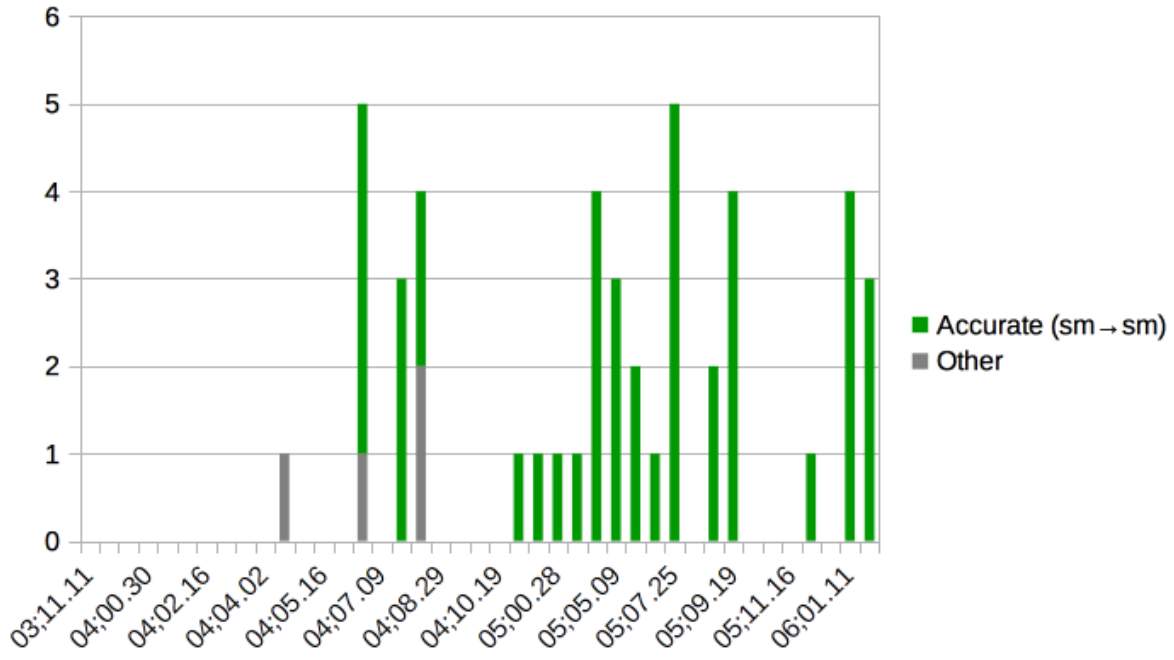
Nura attempted the |sm| cluster only 46 times, as shown in Table 83, with all occurrences coming from word-initial position.

Table 83: Acquisition of |sm| Clusters

Accurate production	42	91%
Other	4	9%
Total attempted	46	100%

As illustrated in Figure 30, Nura mastered |sm| by 4;06.18 or possibly before, given that we have no data between she was able to consistently produce the target cluster, in spite of the fewer attempted productions attested across data.

Figure 30: Acquisition of |sm|



We give representative examples of |sm| cluster productions below.

(52) Word-initial (Accurate Productions)

a.	*smart*	|ˈsmɑɹt| → [ˈsmɑɹt]	5;04.11
b.	*smell*	|ˈsmɛl|→ [ˈsmɛl]	4;07.30

4.4.5 |sn| Cluster

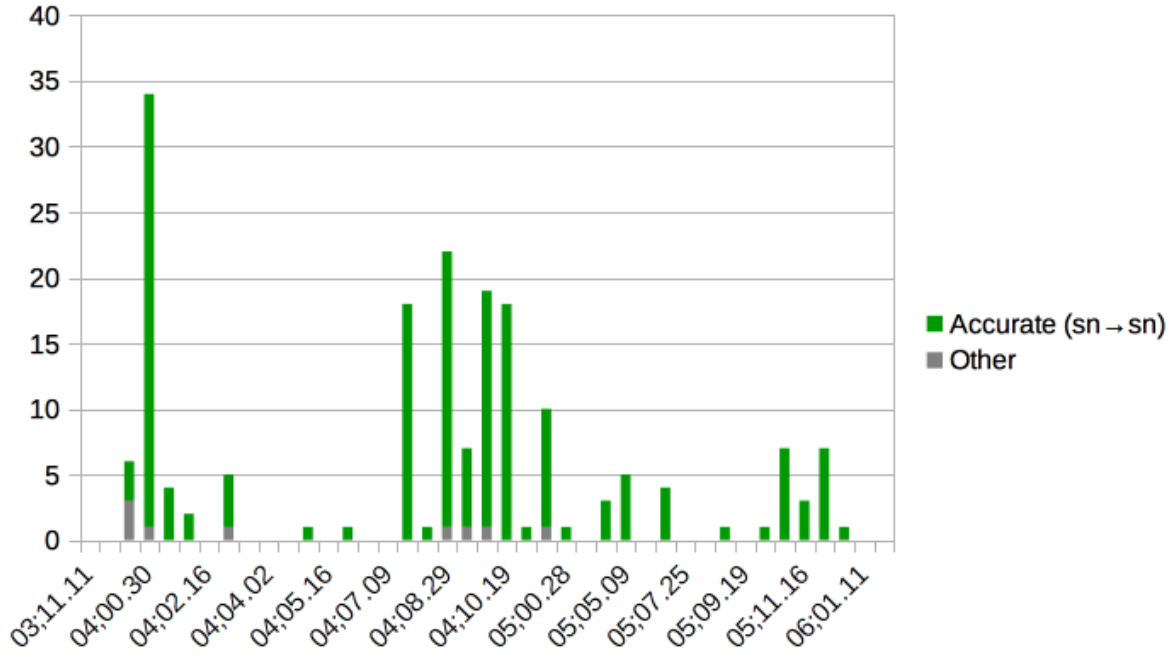
Nura made a total of 182 attempts at |sn| cluster which, consistent with all other S+consonant clusters, displayed high rates of accuracy. This can be see in Table 84, with 95% of accurate productions overall.

Table 84: Acquisition of |sn| Clusters

Accurate production	173	95%
Other	9	5%
Total attempted	182	100%

The following figure shows that Nura indeed acquired |sn| at around 4;00.19. After that, she continued to produce the target cluster consistently. Note as well that all of these attempts come from word-initial clusters.

Figure 31: Acquisition of |sn|



We list a few examples of target productions below.

(53) Word-initial (Accurate Production)

snow	|ˈsnoʊ| → [ˈsnoʊ]	4;08.29
snack	|ˈsnæk| → [ˈsnæk]	4;09.19

4.4.6 |sl| Cluster

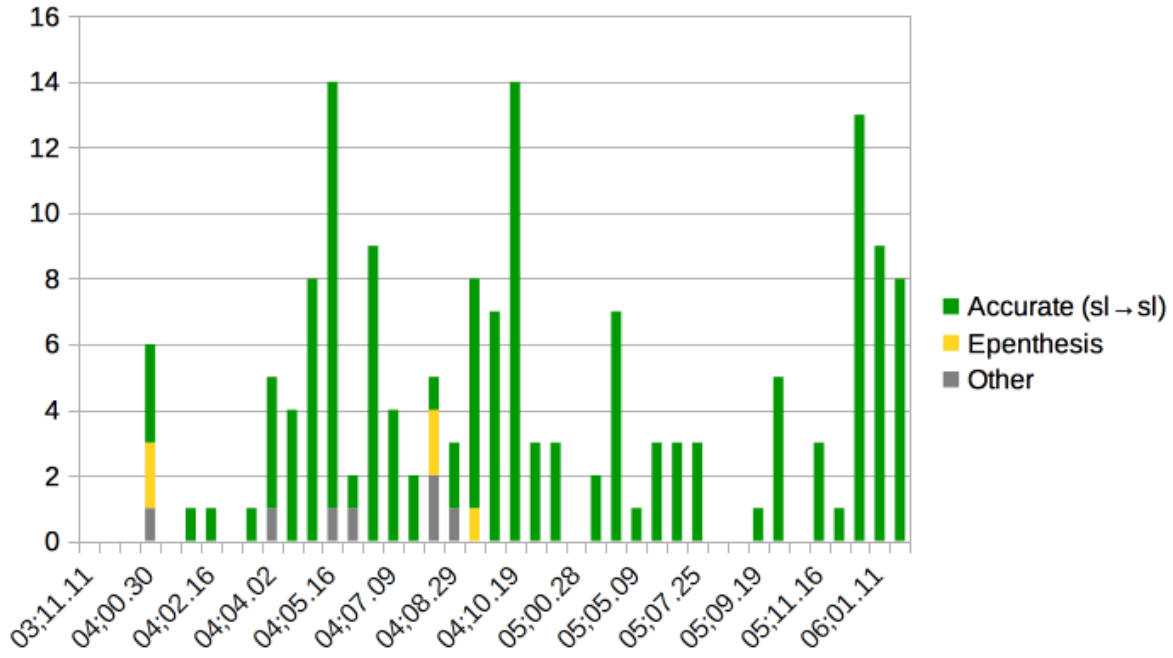
As shown in Table 85, Nura made a total of 159 attempts at |sl| clusters, all but one of which were in word-initial position. 92% of these attempts resulted in accurate productions, with 3% epenthesis and 4% marginal productions.

Table 85: Acquisition of |sl| Clusters

Accurate production	147	92%
Epenthesis	5	3%
Other	7	4%
Total attempted	159	100%

Nura mastered |sl| cluster by 4;02.16 after a number of variable productions recorded at 4;00.30. This is illustrated in Figure 32. Overall, Nura presented consistent and highly accurate productions of |sl| throughout the remainder of the data.

Figure 32: Acquisition of |sl|



Representative example of accurate productions of |sl| are listed in (54).

(54) Word-initial (Accurate Productions)

a.	*sleep*	|ˈsliːp| → [ˈsliːp]	4;02.16
b.	*sled*	|ˈslɛd| → [ˈslɛd]	4;05.30

4.4.7 |sv| Cluster

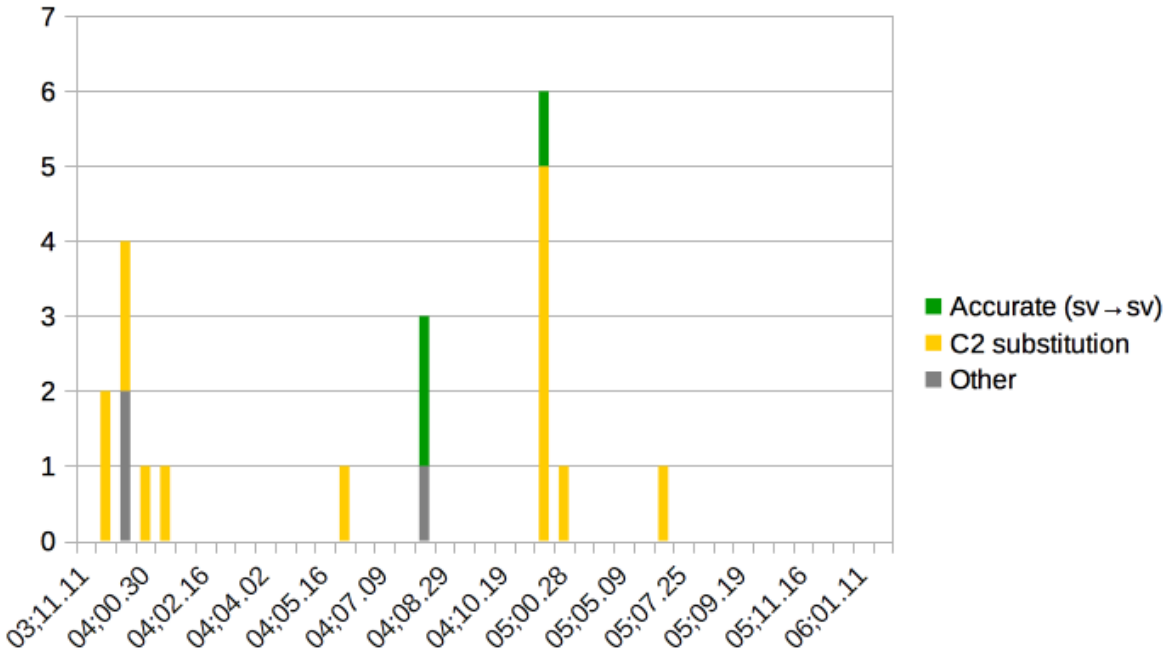
Nura only made 20 attempts at the |sv| cluster. All of which come from the name *Sven*, an animated movie character. The vast majority of these attempts resulted in C2 substitution, with |v| replaced by |w|. This pattern is consistent with Nura's acquisition of |v| in singleton onset. Because of this substitution, as we can see in Table 86, Nura showed only a 15% of accuracy rate across the data. However, she consistently produced both target clusters in some form throughout the dataset.

Table 86: Acquisition of |sv| Clusters

Accurate production	3	15%
C2 substitution	14	70%
Other	3	15%
Total attempted	20	100%

Nura was thus able to grasp the structure of the cluster very early on, similar to what we saw across virtually all her target s+consonant clusters, as shown in Figure 33.

Figure 33: Acquisition of |sv|



4.4.8 |sw| Cluster

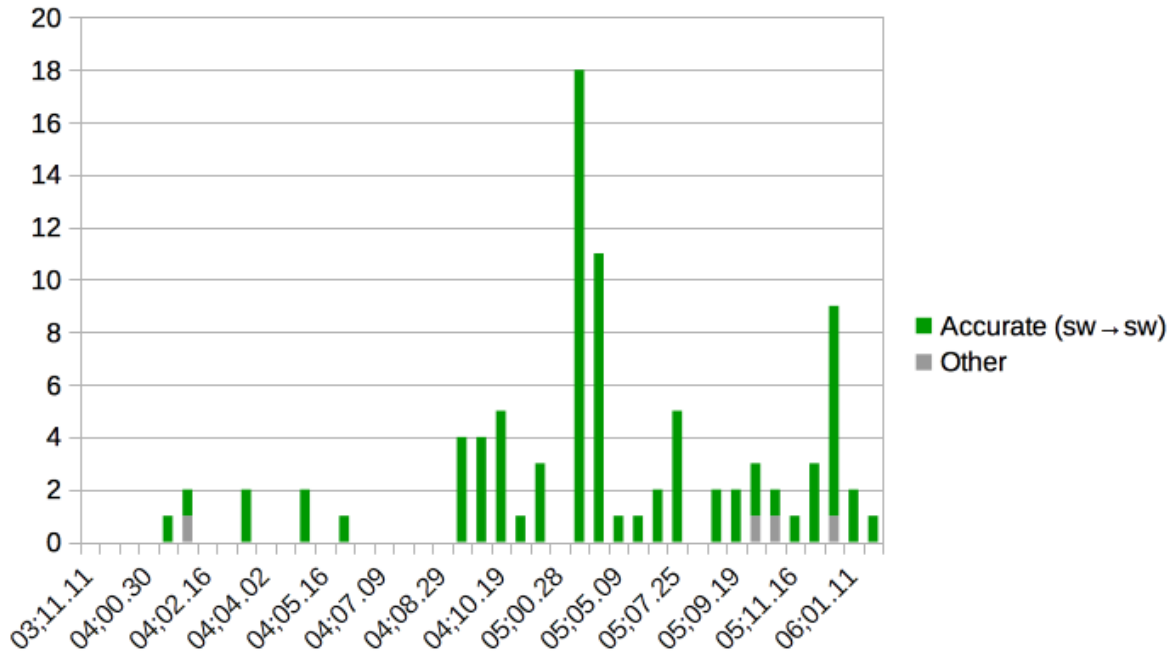
Nura made a total of 88 attempts at the |sw| cluster, and all in word-initial positions, of which 95% were accurate. This is consistent with her acquisition of all other consonant clusters.

Table 87: Acquisition of |sw| Clusters

Accurate production	84	95%
Other	4	5%
Total attempted	88	100%

Nura had indeed mastered |sw| cluster by 4;01.16. She produced this cluster accurately and consistently after that, as we can see in Figure 34.

Figure 34: Acquisition of |sw|



Representative examples for these accurate productions are given below.

(55) Word-initial (Accurate Productions)

a.	*swing*	|ˈswɪŋ| → [ˈswɪŋ]	4;02.02
b.	*sweetie*	|ˈswiːtiː| → [ˈswiːtiː]	4;05.02

This completes our description of Nura's acquisition of s+consonant clusters. As we saw throughout these descriptions, she mastered all sC clusters very early on in spite of issues in segmental productions, which most prominently affected her attempts at |sv| clusters. In the next subsection, we turn to tri-consonantal onset clusters.

4.5 s+Consonant+Approximant Clusters

In this section, we describe Nura's acquisition of s+consonant+approximant clusters, which include [spl, spɹ, skɹ, stɹ, skw]. For each of these clusters, Nura made very few attempts, almost all of them in word-initial position. In spite of the low numbers of attempts, Nura was able to master all of these clusters by the end of the documented period.

4.5.1 |spl| and |skl| Clusters

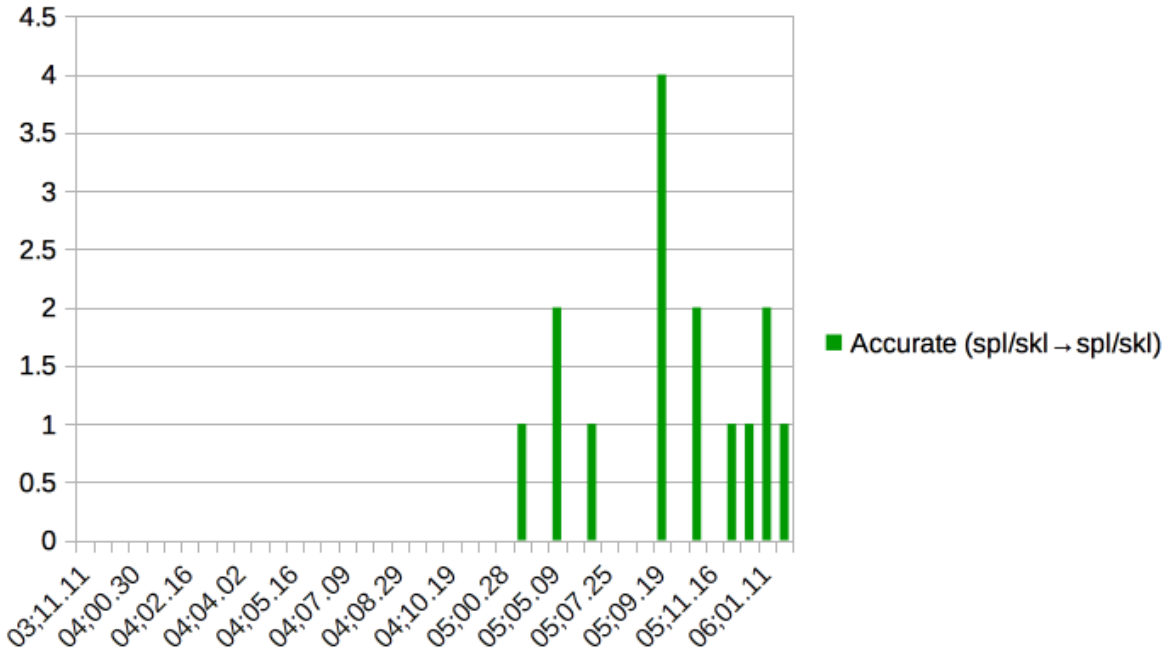
Nura only attempted words containing |spl| and |skl| clusters 16 times in total, of which 12 occurred word-initially, and 4 word-medially. All but one of them were produced accurately.

Table 88: Acquisition of |spl| and |skl| Clusters

	Word-initial	%	Word-medial	%
Number of attempts	12		4	
Accurate production	12	100%	3	75%
Reduction			1	25%

In spite of this very limited sampling, we observe from Figure 35 that Nura had mastered |spl| and |skl| cluster by 5;02.16.

Figure 35: Acquisition of |spl| and |skl|



Example (56) gives some representative examples for Nura's acquisition of |spl| below.

(56) Accurate productions

a. Word-initial

i. *splash* |ˈsplæʃ| → [ˈsplæʃ] 5;02.16

ii. *split* |ˈsplɪt| → [ˈsplɪt] 5;09.19

b. Word-medial

explain |ɪkˈspleɪn|→ [ɪkˈspleɪn] 6;01.25

4.5.2 |spɹ| Cluster

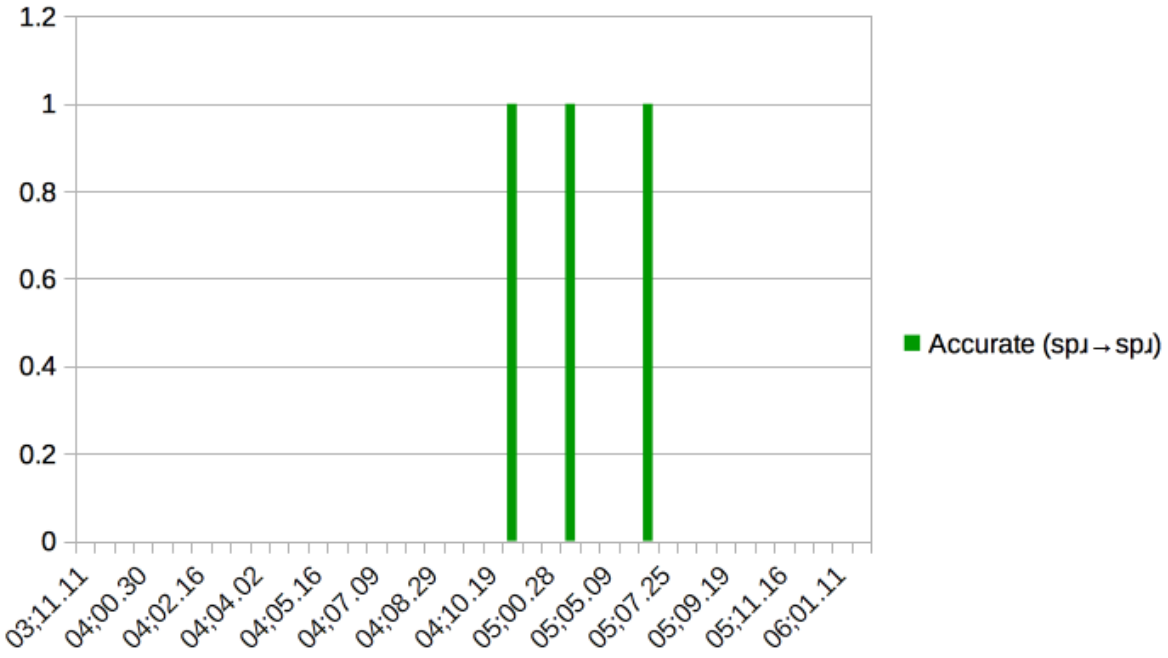
Consistent with |spl|, Nura also had very limited attempts at |spɹ|. As shown in Table 89, Nura had 3 accurate attempts from the words *sprinkley, spring, sprinkle*.

Table 89: Acquisition of |spɹ| Clusters

Accurate production	3	100%
Total attempted	3	

With such limited data, we are not able to say when Nura mastered |spɹ|, however, the data show that she began to produce the target cluster accurately from her very first attempts.

Figure 36: Acquisition of |spɹ|



4.5.3 |skɹ| Cluster

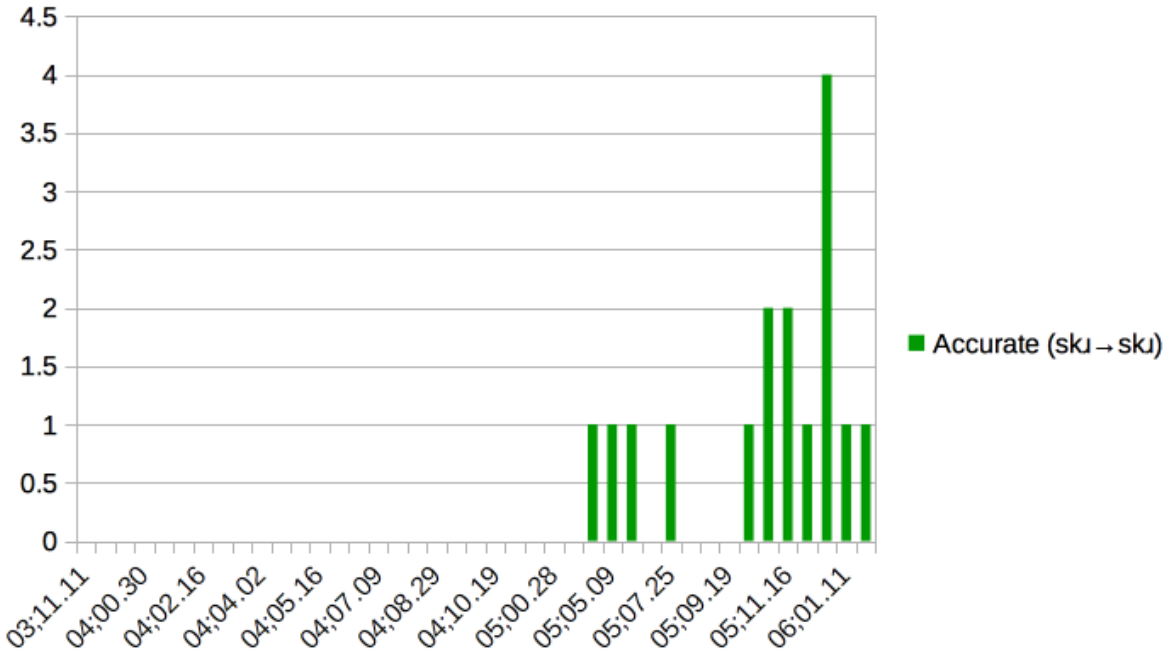
Very consistently, Nura also had very few attempts at |skɹ| cluster, with a total of 16 attempts. Almost all of them occurred word-initially, as shown in Table 90. There was only one instance in word-medial position.

Table 90: Acquisition of |skɹ| Clusters

	Word-initial	%	Word-medial	%
Number of attempts	15		1	
Accurate production	15	100%	1	100%

Based on the pattern from Figure 37, Nura had mastered |skɹ| by 5;00.28. After that, she also only displayed consistent accurate productions.

Figure 37: Acquisition of |skɹ|



We provide examples of these accurate productions below.

(57) Word-initial (Accurate Productions)

a.	*scribble*	|ˈskɹɪbəl| → [ˈskɹɪbəl]	5;06.06
b.	*scream*	|ˈskɹiːm| → [ˈskɹiːm]	5;07.25

4.5.4 |stɹ| Cluster

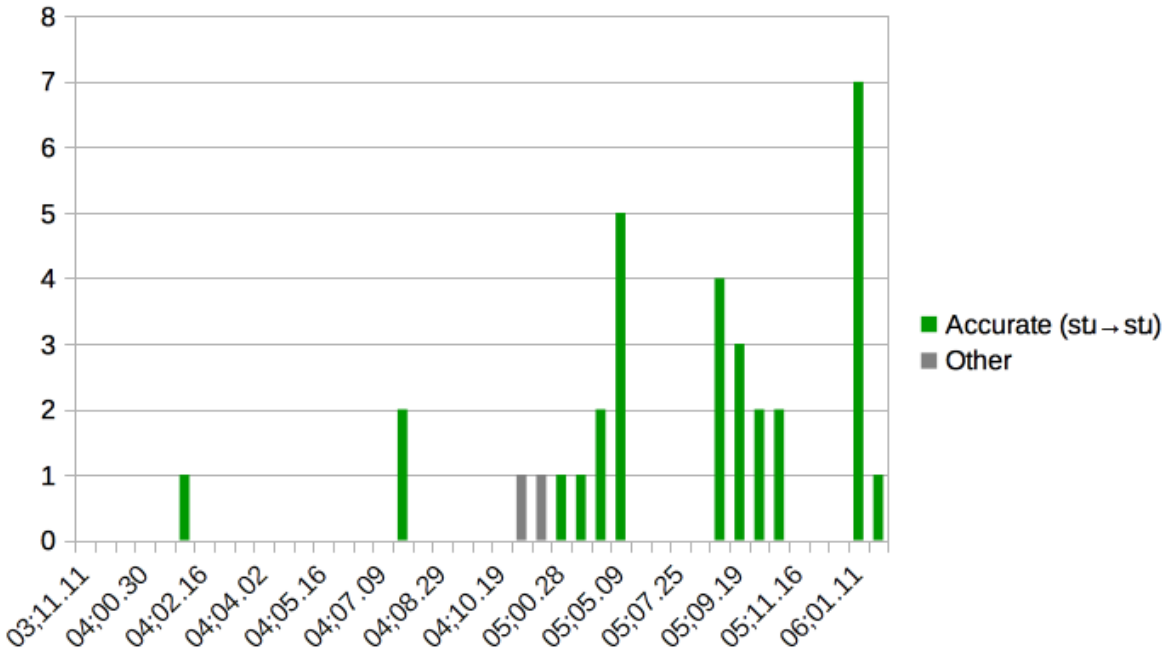
Nura made a total of 33 attempts at |stɹ| cluster, of which 94% resulted in accurate productions.

Table 91: Acquisition of |stɹ| Clusters

Accurate production	31	94%
Other	2	6%
Total attempted	33	100%

Nura first attempted the |stɹ| cluster around 4;00.30, but we did not record many further attempts until she was around five years old. In spite of this, she was able to show consistent performance at this cluster.

Figure 38: Acquisition of |stɹ|



We list examples of Nura's accurate productions below.

(58) Word-initial (Accurate Productions)

a.	*strong*	|ˈstɹɑŋ| → [ˈstɹɑŋ]	4;07.30
b.	*strawberry*	|ˈstɹɑˌbɛɹiː| → [ˈstɹɑˌbɛɹiː]	5;05.09

4.5.5 |skw| Cluster

Nura attempted at |skw| cluster 61 times, 79% of which she produced accurately. As illustrated in Table 92, she also displayed some cases of deletion,[17]and other unsystematic patterns.

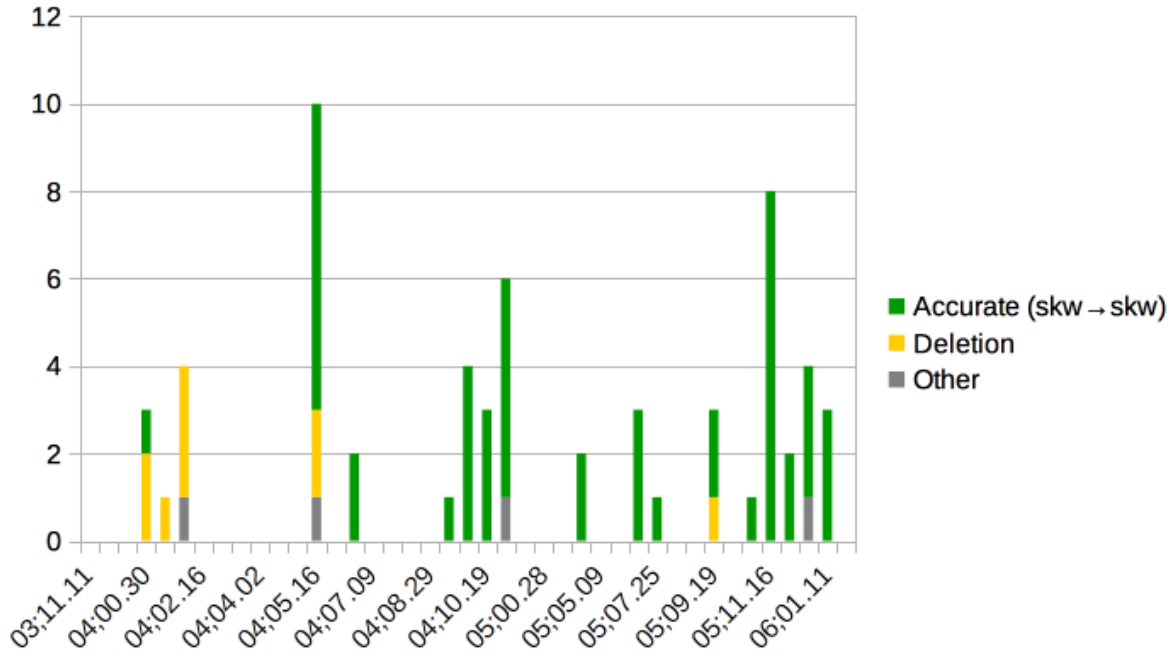
Table 92: Acquisition of |skw| Clusters

Accurate production	48	79%
Deletion	9	15%
Other	4	6%
Total attempted	61	100%

As we can see from Figure 39, Nura encountered difficulties in her early attempts at this cluster.

17. The deletion category includes deletion of the approximant |w| and deletion of stops |k| in the cluster |skw|, and deletion of |w| being the predominant reduction pattern.

Figure 39: Acquisition of |skw|



However, the early deletion observed all came from a single word, *square*. It is thus unclear whether this issue was phonological or lexical.

We give some examples for word-initial accurate production of |skw| below.

(59) Word-initial (Accurate Productions)

a. *squish*	|ˈskwɪʃ| → [ˈskwʌs]	4;09.12
b. *squirrel*	|ˈskwʌɹəl| → [ˈskwɛɹəl]	5;06.27

This completes our description of Nura's acquisition of s+consonant+approximant clusters. Overall, Nura had very few attempts at these clusters, which are preventing us from assessing in more detail her development of these clusters.

4.6 Summary of the Acquisition of Onset Clusters

As we can see in Table 93, Nura has mastered all target onset clusters by 5;06.06. This includes the cluster |sv| if we abstract away from issues in the segmental substitution of |v| (by [w]) in this context.

Of interest in these data are the virtually immediate mastery of sC clusters, the patterns of epenthesis, which affected most C+lateral clusters but not the C+rhotic ones, and the parallels we observed between Nura's development of these clusters and that of the individual consonants that make up these clusters. However, due to issues in data sampling, we could not determine in detail how Nura acquired the three-consonant clusters of English.

This concludes our description of Nura's phonological development. In the next chapter, we turn to her development of inflectional morphology.

Table 93: Acquisition of Onset Cluster: Nura's Timeline

		03;11.11	03;11.28	04;00.19	04;00.30	04;01.16	04;02.02	04;02.16	04;03.04	04;03.08	04;04.02	04;04.18	04;05.02	04;05.16	04;05.30	04;06.18	04;07.09	04;07.30	04;08.13	04;08.29	04;09.12	04;09.19	04;10.19	04;11.21	05;00.07	05;00.28	05;02.16	05;04.11	05;05.09	05;06.06
C+lateral	pl bl				✓	✓E	✓E	✓E		✓E	✓	✓	✓	✓	✓	✓	✓	✓	✓E	✓E	✓	✓✓	✓	✓✓	✓	✓	✓	✓✓	✓	✓
	kl gl		✓	E✓E	✓	✓E	✓✓E	✓	✓		E		✓		✓E	✓✓E	✓✓	✓	✓E	✓EE	✓	✓	✓	✓	✓	✓✓	✓✓	✓	✓✓	✓✓
	fl					✓		✓O	✓	✓			✓				✓	✓	E✓✓E	E✓	✓	✓	✓	✓		✓✓	✓	✓✓	✓✓	✓
C+rhotic	pɹ bɹ			S		S	✓	✓R	✓	✓	R	✓		✓	✓O	✓	✓	✓	✓O	✓	S✓R	RS	✓	✓R	✓S	✓SR	✓SR	✓R	✓R ✓R	✓R ✓	✓✓
	tɹ dɹ		S	✓S	✓R	✓S✓	✓RR	✓	✓S	✓O		✓			✓	✓✓	✓	✓S	E✓	E✓✓	✓	✓	✓	✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓
	kɹ gɹ			S✓	✓S	S✓	S✓	✓	✓	✓S✓	✓	S		✓	✓✓	✓	✓	✓✓	✓E✓	✓E✓	✓	✓S✓	✓✓	✓S	✓	✓✓	✓	✓✓	✓✓	✓✓
	fɹ vɹ			E	✓E	✓	✓E		✓	✓	✓		✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓R	✓✓R	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
	θɹ		E		E		✓	E	E	✓		S	✓	S✓	✓	✓	✓	✓✓	✓E	✓	✓	✓	✓	✓	✓S	✓	✓	✓	✓	✓	✓
C+glide	kw gw	R					✓	✓	✓						✓	✓	✓			✓		✓							✓		
	tw dw																		✓	✓	✓			✓			✓R	✓	✓	✓
s+C	sp				✓	✓	✓			✓				✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	st				✓R	✓	✓S		✓				✓	✓	✓	✓	✓	✓✓	✓✓	✓	✓✓	✓	✓	✓✓	✓	✓✓	✓	✓✓	✓	✓✓
	sk				✓	✓	✓		✓				✓		✓				✓✓	✓	✓✓	✓	✓✓	✓✓	✓✓	✓✓		✓	✓	✓
	sm											O				✓		✓	✓O					✓	✓	✓	✓	✓	✓	✓
	sn			✓	✓	✓	✓		✓				✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
	sl				✓E		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	E	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	sv		S	S	S	S									S			✓							S	S				
	sw					✓	✓O			✓			✓		✓						✓	✓	✓	✓	✓		✓	✓	✓	✓
s+C+App	spl																							✓			✓		✓	
	spɹ skɹ																										✓	✓	✓	✓
	stɹ						✓											✓						O	O	✓	✓	✓	✓	
	skw				ø✓	ø	ø							✓		✓					✓	✓	✓	✓				✓	✓	✓

Legend:

✓=acquired; R=reduction; S=Substitution; E=Epenthesis; O=Other

C+lateral = consonant+lateral; C+rhotic = consonant+rhotic; C+glide = consonant+glide; s+C = s+consonant; s+C+App: s+consonant+approximant

Chapter 5: The Acquisition of Inflectional Morphology

In this chapter, we focus on Nura's L2 acquisition of inflectional morphology in English. Specifically, we document her acquisition of morphological markers, such as plural marking on nouns as well as inflectional markers on verbs. We do not distinguish between individual allomorphs of any morphemes. Our central consideration is about the presence vs. absence of inflection on the words produced by Nura.

In particular, we compare Npl forms (nouns ending with [-s,-z,-əz] as plural markers with Nsg forms (nouns ending with [s/z] as a phonological element) to explore the acquisition of these noun endings, addressing whether it is morphological or phonological in nature. We continue with a description of Nura's acquisition of verbal affixal inflections.

1. Acquisition of Plural Marking on Nouns (Npl)

In this section, we describe Nura's acquisition of nominal plural markers (Npl) found across all contexts within our dataset. We then narrow down our inquiry to her acquisition of Npl in obligatory contexts. "All contexts" refer to all the contexts where Nura made explicit use of Npl markers. This includes general contexts (Npl),[18] ambiguous contexts (NplA); paired words contexts (NplP),[19] error contexts (NplE),[20] as well as the obligatory contexts. Obligatory contexts (NplO) refer to the contexts where

18. General contexts (Npl) refer to where both plural and singular forms can be acceptable in the adult forms.

19. NplP refer to contexts where the words always used in pairs in the adult productions, such as *eyes, legs*, assuming they are conceived as lexemes.

20. NplE refers to contexts where error patterns occurred.

plural markers are absolutely necessary given the syntactic construction at hand. We list an example for each context in (60).

(60) Npl All contexts

a. Npl general	*big carrots*	|ˈkæɹəts| → [ˈkæɹəts]	4;05.02
b. NplA	*This my books*	|ˈbʊks| → [ˈbʊks]	4;02.02
c. NplP	*legs*	|ˈlɛgz| → [ˈlɛks]	4;05.02
d. NplE	*This times I go away*	|ˈtaɪmz| → [ˈtʰaɪməz]	4;08.13
e. NplO	*two friends*	|ˈfɹɛnz| → [ˈfɹɛntʰ]	4;08.13

1.1 Npl in all Contexts

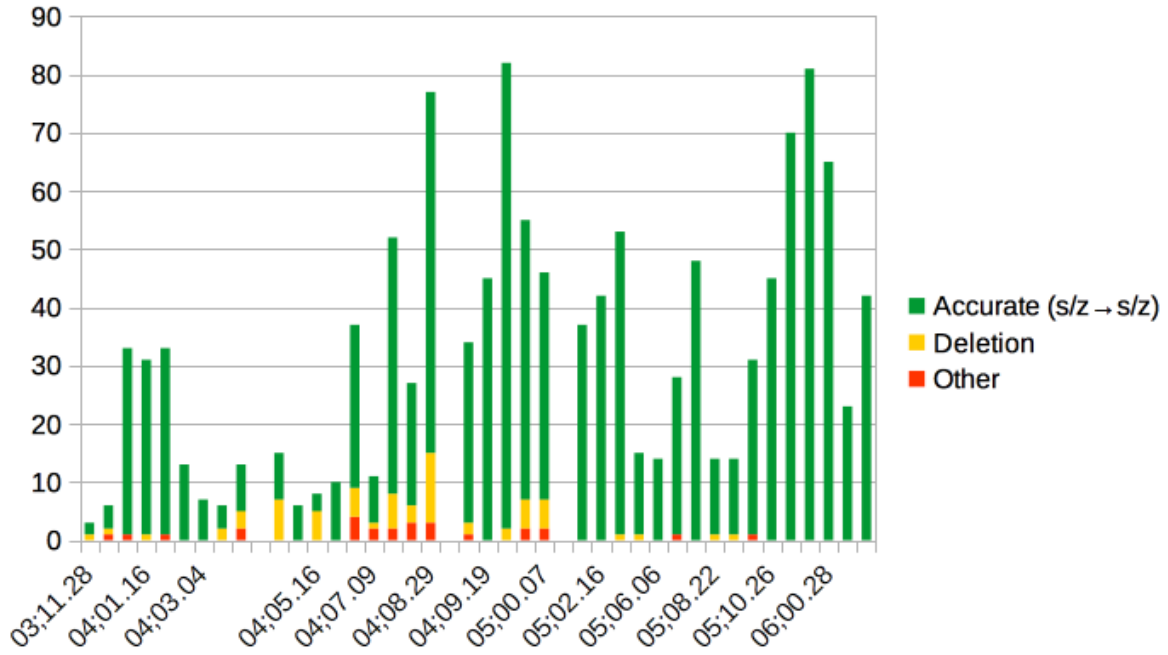
As we can see in Table 94, Nura attempted Npl markers 1272 times in the dataset, 93% of which resulted in accurate productions, 5% in deletion, and 2% in other marginal productions.

Table 94: Npl Productions in All Contexts

Accurate production	1181	93%
Deletion	65	5%
Other	26	2%
Total attempted	1272	100%

Figure 40 displays Nura's overall development of Npl in all contexts. We can see that Nura made accurate productions in a consistent manner at the very early stage, from 3;11.28 to 4;04.02. This is followed by a stage where accurate productions are attested alongside deletion cases, from 4;04.18 to 5;00.07. After that, Nura had mastered the nominal plural marker in English.

Figure 40: Acquisition of Npl in All Contexts



From 3;11.28 to 4;04.02, Nura's accuracy rate was as high as 91%. However, 111 of the total 132 accurate productions came from Npl in paired words (such as *shoes, legs, eyes, boots*) that are primarily used in dual forms in adult productions. Consequently, this high rate of accurate productions at the beginning of her development does not tell us much about her understanding of the morphological system of English, it is rather suggestive of early development at the lexical level: the child was arguably using plural forms she had memorized as such.

Table 95: Npl Productions in All Context (3;11.28 to 4;04.02)

Accurate production	132	91%
Deletion	8	6%
Other	5	3%
Total attempted	145	100%

During the subsequent stage, from 4;04.18 to 5;00.07, Nura's productions of Npl dropped to 86%, with a higher deletion rate at 10%, accompanied by 4% of other productions. Nura then mastered Npl, after 5;00.07.

Table 96: Npl Productions in All Context (4;04.18 to 5;00.07)

Accurate production	433	86%
Deletion	53	10%
Other	19	4%
Total attempted	505	100%

As we mentioned earlier, the descriptive statistics discussed so far include Npl in all contexts (such as general context, ambiguous context, errors, Npl used in pairs, as well as the obligatory contexts). We also noted that the initial accurate productions predominantly came from paired nominals. If we ignore these nominal markers in paired words, we in fact obtain a different developmental picture for the dataset. We turn to this narrower description of Nura's Npl productions in obligatory contexts (NplO) in the next section.

1.2 Npl in Obligatory Contexts (NplO)

This section focuses on Nura's acquisition of Npl in obligatory contexts, where plural affixation has to be explicitly marked, such as NPs followed by a number (i.e., *two books*), or a quantifier (i.e., *many books*). As we can see in Table 97, Nura barely made

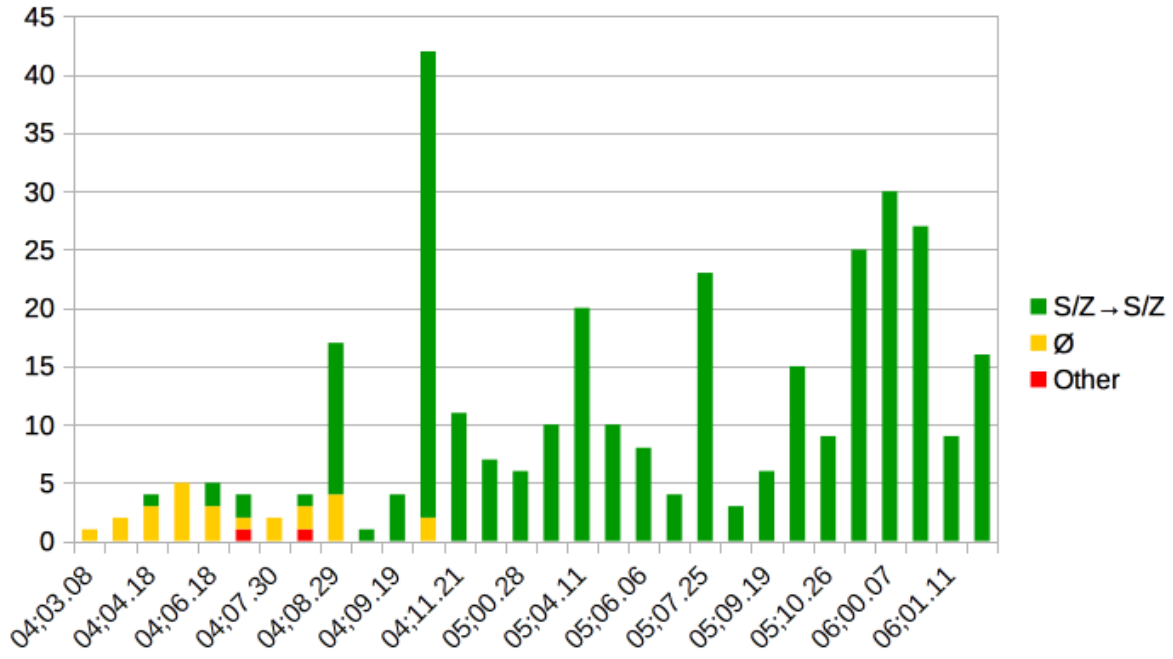
any errors in obligatory contexts. She attempted Npl 330 times, 92% of which resulted in accurate production, 7.6% in deletions, and 0.4% in other productions.

Table 97: Npl Productions in Obligatory Contexts

Accurate production	303	92%
Deletion	25	7.6%
Other	2	0.4%
Total attempted	330	100%

This overall picture however hides the more interesting facts of Figure 41, which clearly illustrates two developmental stages, namely a deletion stage from 4;03.08 to 4;08.29, followed by the mastery stage.

Figure 41: Acquisition of Npl in Obligatory Context



Indeed, Nura deleted the plural marker in nouns in 56% of her attempted productions during the initial stage, from 4;03.08 to 4;08.29. During this stage, she also achieved 16 accurate productions, which accounts for 39% of the total number of attempts, as indicated in Table 98.

Table 98: NplO Productions during Stage 1 (4;03.08 to 4;08.29)

		%
Number of attempts	41	100%
Accurate production	16	39%
Deletion	23	56%
Other	2	5%

Out of these 16 cases, the majority (10 cases) occurred at 4;08.29, which is exactly the transition period from Nura consistently deleting the morphological marker to her mastery of the nominal plural marker.

Qualitative examples illustrating these observations are listed in (61).

(61) Deletion Stage (4;03.08 to 4;08.29)

a. Deletion

i. *Three books* |ˈbʊks| → [ˈbʊk] 4;04.18

ii. *I have four chairs* |ˈʧɛɹz| → [ˈʧɛɹ] 4;06.18

b. Accurate Productions

i. *ten minutes* |ˈmɪnəts| → [ˈmɪnəts] 4;07.09

ii. *I have two teachers* |ˈtiːʧəɹz| → [ˈtʰiːtʰəɹz] 4;08.29

Nura then presented a consistent accurate production of Npl in obligatory context from 4;08.29 onward. As we can see from Table 99, 99% of her productions were accurate during this stage, which marks her mastery of nominal plural inflection in English.

Table 99: NplO Productions during the Master Stage (4;08.29 to 6;01.25)

		%
Number of attempts	284	100%
Accurate production	282	99%
Deletion	2	1%
Other	0	

Below are representative examples of the mastery stage.

(62) Mastery stage (4;08.29 to 6;01.25)

a. *All stickers* |ˈstɪkəɹz| → [ˈstɪkəɹz] 4;09.19

b. *Two colours* |ˈkʌəɹs|→ [ˈkʌəɹs] 5;00.07

1.3 Npl in all Contexts vs. Obligatory Contexts

As we have seen from the previous two sections, Nura mastered Npl in all contexts after 5;00.07, and Npl in obligatory context at 4;08.29. The deletion and other patterns observed between 4;08.29 and 5;00.07 in Figure 40 mostly came from non-obligatory contexts. As illustrated in Table 100, out of the 14 cases of deletions observed during this stage, seven came from nominal plurals in paired words (NplP),[21] five from the general Npl contexts, while only two cases of deletion came from the obligatory contexts. This suggests that the inconsistency in production observed after 4;08.29,

21. This variation in Nura's acquisition of paired words, which contradicts our early observations, may in fact be a core of developmental error related to her partial understanding of the plural system during this period.

illustrated between Figure 40 and Figure 41, does not represent Nura's behaviour in the obligatory contexts, but in rather the non-obligatory contexts, where the plural markers are not required structurally (but might be required semantically).

Table 100: The Acquisition of Npl (4;08.29 to 5;00.07)

		%
Number of attempts	262	100%
Accurate production	243	93%
Deletion	14	5%
Other	5	2%

We give some representative examples of deletion below. (63) illustrates deletion in the paired words, while (64) exemplifies the deletion in the general contexts.

(63) Deletion in Paired Words

a. *eyes* |ˈaɪz|→ [ˈaɪ] 4;11.21

b. *pants* |ˈpænts| → [ˈpaʊ] 5;00.07

(64) Deletion in General Npl Contexts

a. *give my friends* |ˈfɹɛndz| →[ˈfɹɛːːnd] 4;09.12

b. *my words* |ˈwʌɹdz| → [wʌɹk] 4;11.21

This concludes our description of Nura's acquisition of the nominal plural marker (Npl) of English. As we saw in the data, Nura displayed an overall accurate production of plural inflection. However, her productions of Npl in obligatory contexts show that she went through a deletion stage before her mastery of this morphological marker. In addition,

the variation observed in the paired words occurred at the time her system of inflection were emerging.

2. The Acquisition of Singular Nouns (Nsg)

As we have seen in the previous section. Nura went through a deletion stage for the acquisition of Npl before mastery. In order to assess the nature of the deletion of word final [-s] in Npl, to determine it is simply the omission of word-final [-s] phonologically or truly reflects a stage in morphological development, we now report on Nura's acquisition of nouns ending with [-s], [-z] in mono-morphemic words such as *box, princess, horse, dress*. As we can see in Table 101, out of the 317 attempted nouns ending with [-s, z] observed between 3;11.28 and 5;04.11, only five cases of final consonant deletions were observed. This is only 2%, compared with the deletion rate observed in Npl in the obligatory context (56% at the initial stage; 7.6% overall).

Table 101: Acquisition of Nsg (3;11.28 to 5;04.11)

		%
Number of attempts	317	100%
Accurate production	306	97%
Deletion	5	2%
Other	6	2%

In addition, the data on the singular nouns reveals no actual developmental patterns. This clearly suggests that Nura deleted the plural marker during the early stage of development for morphological reasons, as opposed to simply omissions of a phonological element in word-final position.

Example (65) below illustrates a few of these deletion cases, none of which has any bearing on the discussion to follow.

(65) Phonology-related Deletion

a.	*me dress*	|ˈdɹɛs| →[ˈdɹɛː]	4;03.04
b.	*goose*	|ˈguːs| →[ˈgʲuː]	5;00.07

This concludes Nura's acquisition of noun singular words ending with [-s, z]. Nura presented a structurally different acquisition pattern for these mono-morphemic nouns, compared to her acquisition of the nominal plural marker. We have these independently verified that Nura's deletion of [-s,-z] plural markers clearly pertains to issues in morphological development.

3. The Acquisition of Verbal Inflection

Verbal inflections in English consist of the overt realizations of tense projections in morphosyntactic constructions. The tense projections can be expressed in different ways, one of them suffixal (i.e., tense, person, number and agreement markings on the verbal suffixes), the other through suppletive inflections (*be* verbs used as copulas and auxiliaries). We know that L1 and child L2 acquisition present different patterns in their development of verbal affixal inflection and suppletive inflection. In this section, we build on this previous literature to describe Nura's acquisition of English suffixal and suppletive inflections. As we will see, consistent with previous research, Nura was proficient in her use of accurate suppletive inflection, and mastered suppletive morphemes before suffixal inflections. We begin with a description of Nura's acquisition of verbal inflectional markers. We than turn to her acquisition of *be* copula.

3.1 Third Person Singular (V3sg) in Obligatory Contexts

Obligatory contexts refer to third person *he/she/it* followed by third person singular (V3sg) verbal inflection. We can see Nura's overall performance on V3sg markers in the obligatory contexts in Table 102. Nura displayed a 65% accuracy rate overall, as well as 26% deletion and 7% overgeneralization.

Table 102: V3sg Productions Inflections

Accurate production	246	65%
Deletion	100	26%
Overgeneralization[22]	27	7%
Other	6	2%
Total attempted	379	100%

In the following sub-sections, we describe these patterns in detail, starting with optional inflections in 3.1.1, followed by an error analysis of Nura's error patterns in 3.1.2.

3.1.1 Optional Inflection in V3sg Contexts

The following chart shows that Nura attempted verbs with third person singular *-s* (V3sg) 352 times in our dataset, 70% of them resulted in accurate productions, 28% in deletion, and the remaining 2% in other marginal productions. Compared to her deletion rate of Npl in obligatory contexts (7.6%) as seen previously in Table 97, Nura presented an overall high rate of deletion (28%) for V3sg, at best from a quantitative point of view.

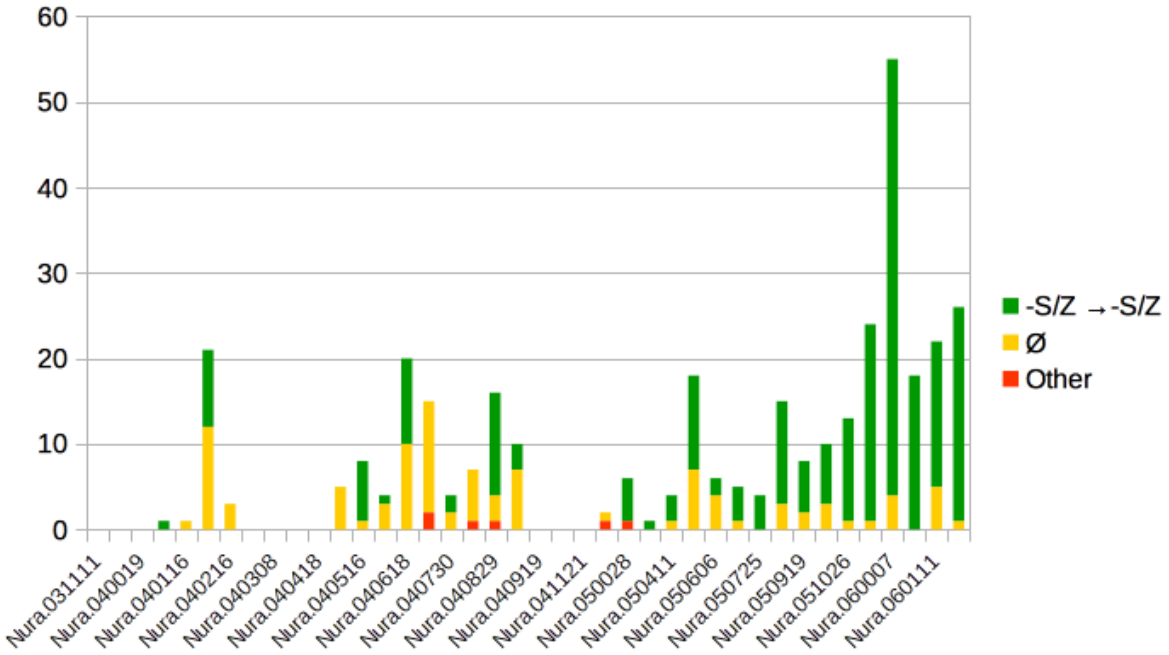
22. The 'overgeneralization' category is different from the 'other' category. The former refers to the forms are phonetically accurate but structurally inaccurate (such as applying regular past tense paradigm on irregular forms), while the latter consists of phonetically inaccurate forms.

Table 103: Acquisition of V3sg

Accurate production	246	70%
Deletion	100	28%
Other	6	2%
Total attempted	352	100%

Figure 42 shows two relatively clear developmental stages in Nura's acquisition of V3sg in obligatory contexts: the deletion stage, from 4;00.30 to 4;09.12, and the mastery stage, from 5;00.07 onward.

Figure 42: Acquisition of V3sg in Obligatory Contexts



3.1.1.1 Stage 1: Deletion (4;00.30 to 4;09.12)

Nura did not attempt third person singular *-s* until 4;00.30. Between then and 4;09.12, the majority of Nura's attempts at V3sg resulted in deletion. As we can see in Table 104,

the proportion of deletion at this initial stage was 57%, with Nura's accuracy rate at only 39% (45 out of 115).

Table 104: V3sg Productions during Stage 1 (4;00.30 to 4;09.12)

Accurate production	45	39%
Deletion	66	57%
Other	4	4%
Total attempted	115	100%

Out of these 45 accurate productions of third person singular [-s, z] at this initial stage, the majority (n=30) came from the word *goes*.[23] Representative examples are given below.

(66) Deletion

a. *mommy go out* |ˈgoʊz| →[ˈgoʊ] 4;01.16

b. *daddy show me* |ˈʃoʊz| →[ˈzoʊ] 4;08.13

(67) Accurate production

a. *This goes here* |ˈgoʊz| →[ˈgoʊz] 4;05.16

b. *like this goes too* |ˈgoʊz| →[ˈgoʊz] 4;08.29

23. In total Nura produced 37 cases of *goes* at this stage, of which 30 cases were accurate, and seven cases were deletion.

3.1.1.2 Stage 2: Mastery (5;00.07)

Nura did not attempt V3sg between 4;09.19 and 4;11.21. After this short period, the majority of her attempts (85%) resulted in accurate productions, and her deletion rate dropped dramatically from 57% during the previous stage to 14%. We did not detect any lexical factors affecting Nura's deletion patterns during this second stage.

Table 105: V3sg Productions during the Mastery Stage (5;00.07 to 6;01.25)

Accurate production	201	85%
Deletion	34	14%
Other	2	1%
Total attempted	237	100%

The following examples illustrate our main observations.

(68) Accurate production

a. *snow glows white* |ˈgloʊz| →[ˈgloʊz] 5;04.11

b. *The chair makes a beautiful sound* |ˈmeɪks| →[ˈmeɪks] 5;10.05

(69) Deletion

a. *The bad guy goes through the mirror* |ˈgoʊz| →[ˈgoʊ] 5;09.19

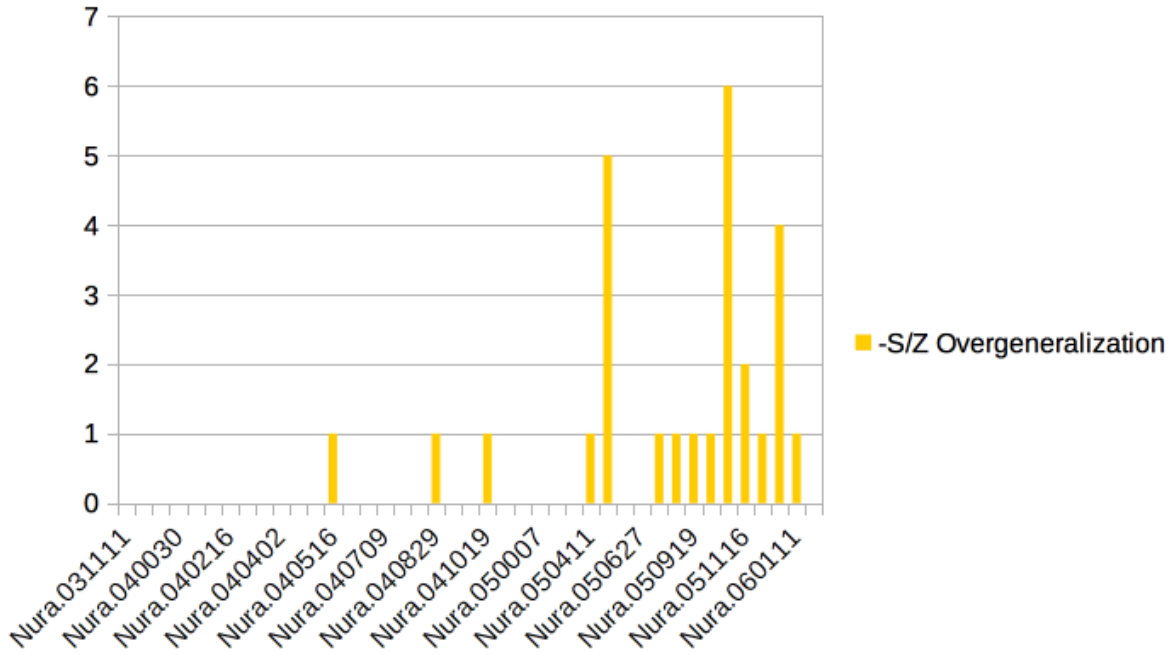
b. *she open the presents* |ˈoʊpənz| →[ˈoʊpən] 5;05.09

3.1.2 Overgeneralization in the Acquisition of V3sg

In addition to the cases of accurate production and deletion described above, we documented Nura's inaccurate productions of V3sg elsewhere in our dataset. Only 27 such cases are attested in total. They can be categorized into two patterns: overgeneralization in subject and verb person agreement, and overgeneralization in

inflection, which involves inflection overtly marked both on main verbs and auxiliaries. As we can see in Figure 43, Nura started to make overgeneralization errors from 4;05.16, with sporadic examples found throughout the remainder of the documented period.

Figure 43: Acquisition of V3sg (Overgeneralization)



Further, we found more person agreement errors (2 out of 3) during the beginning of the period (from 4;05.16 to 4;10.19), and more overgeneralization of inflection (17 out of 24) during the later stage (from 5;04.11 to 6;01.11). These types of overgeneralization also involved more syntactically complex sentences such as simple questions (*do*-insertion) and *wh*- questions (*wh*-movement). The complete lists of productions involving each type of overgeneralization is provided in (70) and (71), respectively.

(70) V3sg overgeneralization inflections from 4;05.16 to 4;10.19 (initial stage)

a.	*you goes here*	|ˈgoʊz| →[ˈgoʊz]	4;05.16
b.	*what's that means*	|ˈmiːnz|→[ˈmiːnsː]	4;08.29
c.	*I just needs pinks*	|ˈniːdz|→[ˈniːdz]	4;10.19

(71) V3sg overgeneralization inflections from 5;04.11 to 6;01.11 (later stage)

a.	*Some stays like this*	|ˈsteɪ| → [ˈsteɪz]	5;04.11
b.	*They works and they made the song*	|ˈwʌɹk| →[ˈwʌɹks]	5;05.09
c.	*They likes each otherwise*	|ˈlaɪk| →[ˈlaɪks]	5;05.09
d.	*Those are looks like the same.*	|ˈlʊk| →[ˈlʊks]	5;05.09
e.	*This one should works.*	|ˈwʌɹk| →[ˈwʌɹks]	5;05.09
f.	*Those are looks like hard.*	|ˈlʊk| →[ˈlʊks]	5;05.09
g.	*I colours on shes (her) eyes.*	|ˈkʌləɹ| →[ˈkʌləɹz]	5;07.25
h.	*My baby have a puzzle*	|ˈhæz|→ [ˈhæv]	5;08.22
i.	*Why is look like a eyes*	|ˈlʊks| →[ˈlʊks]	5;09.19
j.	*Does that stings too?*	|ˈstɪŋ| → [ˈstɪŋz]	5;10,05
k.	*Don't looks like we did this one before*	|ˈlʊk| → [ˈlʊks]	5;10.26
l.	*My dad don't likes the movie*	|ˈlaɪk|→ [ˈlaɪks]	5;10.26
m.	*Does he hates it?*	|ˈheɪt| → [ˈheɪts]	5;10.26
n.	*Does this says activities?*	|ˈsɛ|→ [ˈsɛz]	5;10.26
o.	*This is calls a tattle tail.*	|ˈkɑlz| → [ˈkɑlz]	5;10.26
p.	*What is don't you worry means?*	|miːn| →[miːnz]	5;10.26
q.	*does it looks like a squishy?*	|ˈlʊk|→ [ˈlʊks]	5;11.16
r.	*What does this says*	|ˈsɛz| → [ˈsɛz]	5;11.16
s.	*What does shes hair looks like*	|ˈlʊk|→ [ˈlʊks]	6;00/07
t.	*my mom and dad picks*	|ˈpɪk|→ [ˈpɪks]	6;00.28
u.	*all of them jumps down*	|ˈʤʌmp|→[ˈʤʌmps]	6;00.28
v.	*what does this says*	|ˈsɛ|→ [ˈsɛz]	6;00.28
w.	*why did my feet wants to float?*	|ˈwɑnt|→ [ˈwɑnts]	6;00.28
x.	*Does that tickles?*	|ˈtɪkəl| →[ˈtɪkəlz]	6;01.11

3.1.3 Interim Summary: Acquisition of V3sg

In summary, Nura attempted V3sg verbal inflections from 4;00.30, and went through a prominent omission period until 04;09.12. Nura then mastered the V3sg <-s> marker around 05;00.07. In addition, Nura displayed very few overuse errors involving this

marker (27 cases), which can fall into overgeneralization in subject and verb person agreement (i.e., **I needs*), and overgeneralization in inflection (i.e., **Does this says*).

3.2 Verb Simple Past Tense (Vsp) in Obligatory Contexts

In this section, we describe Nura's acquisition of past tense verbal inflection in obligatory contexts, which include all cases of regular past tense *-ed*. Table 106 offers a summary of Nura's overall performance at Vsp. Nura's overall accuracy rate was 79%, with 17% deletion and 4% overgeneralization errors. This is consistent with Ionin & Wexler's (2002) documentation of child L2 learners, who optionally leave out inflections while making fewer inflection/finiteness errors.

Table 106: Vsp Productions

Accurate Production	127	79%
Deletion	27	17%
Overgeneralization	6	4%
Total	160	100%

In the following sections, we describe these patterns in detail. We begin with accurate productions and optional inflections in 3.2.1, followed by an analysis of Nura's errors in her acquisition of Vsp in 3.2.2.

3.2.1 Optional Inflection in Vsp Contexts

Table 107 displays Nura's overall performance on verbs involving simple past tense *-ed* inflections. As we can see, 82% of her attempts resulted in accurate productions, the

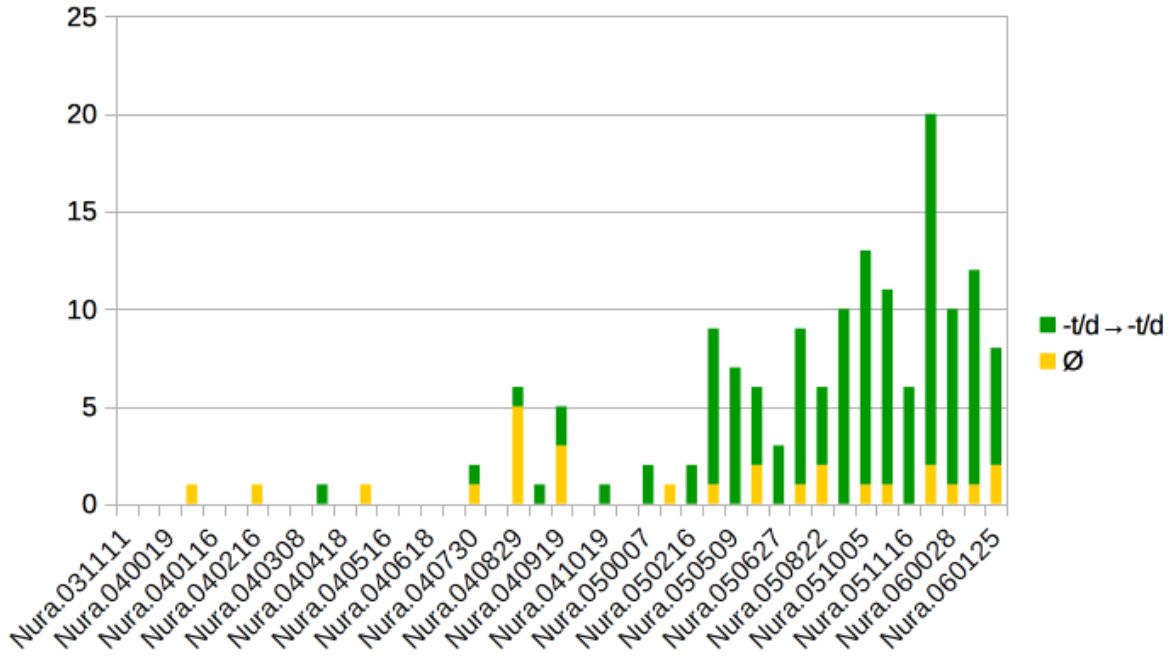
most prominent pattern overall. The other pattern is that of deletion, which applied to 18% of Nura's attempts at Vsp.

Table 107: Acquisition of Vsp

Accurate Production	127	82%
Deletion	27	18%
Total	154	100%

As we can see in Figure 44, deletion was more prominent during the early period, between 4;00.30 and 4;09.19. This was followed by mastery of the morphological marker, at around 4;10.19.

Figure 44: Acquisition of Vsp (Past tense *-ed*)



3.2.1.1 Stage 1: Deletion (4;00.30 to 4;09.19)

There were very few attempts recorded during the initial stage, and the majority of them (67%) resulted in Vsp deletion, as we can see in Table 108, with the proportion of accurate productions at 33%. None of this variation can be traced to specific verbs or particular types of phonological patterns.

Table 108: Vsp Productions during Stage 1 (4;00.30 to 4;09.19)

Accurate Production	6	33%
Deletion	12	67%
Total	18	100%

We list representative examples from this initial stage below.

(72) Deletion

a.	*cold never <u>bothered</u> me*	[ˈbɑðəɹd]→[ˈbɑdəɹ]	4;00.30
b.	*daddy <u>helped</u> me*	[ˈhɛlpt]→[ˈhaʊb]	4;05.02

(73) Accurate productions

a.	*<u>bumped</u> her head*	[ˈbʌmpt] →[ˈbʷʌmpt]	4;07.30
b.	*my daddy <u>fixed</u> this*	[ˈfɪkst]→[ˈfɪkst]	4;09.19

3.2.1.2 Stage 2: Mastery (4;10.19)

Table 109 highlights Nura's acquisition of Vsp during the second stage, between 4;10.19 and the end of the observation period. Her accuracy rate during this second stage was 89%, which marks her mastery of this morphological marker, with her rate of omission dropping to 11% during this stage. In line with previous observations, we could not

detect specific contexts driven by lexical or phonological factors during this stage of development.

Table 109: Vsp Productions during Stage 2 (4;10.19 to 6;01.25)

Accurate Production	121	89%
Deletion	15	11%
Total	136	100%

The following examples are representative of these two patterns.

(74) Accurate productions

a.	*What's called blue*	[ˈkɑld] →[ˈkoʊld]	5;00.07
b.	*I garbaged it*	[ˈgɑɹbɪʤd] →[ˈgɑɹbɪʤd]	5;04.11

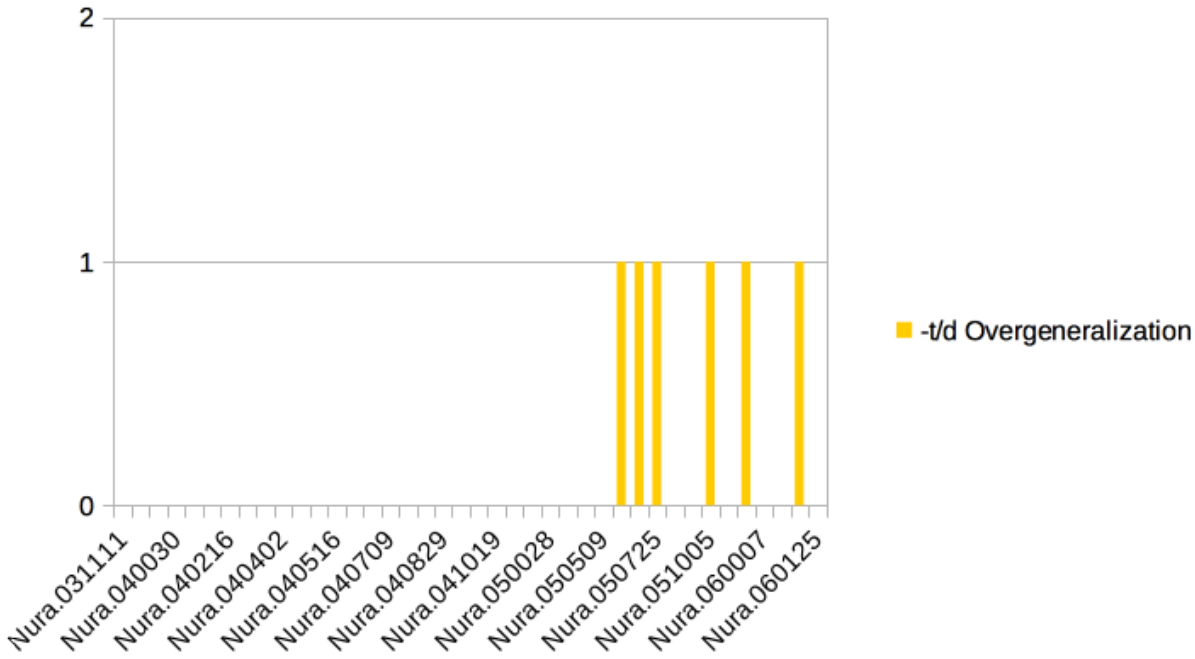
(75) Deletion

a.	*I just heard what you said*	[ˈhɪɹd]→[ˈhɪɹ]	5;06.06
b.	*you already coloured*	[ˈkʌləɹd]→[ˈkʌləɹ]	6;00.07

3.2.2 Overgeneralization in the Acquisition of Vsp

There are only 6 instances of incorrect use of the past tense *-ed* found in the data between 5;6.06 and 6;01.11. This is consistent with Nura's acquisition of V3sg, which also involved very few overgeneralization or incorrect use of the target inflection, as we saw earlier.

Figure 45: Overgeneralization of Vsp



Some additional observations can however be extracted from these few overgeneralizations of past tense *-ed*. First, they all occurred during the later stage of development, from 5;6.06 to 6;01.11. Second, these errors occurred not in simple declarative sentences but in syntactically complex sentences involving *wh*-movement, *do*-insertion, or a subordinate clause. We provide the complete list of examples in (76).

(76) Overgeneralization of verb past tense *-ed*

a.	*Why do I just <u>used</u> it?*	[ˈjuːz] → [ˈjuːzd]	5;06.06
b.	*Is <u>tickled</u> me right now*	[ˈtɪkəl] →[ˈtɪkəld]	5;06.27
c.	*you <u>needed</u> to find what I find.*	[ˈniːd] →[ˈniːdəd]	5;07.25
d.	*Do that <u>scared</u> you?*	[ˈskɛɹ] →[ˈskɛɹd]	5;10.05
e.	*Did we <u>passed</u> it?*	[ˈpæs] →[ˈpæst]	5;11.16
f.	*Why did they <u>locked</u> it?*	[ˈlɑk] → [ˈlɑkt]	6;01.11

This concludes our description of Nura's acquisition of verb past tense. Deletion was much more prominent during the early developmental period (4;00.30 to 4;09.19). Nura then mastered the past tense morphological marker *-ed* at around 4;10.19. In addition, she displayed very few errors in the acquisition of the simple past inflection. This is also consistent with Ionin & Wexler's (2002) documentation of child L2 learners who optionally leave out inflections, while making fewer inflection or finiteness overgeneralization errors.

3.3 Copula *be* in Obligatory Contexts

As reviewed at the beginning of this chapter, L1 and child L2 learners present different patterns in their development of verbal affixal inflection and suppletive inflection in obligatory contexts. The obligatory contexts, in the case of the suppletive *be* copula refer to the contexts in which the morpheme would normally be used in adult English. In this section, we describe Nura's acquisition of the copula *be*.

The word copula derives from Latin, meaning *to link* or *tie*, effectively connecting two different things. In linguistics, copula can also called linking verbs. The main copula of English is the verb *to be*. Some other verbs also have similar functions (such as

become, get, seem). However, we only focus on the main form copula be and its various suppletive allomorphs (i.e., *am, is, are, was*).

As we will see, Nura presented a high proportion of accurate suppletive inflections and mastered all types of copula *be* morphemes by 4;07, which is prior to her mastery of both nominal and verbal suffixes, described previously.

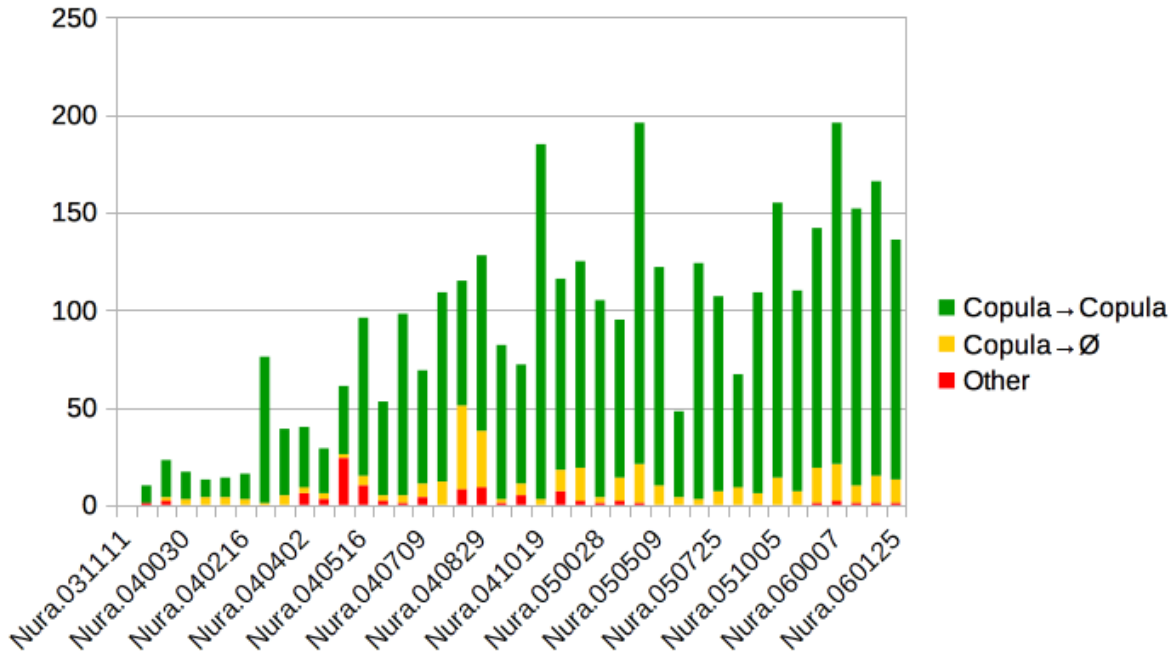
Table 110 shows Nura's overall performance on all types of *be* copula, which includes *am, is, are*, and the past tense *was*. As we can see from this table, 88% of all productions were accurate, 8% involved deletion, and 3% involved other random outcomes.

Table 110: All Copula Performance

Accurate Production	3182	88%
Deletion	339	9%
Other	95	3%
Total	3616	100%

We can see in Figure 46 that Nura displayed accurate productions very early on, starting at 3;11.28, and presented a high accuracy rate throughout the data. Nura also displayed noticeable amounts of omissions throughout the sessions, particularly during the month-long period between 4;07.30 and 4;08.29, and more or less variable productions between 4;03,08 and 4;05.16.

Figure 46: Acquisition of *be* Copula (All Types)



In order to characterize Nura's acquisition of the copulas more clearly, we describe each copula type (*am, are, is, was)* separately in the following sections. As we will see, all types of copulas underwent deletion between 4;07.09 and 4;08.29, (more prominently in the case of the copulas *are* and *is*). The variable patterns between 4;02.02 and 4;05.16 came from her acquisition of the copula *is*. By further categorizing this copula into contracted *is* (i.e., *she's, there's*, etc.) and non-contracted *is* (i.e., *she is, he is,* etc.), we

see that these variable patterns came from Nura's acquisition of the non-contracted copula *is.* We start with Nura's acquisition of the copula *am.*

3.3.1 Copula *am*

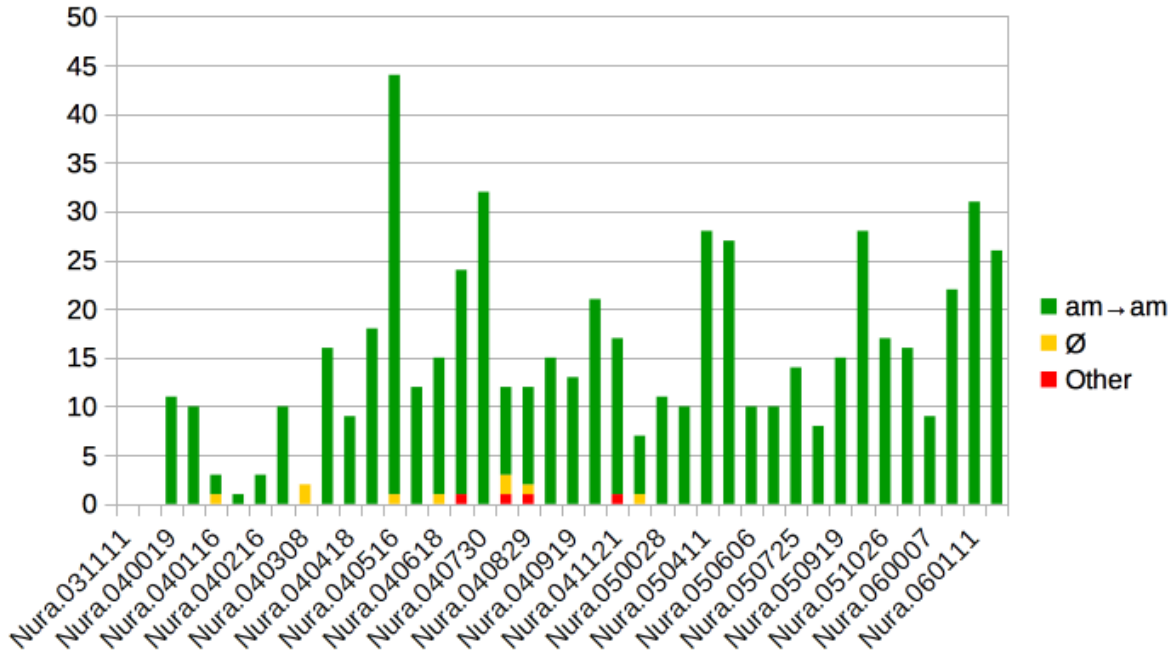
As we can see in Table 111, 98% of Nura's attempted productions of the copula *am* were accurate, with only a few cases of deletion and other marginal forms attested in the data.

Table 111: Acquisition of Copula *am*

Accurate Production	576	98%
Deletion	9	1.5%
Other	4	.5%
Total	589	100%

Nura has thus acquired the copula *am* as early as 4;00.19, and the vast majority of her attempts resulted in accurate productions. She only made a few deletion and other errors between 4;08.13 and 4;08.29.

Figure 47: Acquisition of Copula *am*



3.3.2 Copula *are*

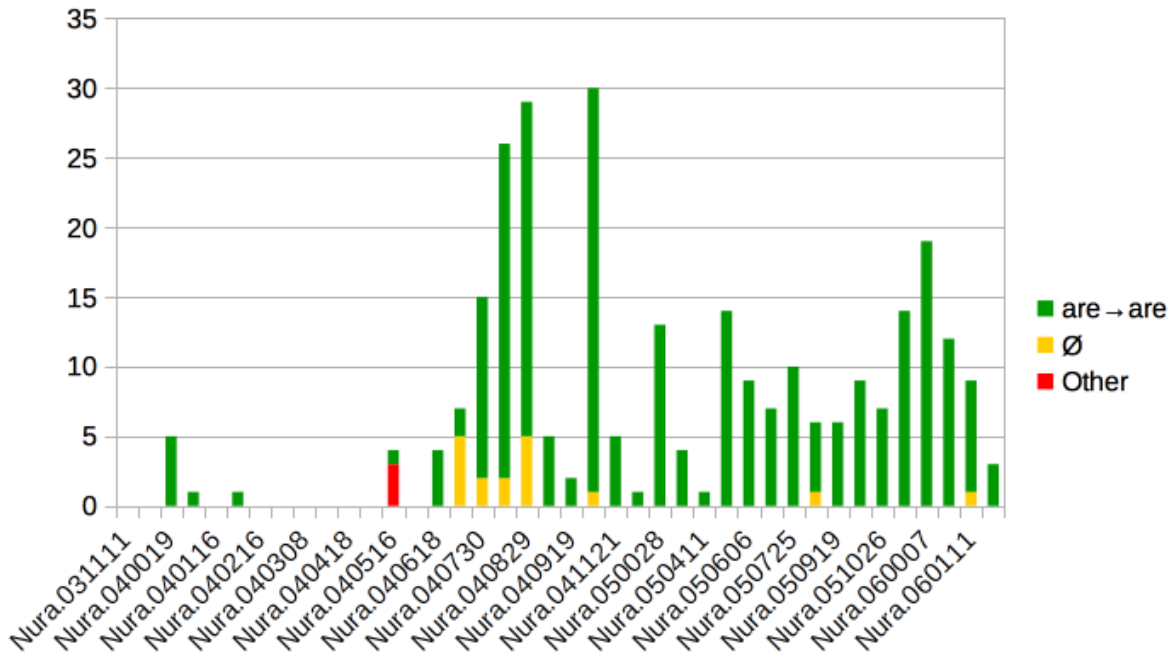
Table 112 displays Nura's performance with the copula *are*, for which 93% of all attempts resulted in accurate productions, with 6% deletion, and 1% of random attempts throughout the observation period.

Table 112: Acquisition of Copula *are*

Accurate Production	258	93%
Deletion	17	6%
Other	3	1%
Total	278	100%

Nura used a few copula *are* during the early sessions, between 4;00.19 and 4;02,02, but made more productive attempts at it from 4;05.16 onward. We notice a short period of deletion between 4;07.09 and 4;08.29, which is consistent with the deletion we saw in Figure 46 for all types of copula *be*.

Figure 48: Acquisition of Copula *are*



3.3.3 Copula *is*

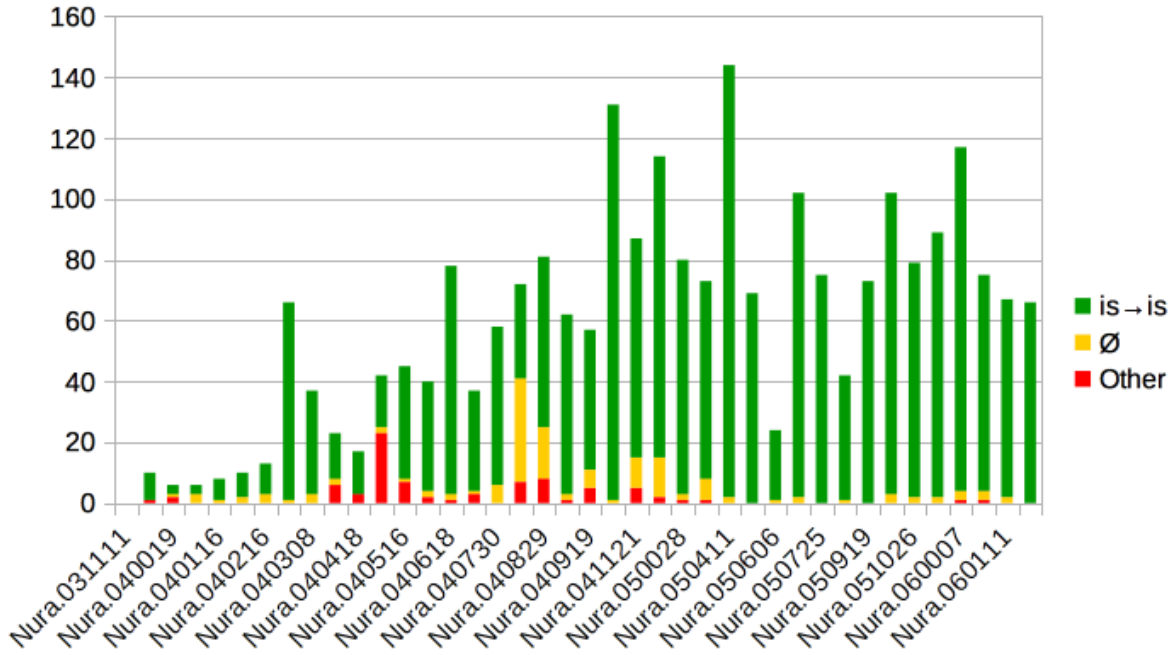
Table 113 below illustrates Nura's quantitative performance on the copula *is*. We can see that 91% of all attempts at the copula were accurate, while 6% of them resulted in deletion, and 3% in other idiosyncratic forms. Although the overall accuracy rate is very high, Nura's acquisition of this type of copula presented more variable productions than did other types of copula (*am, are*).

Table 113: Acquisition of Copula *is*

Accurate Production	2154	91%
Deletion	143	6%
Other	80	3%
Total	2377	100%

Nura attempted copula *is* starting at 3;11.28. From there, she gradually became more productive. We observe more variable patterns between 4;02.02 and 4;05.16, which together account for the marginalized patterns observed in the general data in Figure 46. In addition, deletion became very prominent between 4;08.13 and 4;08.29, consistent with all copula *be* forms.

Figure 49: Acquisition of Copula *is*



3.3.4 Copula *is*: Contracted and Non-contracted Forms

So far, we have seen that Nura mastered all types of copula during the observation period (*am* by 4;01; *is* by 4;03, *are* by 4;07; and *was* by 5;04). All types except *was* were affected by a noticeable spike in deletion between 4;07.09 and 4;08.29. In addition, the copula *is* showed more variable patterns. Since there are contracted forms (*that's, there's, she's,* etc.), and non-contracted forms for this copula, we investigated these contexts in more detail, which we discuss in the next sections.

3.3.4.1 Contracted Copula *is*

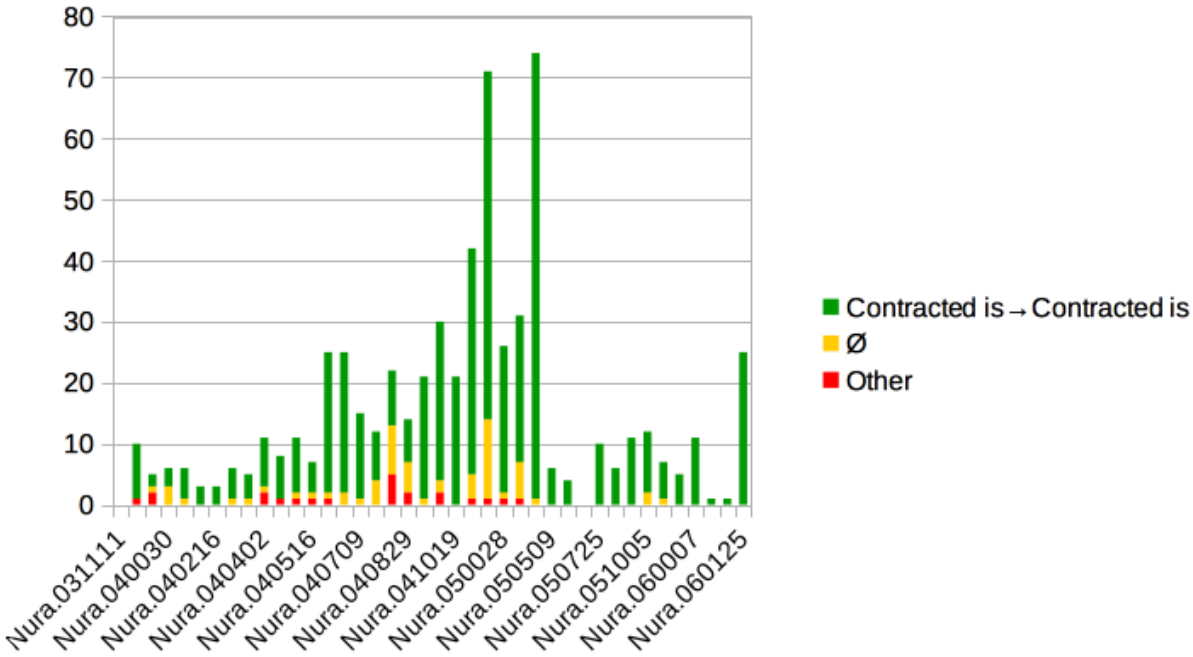
The term contracted copula refers to the shortening, or contraction, of *is* in phrases such as *he is happy* produced as *he's happy*, or *who is here*? as *who's here*?. As we can see in Table 114, Nura's overall accuracy rate for contracted *is* was 86%, with 10% deletion, and 4% marginal forms.

Table 114: Contracted Copula *is (that's, who's)*

Accurate Production	525	86%
Deletion	62	10%
Other	22	4%
Total	609	100%

The following figure shows that Nura made proportionally more accurate productions at the beginning of the observation period, between 3;11.28 and 4;03.08. This was followed by a stage where deletion became more prominent, between 4;08.13 and 5;02.16. Nura then mastered the contracted copula by 5;04.11.

Figure 50: Acquisition of Contracted Copula *is*



3.3.4.2 Non-contracted Copula *is*

Turning now to the non-contracted allomorph of *is,* Table 115 shows that 92% of Nura's overall attempts at *is* (non-contracted copula) were accurate, while 5% underwent deletion, and 3% resulted in other variable productions.

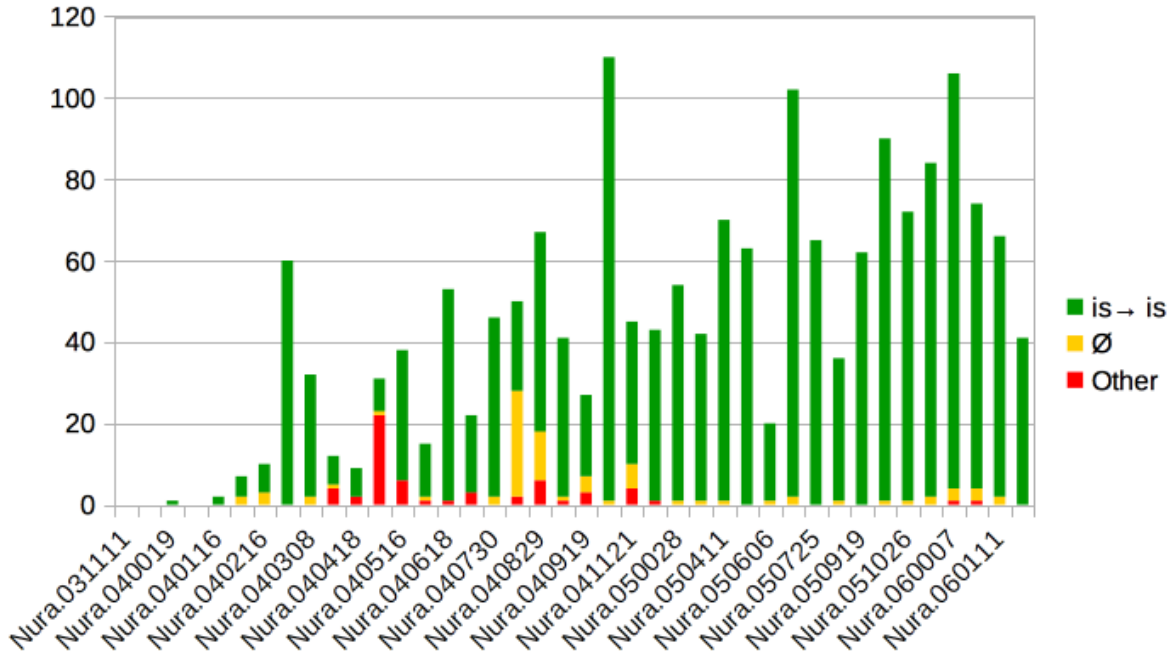
Table 115: Non-contracted Copula *is*

Accurate Production	1629	92%
Deletion	81	5%
Other	58	3%
Total	1768	100%

These numbers suggest that Nura had better performance at the non-contracted forms than at the contracted forms (described above). However, the developmental picture tells us a different story.

As we can see in Figure 51, Nura presented consistent accurate productions of non-contracted copula *is* starting at 4;01.16, which is later than her accurate productions of the contracted form, which were attested as of 3;11.28. In addition, we see more variable outcomes between 4;04.02 and 4;05.16, which suggests that Nura had more difficulties with the non-contracted copula *is* during the early period of acquisition. The deletion cases observed between 4;08.13 and 4;08.29 are consistent with what we observed for all *be* copula, as noted already.

Figure 51: Acquisition of Non-contracted Copula *is*



In summary, we have seen that Nura mastered all types of copula *be* between 4;01 and 4;07. This is much earlier than her mastery of affixal inflections (4;10,19 for Vsp; 5;00.07 for V3sg) discussed in the previous sections. Again, this is consistent with previous studies (e.g. Ionin & Wexler 2002) in terms of developmental differences between suppletive inflection and affixal inflection observed in child L2 context.

3.3.5 Copula *was*

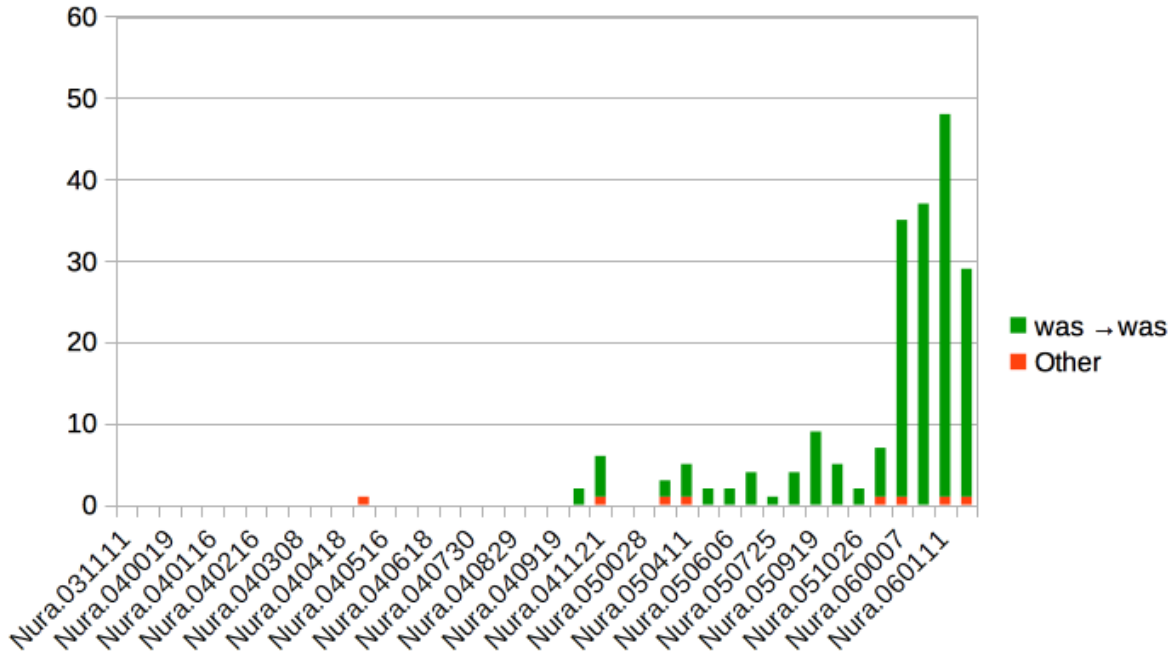
There were only 202 attempts at the copula *was* in our data. As we can see in Table 116, 96% of these attempts resulted in accurate productions, while 4% resulted in deletion.

Table 116: Acquisition of Copula *was*

Accurate Production	194	96%
Deletion	8	4%
Total	202	100%

Nura did not attempt the past tense copula *was* early on. This is expected because past tense features are generally acquired later than present inflection in the acquisition process. The first few cases were attested at 4;10.19, as we can see in Figure 52. Nura became more productive toward the end of our documentation period. We can say that Nura mastered the past tense copula *was* at 5;04.11. This is consistent with her acquisition of all copula forms (as in Figure 46).

Figure 52: Acquisition of Copula *was*



3.4 Summary of the Acquisition of Verbal Morphology

This concludes our description of Nura's acquisition of English inflectional morphology. We focused on affixal inflection (past tense <-ed>, third person singular <-s>), as well as the suppletive inflection (copula *be*) in obligatory contexts. Concerning the acquisition of past tense <-ed>, Nura went through a deletion period during the initial stage (4;00.30 and 4;09.19). She mastered this verbal inflectional marker at around 4;10.19. Consistent with previous studies, she made very few errors. Specifically, we only observed some overgeneralization in syntactically complex sentences at later stages, between 5;06.06 to 6;01.11. Nura displayed a deletion period for her acquisition of V3sg <-s> at the initial stage, between 4;00.30 to 4;09.12, although we observed that this deletion pattern came from the single word *goes*. Nura mastered V3sg round 5;00.07. Consistent with her

acquisition of past tense *-ed*, Nura also had some overgeneralization errors during the later stage, between 5;04.11 and 6;01.11 in complex clauses.

In contrast, Nura mastered suppletive inflections earlier than her affixal inflections. Copula *am* was mastered by 4;01; *is* by 4;03; *are* by 4;07; and *was* by 5;04. Aside from these observations, we have seen that Nura displayed a general stage of deletion (omission) between 4;07.09 and 4;08.29 for all types of copulas, except for *was*, which she only mastered at a later age, by 5;04.11.

Chapter 6: Analysis of Nura's L2 Acquisition of English Consonants

1. Introduction

One of the important themes of this research is to address the role of the L1 in the process of L2 development. From a systematic perspective, this requires an understanding of how the different levels of structure of the L1 grammar (e.g., phonological, morpho-syntactic) can interfere with Nura's interlanguage grammar. Generally, it is assumed that the acquisition of phonology is qualitatively different from the acquisition of syntax in L2 development. This assumption is based on the general observation that L2 learners seem to be able to master even complex syntactic knowledge meanwhile they have tremendous difficulties in mastering L2 pronunciation and intonation (Brown 1998). This raises questions such as whether we should look at phonological phenomena and morpho-syntactic phenomena separately, or study inter-relations between these two domains.

Researchers have claimed that L2 learners' superficial morphological behaviours reflect their underlying syntactic knowledge and representations. For example, Prévost & White (2000) argue that L2 learners have unconscious/abstract knowledge of the functional categories and features associated with tense and agreement. In this view, missing morphological inflections (such as *like*<u>*s*</u> vs. *like-*<u>*Ø*</u>) reflect difficulties in the mapping of abstract features to their surface morphological realizations. This forms the basis of the *Missing Surface Inflection Hypothesis (MSIH)* by Prévost & White (2000).

Researchers have also uncovered phonological effects on the L2 development of functional categories in production. Goad & White (2004) propose that the production of

functional material may be constrained by aspects of L1 prosodic representation. This forms the essence of the *Prosodic Transfer Hypothesis (PTH)*, which not only predicts L1 transfer in L2 acquisition, but also explicitly relates morphosyntactic phenomena in L2 development with phonological properties of speech. Based on this proposal, L2 speakers initially adopt L1 prosodic representations, and if the L1 does not permit certain prosodic representations as required by the L2, then the L2 learners are predicted to have difficulties in representing such morphology in the outputs of the phonological component of their interlanguage grammar (Goad & White 2004).

As we will see below, both phonological and morpho-syntactic features of Nura's developing L2 have been systematically influenced by representational and grammatical properties of her L1. Further, we will see that an extension of this feature-based approach to L2 acquisition can be made in the realm of speech phonetics, given that phonological features alone cannot fully describe the phonetic implementation of speech sounds or the acquisition of the detailed knowledge it involved. In the following section, we first discuss aspects of Nura's phonological development in English. We then address in the subsequent chapters cross-grammar interactions in aspects of her morphological development.

2. Phonological Development

The pedagogical method known as *Contrastive Analysis* (CA), developed during the 1960s, focused on linguistic behaviours between a learner's L1 and L2 (Fries 1945; Lado 1957). CA predicted learning problems based on structural differences between the L1 and the L2.

The core assumptions of CA were that structural similarities between the L1 and the L2 imply ease, while differences cause difficulties in the course of L2 acquisition. Thus CA assumed interference (or transfer) in L2 learning. However, this traditional approach merely predicted that differences between the L1 and the L2 would cause difficulties in the course of L2 acquisition, without however specifying the actual nature of these problems.

Flege, Takagi & Mann (1995) examine the acquisition of the English liquids /l/ and /ɹ/ by Japanese adult speakers at the initial stage, and aimed to account for the learning of phonetic segments in an L2. They propose that the errors made by these adult L2 learners were not the result of them having passed the critical period. Rather, their data suggest that the errors might be attributed to the absence of phonetic categories for English /l/ and /ɹ/, which in turn is due to insufficient phonetic input[24] or to the possibility that they may have failed to perceive and discriminate the English liquids (/l/ vs. /ɹ/) from one another, or from Japanese consonants /ɾ/, /w/.

Such attempts to explain how speech perception may affect phonological acquisition illustrate the fundamentals of the *Speech Learning Model* (SLM) developed by Flege (1991; 1995). Other basic premises about the SLM include the processes and mechanisms that guide successful L1 speech acquisition (including the ability to form new phonetic categories), which are assumed to remain intact and accessible across the life span. This model emphasizes the perception by L2 learners of phonetic properties of the non-native segments; however, it does not explicitly encode what

24. Recent investigations also indicate that orthographic input can affect the learner's phonological development and lexicon during second language acquisition, particularly in instructed setting (Bassetti, Escudero & Hayes-Harb 2015).

aspects of the learners' L1 systems block their accurate perception of these non-native segments. In sum, the SLM does not provide a grammar-based proposal as to how L2 sounds should be compared to L1 sounds (Brown 1997).

In contrast to this, under feature-based approaches to phonology, functional differences between contrastive segments are assumed to lie in their unique featural representations. Infants are, initially, during their first six months of life, able to perceive all phonological contrasts relevant to the world's languages, both those present in their native languages and beyond (Werker & Tees 1984). Infants then gradually become more and more sensitive to the phonological contrasts relevant to their native languages. This gradual specialization also results in the relative loss, especially during the second half of the infants' first year, in their ability to perceive contrasts between phones which are not relevant to their native language(s) (Werker & Tees 1984). These phenomena can be related to the emergence of categorical speech perception, whereby speaker-listeners are able to easily distinguish members of different native phonemic categories (i.e., /t/ and /d/) while being relatively unable to discriminate allophonic variants of the same native phonemic categories (i.e., [t] and [t^h]). From the perspective of phonological features, this relative loss in infants' ability to perceive non-native contrasts can be encoded in terms of the absence of the phonological features relevant to these contrasts from the children's (L1) phonological systems of representation (Brown & Matthews 1993).

Building on this theoretical proposal, Brown (1998) proposed that the symmetry between the gradual decline in universal perceptual capacities and the increase in the ability to distinguish sounds phonologically in the children's native languages are the result of the

same internal, feature driven mechanism. This, in turn, has important implications for the acquisition of non-native contrasts by L2 learners. In this view, whether or not an L2 learner is able to perceive a non-native contrast ultimately depends on aspects of his/her L1 phonological development; the native phonological system may either prevent or facilitate accurate perception of non-native contrasts. According to this theory of *Phonological Interference* (Brown & Matthews 1993; Brown 1998), a speaker's phonological knowledge thus consists of phonemic representations constructed as combinations of phonological features. It is thus these features and their combinations, as opposed to the actual segments contained in the L1 inventory, that constrain perception. This proposal also supplements Flege's SLM by explicitly accounting for why L2 learners fail to perceive and discriminate non-native phones in acquisition.

Brown (1998) illustrates on this hypothesis by discussing how the features represented in L1 phonological systems may impinge upon L2 perception (and production). She examined the acquisition of segmental contrasts (/l~r/, /b~v/ and /f~v/) by Japanese and Chinese learners of English. She introduced three types of contrasts that learners encounter during the course of L2 acquisition, as summarized in the following paragraphs:

Type 1: each member of the contrast in the L2 is similar to distinct segments in the learner's L1. For example, the glottalized /t'/ and /k'/ of Salish may correspond to /t/ and /k/ in English. The L2 learner is able to acoustically discriminate these non-native contrasts, but this ability is not based on the phonetic (physical) characteristics of the segments, but on them being perceived as distinct phonemes in the L1 (Brown 1998). Thus, the learner can categorize the members of the non-native contrast into phonemic

categories corresponding to those of his/her L1; no new phonological structure is established in the interlanguage grammar.

Type 2: neither of the sounds involved in the L2 contrast exists or has direct correspondents in the learner's L1. An example of this would be the acquisition of Zulu clicks by English speakers. Because no phonological structure is available in the learner's L1 to represent either of the segments, perception of such non-native contrast will not be blocked by the learner's L1. Acquisition of this type of contrast is predicted to most closely resemble L1 acquisition, and the L2 learner should not encounter any difficulties during the acquisition process, and should thus be able to construct representations for this non-native contrast.

Type 3: when only one member of the non-native contrast has a corresponding phoneme in the learner's L1. The L2 learner may be able to perceive this non-native contrast if the feature that distinguishes the two segments is present in his/her L1 grammar for independent reasons (i.e. the feature is involved in the representation of other L1 contrasts). This also predicts that acquisition of the accurate phonological representations for this non-native contrast is possible. On the other hand, the L2 learner may not be able to perceive (or produce) the contrast if the L1 grammar lacks the feature needed to distinguish the L2 pair of phones.

In sum, Brown (1998) suggests that a feature-based examination of a speaker's L1 phonological representation is necessary to evaluate a L2 learner's ability to perceive and eventually produce non-native contrasts.

In a more recent study, Martinez, Goad & Dow (2021) expanded the scope of feature-based approaches to L2 acquisition by addressing the possibility of feature recombination, depending on the different roles that a given feature may play in either the L1 or the L2 grammar, in which features may function contrastively, allophonically or phonetically. This approach thus extends Brown's (1998) proposal, in which perception and production of non-native contrasts can only arise through a recombination of features that are phonologically contrastive in the L1. In their attempt at extending the proposal, Martinez et al. addressed the question as to whether allophonic features of the L1 can serve a contrastive function in the L2 system. They obtained divergent results, whereby certain L2 listeners could not discriminate non-native contrasts at first exposure, while others were able to accurately perceive them. Martinez et al. proposed that redeployment might be possible when allophonic features are in pseudo-contrastive contexts. For example, the feature [nasal] functions allophonically on vowels in Caribbean Spanish, whose deletion of the nasal consonant that assimilates a vowel is frequently observed while the vowel's derived [nasal] feature is maintained. This results in CṼ syllables (e.g. /sin/ → [sĩŋ] → [sĩ] *without*), which superficially contrast with CV syllables with old vowels (e.g. [si] *yes*). Martinez et al. (2021) refer such cases as pseudo-contrastive. In addition, they distinguish allophonic and phonetic nasality in their approach. They propose that allophonic nasalization, like phonemic nasalization, is intended and controlled by speakers, whereas phonetic nasalization is unintended and automatic, as it results from physiological constraints on coarticulation (Martinez, Goad & Dow 2021).

In addition to the possibilities of feature recombination across allophonic vs. contrastive levels discussed above, Martinez et al. (2021) also address other conditions under which phonological features present in the learner's L1 grammar could be redeployed to build new categories in the L2, for example in the case of features operating in different subsystems of the phonological grammar of the language (e.g. vocalic vs. consonantal features). They observe that contrastive features operating in different subsystems may behave in different ways, suggesting that redeployment within the same system is possible for vowel features but not for consonant ones. However, considering that many features in the phonology of a language operate in both the consonant and vowel systems, Martinez et al. propose that redeployment across subsystems is an important and understudied area of segmental development, which may reveal even more possibilities for feature redeployment. Martinez et al. (2021) thus emphasize the effects that different functions of a feature may play (contrastive, allophonic or phonetic) in both the L1 and L2 systems, as well as their implications for L2 phonemic acquisition.

Together, Brown & Matthews (1993, 1998) and Martinez et al. (2021) thus offer a systematic perspective on L2 phonemic acquisition, also in light of the general decline of perceptional ability for non-native contrasts that correlate with L1 segmental development in L1 acquisition. We now expand on this systematic perspective next.

Under any feature-based approach to L1 and L2 acquisition, L1 phonological representation lays out what successful phonological development looks like for a given language, and gives us the content that an L2 learner has to master to be successful in his/her L2 acquisition. In terms of segmental representation, phonologists generally agree that phonemes have an internal structure, which consists of distinctive features

that are organized into hierarchical constituents. This is well represented in all approaches to Feature Geometry (Clements 1985; Sagey 1986).

Figure 53: A Feature Tree (De Lacy 2007; Gussenhoven & Jacobs 2011)

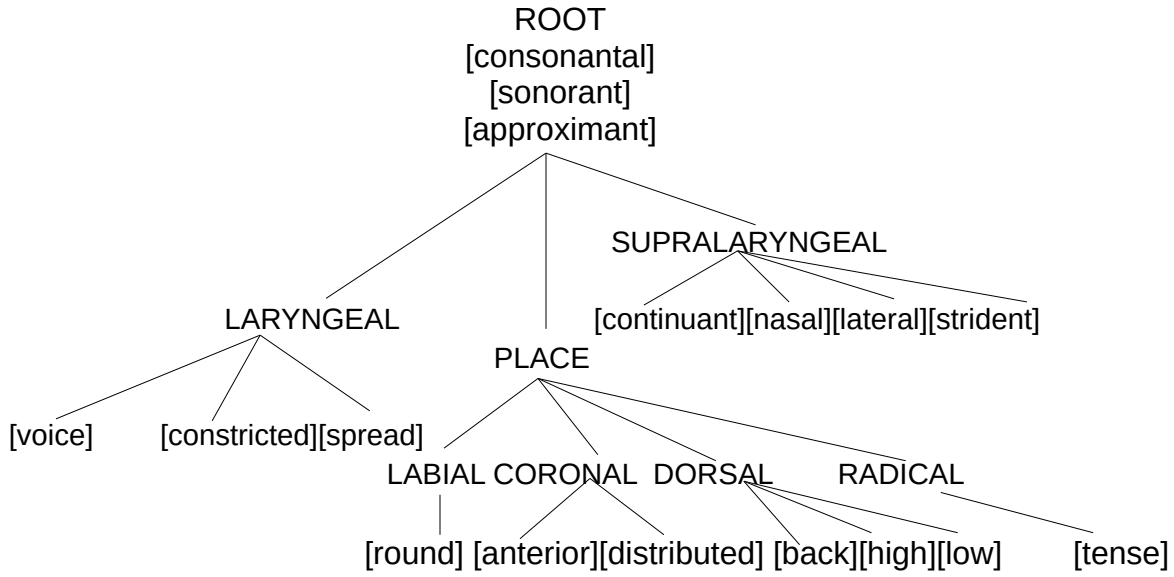


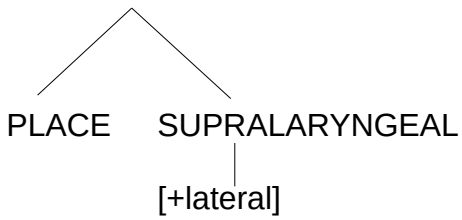
Figure 53 illustrates such a model, itself adapted from the pioneering works by Clements (1985) and Sagey (1986). The top node is referred to as the Root node, which dominates the nodes that organize the Laryngeal, Supralaryngeal manner and Place features of the segment. The Laryngeal features specify different states of the glottis, for example voicing and aspiration. The manner features are organized under the Supralaryngeal node. Finally, under the Place node[25] are four articulator nodes (i.e. [labial], [coronal], [dorsal], and [radical]), each of which organizes corresponding features specifying different places of articulation.

25. The Place node may be located inside the Supralaryngeal node in other models (e.g Gussenhoven & Jacobs 2011).

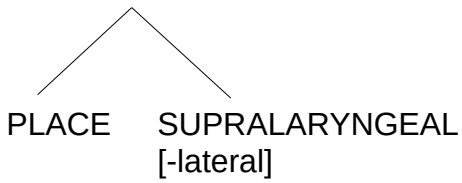
Given that Feature Geometry is a model of phonological, as opposed to phonetic, representation, a segmental representation within this model contains only the information needed to distinguish a given segment from all other segments present in the phonemic inventory of the language. For example, in English, the lateral approximant /l/ and the retroflex approximant /ɹ/ can be represented as in example (77), omitting all other unnecessary structure, with only the unique feature (i.e. [±lateral]) to distinguish between the two consonants.

(77) Feature Geometry of English Liquids

a. /l/



b. /ɹ/



These representations also follow the assumption held by many scholars that the presence of a place feature in the representation of a segment designates the active

involvement of its corresponding articulator. For example, the presence of the feature [round] in a representation entails the projection of the LABIAL node. Similarly, the absence of a place feature entails that the corresponding articulator is not active for a given segment. Any further specification beyond the representation of the phonological contrast must be provided by a system of phonetic implementation. For example, in the representations above, the coronality of both sounds, and the precise articulations involved in the production of /l, ɹ/ need to be specified at the level of phonetic implementation.

Feature Geometry, as a model of phonological representation, thus provides a blueprint for understanding segmental development at the level of phonology, including the internal phonological structure of the phoneme at hand. However, it does not always offer the types of phonetic specifications required to successfully master a specific segment in any given language. Similarly, feature-based studies on L2 segmental acquisition such as Martinez, Goad & Dow (2021) emphasize the role of phonological features and the role of feature recombinations in L2 development. As we will see below, however, this is not enough to capture all the behaviours observed in our L2 data.[26] Therefore, we propose to extend this model to incorporate phonetic aspects of learning and related specifications at the level of speech articulation.

Recall that we have focused on Nura's acquisition of English |f-v|, |θ-ð|, |ɹ|, |ʃ-ʧ|.[27] In order to master these contrasts successfully, Nura not only needed to build the

26. In addition, there are individual differences in the production and perception among native and non-native speakers of English (for more detail, see Smith & Hayes-Harb (2011).

27. |ʒ| will not be analyzed due to lack of data, and also given that |ʒ| has extremely low frequency in the target language.

phonological structure that differentiates each segment in her phonological representations, based on her perception of the input and her understanding of the sound distribution in the language. She also needed to master the phonetic features of these phones (if absent from Kazakh) in order to accurately pronounce them as part of her English speech productions. As we will see in the next subsections, Nura's acquisition of each of these phones involved combination of perceptual factors (with or without L1 interference), possibilities of phonological feature recombinations, as well as the development of phonetic knowledge specific to these English consonants. We begin with Nura's L2 acquisition of |f, v| in English.

2.1 |f| and |v|

Recall from Brown (1998) that an L2 learner should have no difficulties perceiving non-native contrasts which do not exist or have no direct correspondents in the learner's L1. This is because there should be no interfering phonological structure in the L1 to undermine perception of the new contrasts. Recall as well there are no labio-dental fricatives such as /f, v/ in Nura's L1, nor is there any other form of labial fricatives in the language. As predicted by Brown (1998), Nura should not have had any particular issues with perceiving /f, v/ in the English input. In addition, fricatives are documented to have high acoustic prominence (through their frication noise). Further, Ladefoged & Maddieson (1996:142) show that /f, v/ offer perceptually more robust auditory cues than bilabial fricative sounds (/ɸ, β/). These acoustic properties of /f, v/ were also arguably facilitating Nura's perception of these speech sounds.

In English, /f/ and /v/ share almost all their phonological features, as shown in (78). Key to these representations is not only the voicing contrast between /f/ and /v/, but also the fact that these segments contrast in place, manner and voicing with other phonemes in the language. The unique feature combinations in (78) unambiguously represent this pair of consonants in English.

(78) Phonological Features: /f, v/

/f/	/v/
+consonantal	+consonantal
-sonorant	-sonorant
-approximant	-approximant
+labial	+labial
+continuant	+continuant
-voice	+voice

At the phonological level, these feature specify /f, v/ broadly as labial, in terms of their place of articulation, but do not specify the exact nature of the labial constriction. Consequently, in the context of L2 acquisition, we must also consider whether the learner has, in his/her L1 system, all of the features to allow representations at both the phonological and phonetic levels of representation. At the phonological level, in line with Brown (1998) and Martinez, Goad & Dow (2021), we examined the possibilities of L1 feature recombination in Nura's L2 representations. The phonological features in question for the acquisition of |f, v| are [labial] and [+continuant]. As shown in the following table, both English and Kazakh have labial consonants (e.g. /p, b, m/), as well as [+continuant] obstruents. This suggests that it was readily possible for Nura to recombine these feature in her acquisition of English.

Table 117: English vs. Kazakh ([labial] [+continuant])

	English	Kazakh
[labial]	p, b, m, f, v	p, b, m, w
[+continuant]	s, z, ɹ, θ, ð	s, z

However, these features do not supply the fine phonetic characteristics of the actual labial constriction, which involves the lower lip and the upper front teeth. Because the labio-dental phonetic nature of these fricatives does not need to be phonologically specified in English, it is only incorporated as part of the phonetic representations of /f, v/, through a phonetic feature such as [labio-dental] and the articulatory gestures that this feature entails in speech articulation. Consequently, an L2 learner cannot attain accurate production of these phones if he/she fails to identify and master this phonetic feature at the articulatory level, even when the phones are successfully represented at the phonological level. In the case of /f, v/, however, this latter challenge appears to be more or less insignificant, given that the labio-dental constriction seems relatively unmarked, as it is much more prominent cross-linguistically than the bilabial constriction. Indeed, Maddieson (1984:45) documents that labio-dental /f, v/ appear in more languages than bilabial /ɸ, β/, suggesting /f, v/ is favoured typologically over /ɸ, β/; in other words, [labio-dental] is a common phonetic expression for labial fricatives cross-linguistically. As part of the UPSID[28] database of 451 languages, /f/ is attested in 135 languages, /v/ is attested in 67 languages. In contrast, /ɸ/ and /β/ are attested in only 21 and 32 languages, respectively. The labio-dental constriction of /f, v/ is thus the most common among labial fricatives cross-linguistically. From an articulatory standpoint, there are also strong visual cues that the learner can rely on to acquire the

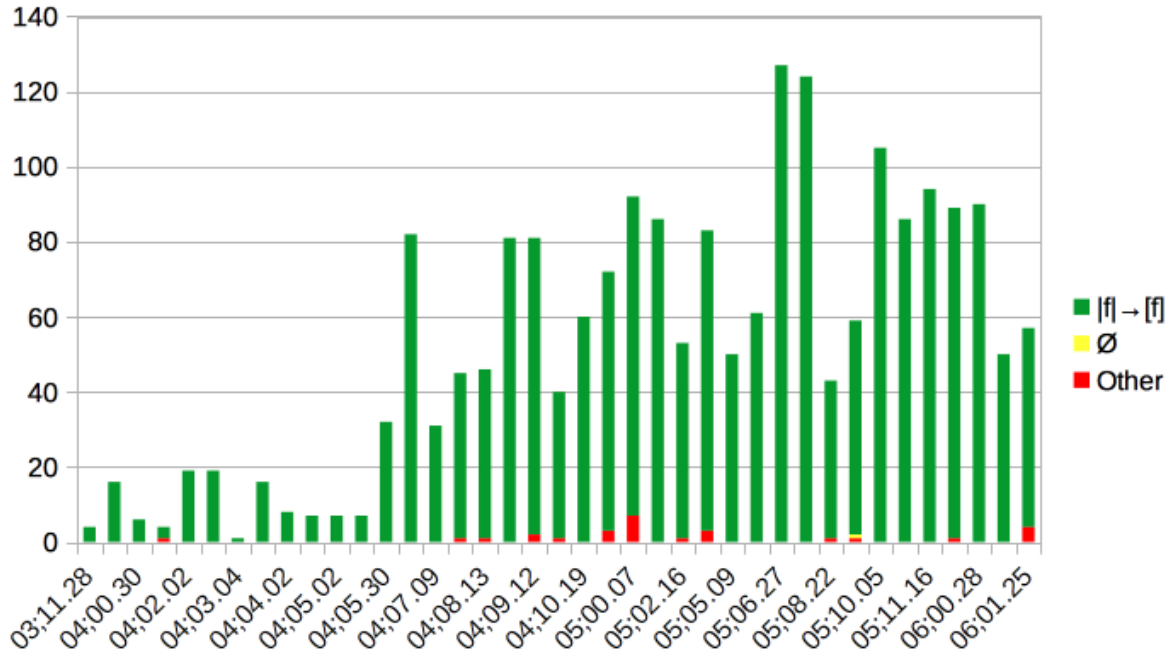
28. UPSID: UCLA Phonological Segment Inventory Database.

labiodental constriction of /f, v/ in English, given that we can relatively easily visualize a speaker bringing his/her lower lip to the upper teeth in speech production. Together, these facts may account for Nura's rapid acquisition of |f, v| in her L2.

In summary, for the acquisition of |f, v| in English, Nura could benefit from unimpeded perceptual cues, had access to the relevant phonological features through her L1 system of representations, and could benefit from a cross-linguistically unmarked constriction for the phonetic expressions of these features, which are also accessible through unimpeded visual cues. Together, these facts conspired to predict rapid acquisition, a hypothesis very clearly supported by our data.

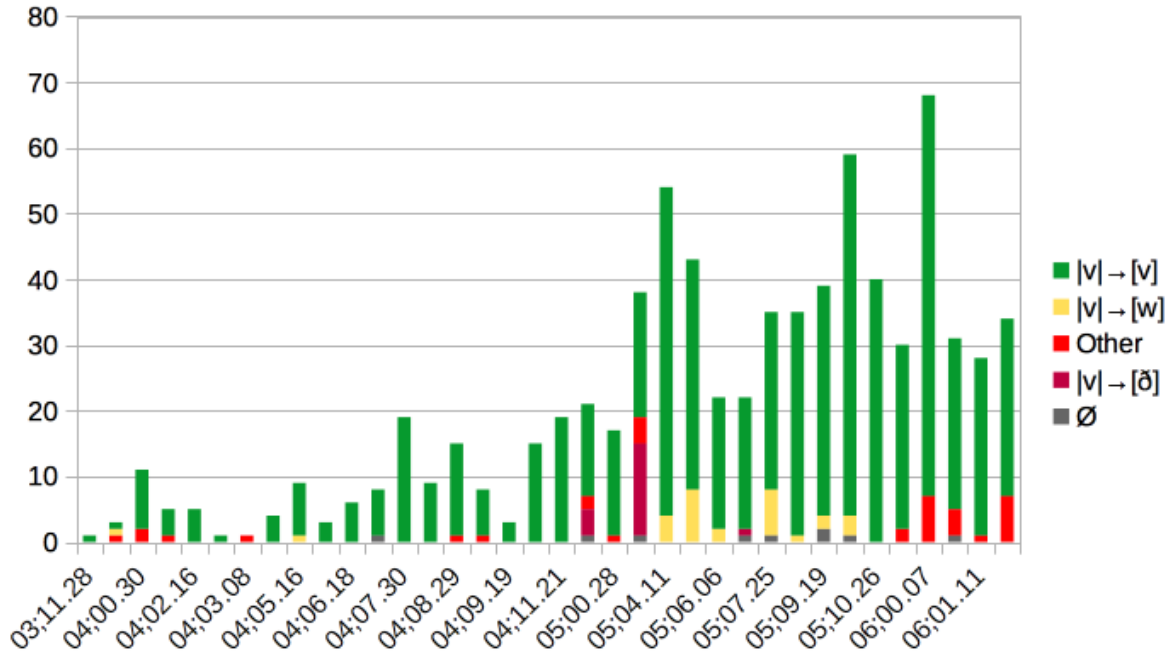
Recall that Nura's development of |f, v| in singleton onsets was extremely rapid, as repeated in Figure 54 below for convenience. We can see that Nura acquired |f| from the very beginning of our documentation, with only one instance of deletion attested in the whole dataset.

Figure 54: Nura's Acquisition of |f| in Singleton Onset (Repeated from Figure 6)



Similarly, as we can see in (repeated) Figure 55, Nura mastered |v| very early on, in spite of some substitutions to [w] and [ð] during later stage (between 5;00.07 and 5;10.05), which originated from a single lexical item *very* and, as such, were not representative of her phonological or phonetic abilities to produce the target phone.

Figure 55: Nura's Acquisition of |v| in Singleton Onset (Repeated from Figure 7)



Nura's development of |f, v| in singleton coda also present similar patterns. Nura had indeed mastered |f| in singleton coda by 3;11.11, where she was 100% accurate at the word-medial positions, while her word-final position showed high accuracy in spite of some deletions, as repeated in Figure 56, and Figure 57. These data also show that Nura had already mastered |v| in singleton coda by the beginning of our documentation.

Figure 56: Nura's Acquisition of |f| in Singleton Coda (Repeated from Figure 13)

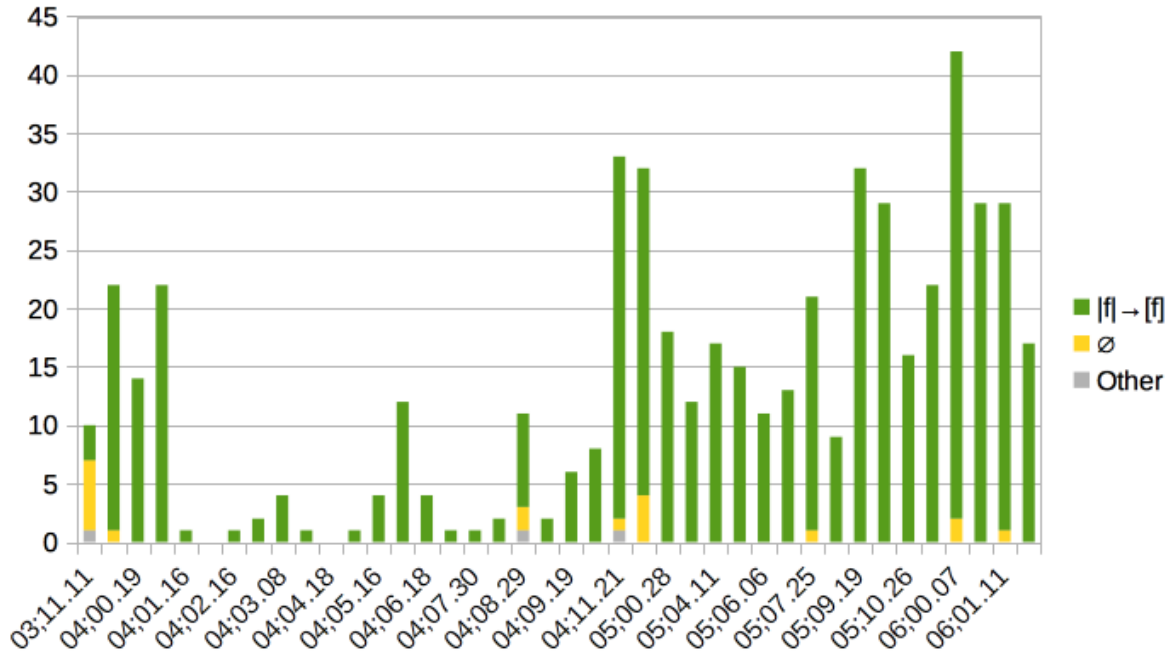
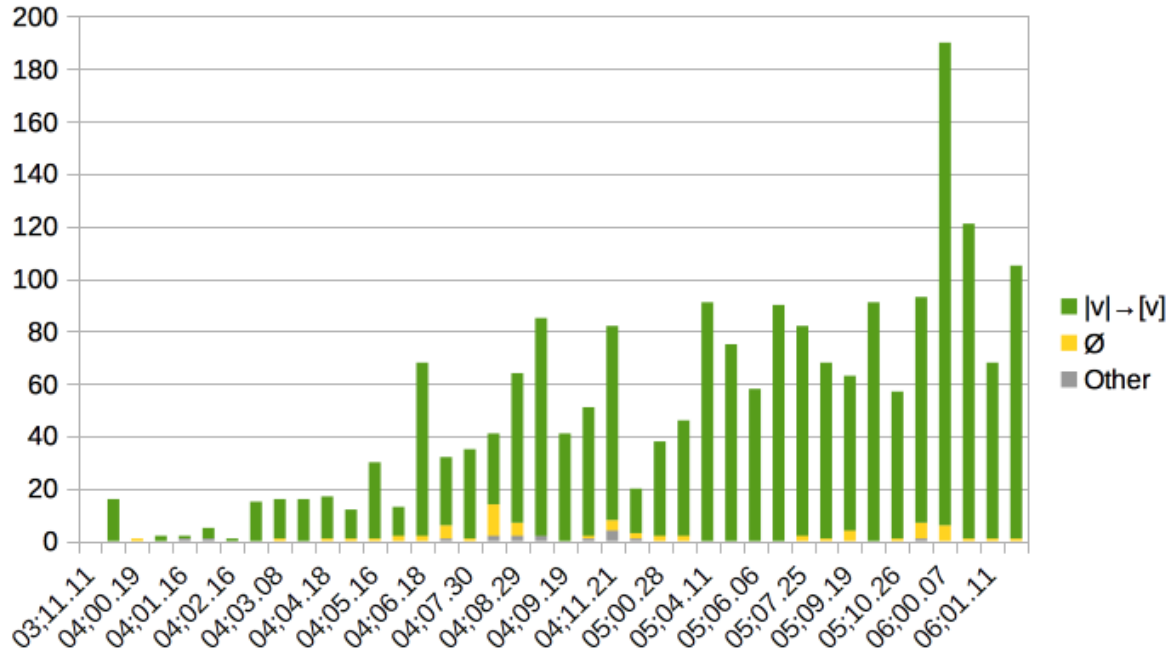


Figure 57: Nura's Acquisition of |v| in Singleton Coda (Repeated from Figure 14)



In sum, in the context where Nura already had the required phonological feature on hand and the phonetic implementation of these features can be considered as unmarked. She very rapidly acquired the representations relevant to her L2

2.2 |θ| and |ð|

In this section, we turn to Nura's development of the interdental fricatives |θ| and |ð| of English. Research has shown that the perceptual cues of the interdental fricatives in English are variable and at times potentially confusing, which yields ambiguity and relative difficulties toward acquisition. For example, Levitt et al. (1987) studied the perception of fricatives by English-learning infants. Their results, parallel with those found in adults by Carden et al. (1981), show that the voiceless interdental fricative (/θ/) is often mis-identified as labiodental (/f/). In contrast, the infants were able to discriminate the voiced pair /v/ and /ð/ with much more ease. Indeed, the perception and discrimination of labiodental fricative (/f/) away from the interdental fricative (/θ/) are documented among the most challenging in English, due to similarities in the acoustic properties of these two consonants (Levitt et al. 1987:33). Ladefoged & Maddieson (1996:144) also state that the overall perceptibly of this contrast can also vary a lot between different phonological contexts and even speakers. For example, Mielke (2012) highlights that non-sibilant fricatives offer relatively weak auditory cues to their places of articulation. Similar findings are reported in L2 acquisition. Brannen (2013) investigated the substitution of interdental fricatives by learners of English as a second language, and reported variable patterns of acquisition, for example that Japanese and European French speakers substitute /s, z/ for /θ, ð/, while Quebec

French speakers replace these interdental fricatives by /t, d/, although these languages all have /s, z, t, d/ in their phonemic inventories.[29] In an earlier study, Brannen (2002) also reported that confusion between /f/ and /θ/ is greater for French than it is for Japanese listeners.

Anrrich (2008) investigated the substitutions for English consonants produced by adult speakers of Cuban Spanish and reported that the voiceless interdental fricative /θ/ was replaced by [s] and [t] in onset as well as in coda. In addition, Anrrich reported on lexical difficulties found in many speakers who perceived /θ/ as [f] in one specific word *ethnic*, an observation which points to contextual effects in the perception of this contrast.

Together, these studies show that the non-sibilant fricatives of English offer impoverished perceptual cues to their manners and places of articulation, which in turn result in many substitution variations both among different phonological contexts and between learners. This general observation and implications for L2 learning also reflect themselves in Nura's acquisition of |θ, ð|. As we reported in section 2.1.1 of Chapter 4. Nura not only presented various substitution patterns at the initial stage of the acquisition, she also showed positional differences between singleton onsets and codas. For example, Nura substituted [s] for singleton onsets |θ| between 3;11.11 and 4;08.13, where she replaced the same consonant by stops between 4;08.13 and 6;01.25. There

29. The phonetic inventory for European French involves the labiodental fricatives [f, v], apical dental stops [t̪, d̪], and laminal dental fricatives [s̪, z̪]. The Québec French involves the labiodental fricatives [f, v], laminal dental stops [t̪, d̪], and laminal alveolar fricative [s, z]. The Japanese phonetic inventory includes a voiceless bilabial fricative [ɸ], apical alveolar stops [t, d] and laminal alveolar fricative [s̪, z̪] (Brannen 2013:54).

were no data for Nura's acquisition of |θ| as a singleton coda between 3;11 and 4;11. Between 4;11.21 and 6;01.25, her attempts at |θ| in this position mainly resulted in substitutions by [f]. In contrast, Nura's attempts at |ð| were mainly replaced by coronal stops in both singleton onsets and codas. These variable behaviours observed in Nura's production of |θ, ð| in different phonological positions reflect the relatively weak auditory cues across these positions as well as her interpretation of these acoustic cues throughout the observation period.

From the perspective of L1 transfer, we know from the *Speech Learning Model* (Flege 1991) and the *Phonological Interference Hypothesis* (Brown & Matthews 1993) that speech perception is not a general phenomenon solely performed by our general auditory system. Rather, it is a language-specific phenomenon that causes L2 learners to interpret non-native contrasts based on their L1 phonological experience and related knowledge.

Recall as well there are no interdental fricatives (/θ, ð/) in Kazakh, nor are there any segments employing the dental place of articulation. However, there are potentially corresponding fricative consonants in Kazakh for the English interdentals, namely /s, z/.[30] According to Brown (1998), when non-native contrasts are similar to ones present in the L2 learner's L1, this learner will categorize them into the phonemic categories corresponding to those of his/her L1 at the initial stage of acquisition. This hypothesis is partially supported by Nura's data. In section 2.1.1 of Chapter 4, we have reported that

30. Studies have shown that Japanese learners of English substitute [s] for |θ|, and that Russian learners substitute [t] for |θ| despite them both having /s/ and /t/ in their phonemic inventories (Weinberger 1988). Owolabi (2012) documents that Yoruba adult L2 learner of English substituted [t, d] for |θ, ð|. See also Brannen (2002; 2013).

64% of Nura's word-initial singleton onset /θ/ were replaced by [s] between 3.11 to 4;03.04. This pattern continued until 4;08.13, but mainly in word-medial onsets.

At the level of phonological representation, in line with Brown (1998) and Martinez, Goad & Dow (2021) Nura needed to master all the features listed below in (79) in order to distinguish English interdental fricatives from one another, as well as from the other consonants in the system.

(79) Phonological Features: /θ, ð/

/θ/	/ð/
+consonantal	+consonantal
-sonorant	-sonorant
-approximant	-approximant
-voice	+voice
+anterior	+anterior
+distributed	+distributed
+continuant	+continuant
-strident	-strident

As we can see, /θ, ð/ can be represented as [+anterior, +distributed] coronals in terms of their place of articulation. The feature [+anterior] is used to identify that /θ, ð/ are articulated with the anterior part of the coronal area of the vocal tract, which differentiates them from the alveo-palatals (/ʃ, ʒ/). The feature [+distributed] captures the fact that the interdental fricatives in English are pronounced through more or less broad a constriction between the tongue corona and the teeth. This distinguishes /θ, ð/ from the alveolar coronals (/s, z/), the latter instead involving tongue grooving that channels the constriction through the centre of the corona. Other features such as [+continuant] and [-strident] are used to further categorize these sounds in terms of their

manner of articulation and degree of intensity (non-strident fricatives yielding less intense frication cues).

Given the feature sets in (79), feature recombination at the phonological level should possible for Nura's acquisition of |θ, ð|. As illustrated in Table 118, both English and Kazakh involve contrasts among the places of articulation mentioned above, namely [+anterior] and [+distributed]. Note in this context that while the feature [+distributed] encodes an allophonic segment in Kazakh ([ʃ]), this feature also arguably encodes the fricative release of the affricate phoneme /ʧ/. Martinez, Goad & Dow (2021) support the redeployment possibilities for allophonic features as well.

Table 118: English vs. Kazakh ([+anterior] [+distributed])

	English	Kazakh
[+anterior]	t, d, n, l, s, z, θ, ð, ɹ	t, d, n, l, s, z
[+distributed]	θ, ð, ʃ, ʒ	[ʃ] allophone of /ʧ/

The parallels in Table 118 thus suggest a relatively close relationship between the two languages in terms of phonological features and resulting representations. However, these phonological features do not provide us with the exact articulatory constrictions involved in the production of the dental fricatives in English. In the case of /θ, ð/, the phonetic properties of these non-sibilant fricatives and the articulatory gestures they involve can be encapsulated in the phonetic feature [interdental], which is non-existent in Nura's L1, as we mentioned earlier. Nura was thus faced with the challenge of learning this phonetic specification. Further, as we mentioned earlier, the perceptual cues to interdental fricatives in English are generally weak and potentially confusing.

Consequently, similar to what is observed in other studies, Nura presented variable substitution patterns highlighting difficulties in her acquisition of |θ, ð|.

As shown in Figure 58, repeated from Chapter 4, subsection 2.1 for convenience, Nura presented different behaviours for |θ| and |ð| in singleton onset. She initially displayed an [s] substitution stage and, later, alongside increasingly prominent patterns of accurate production, she displayed cases of stopping especially between 4;08.13 and 6;01.25. In contrast, her acquisition of |ð| involved substitutions by stops, the prominence of which decreased by 5;05.09 but remained attested until the end of the observation period.

Figure 58: Nura's Acquisition of |θ| and |ð| in Singleton Onset

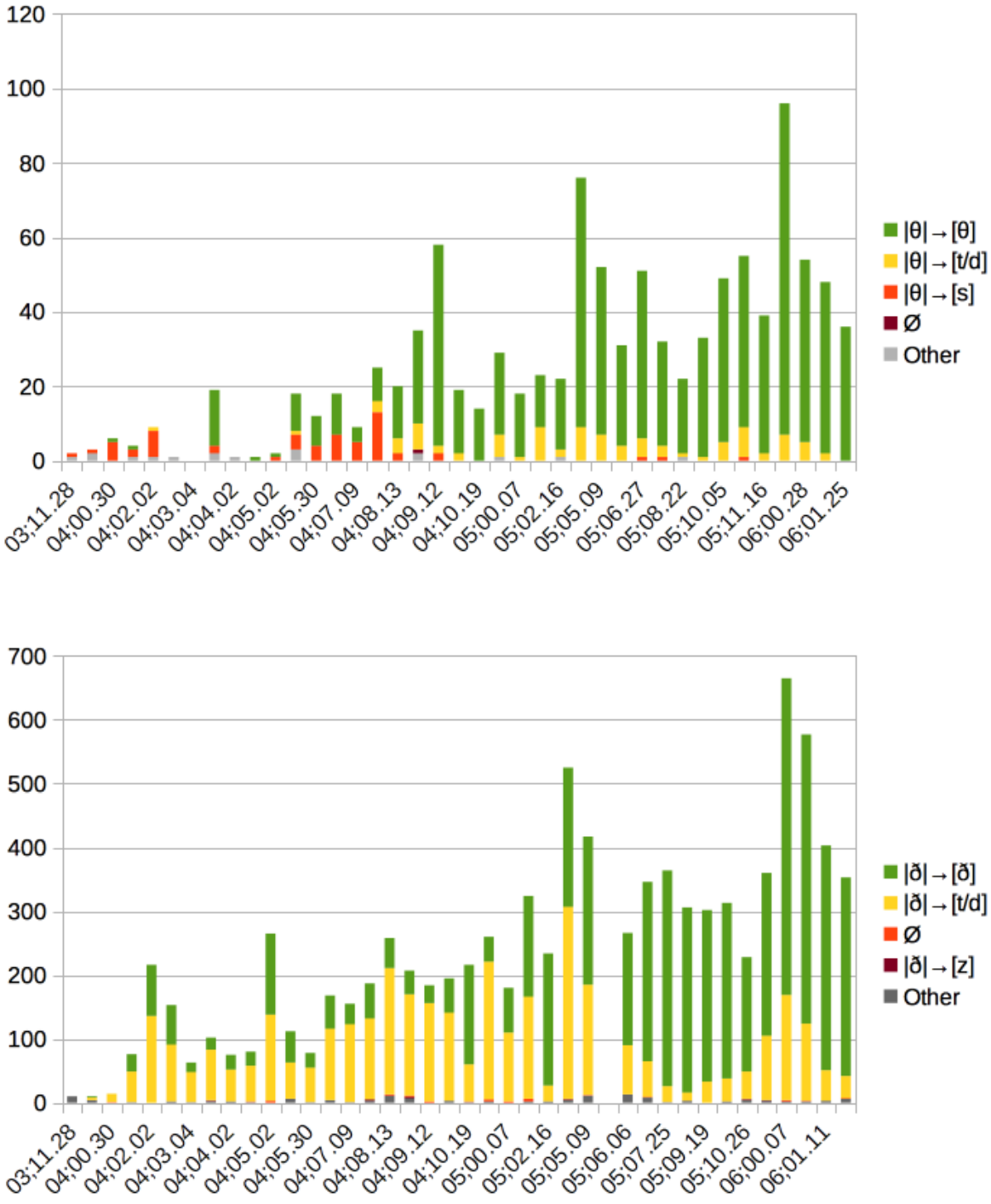


Table 119 below illustrates in more detail the positional variations that Nura presented in her acquisition of |θ, ð| in singleton onset, where she replaced different sounds for |θ|

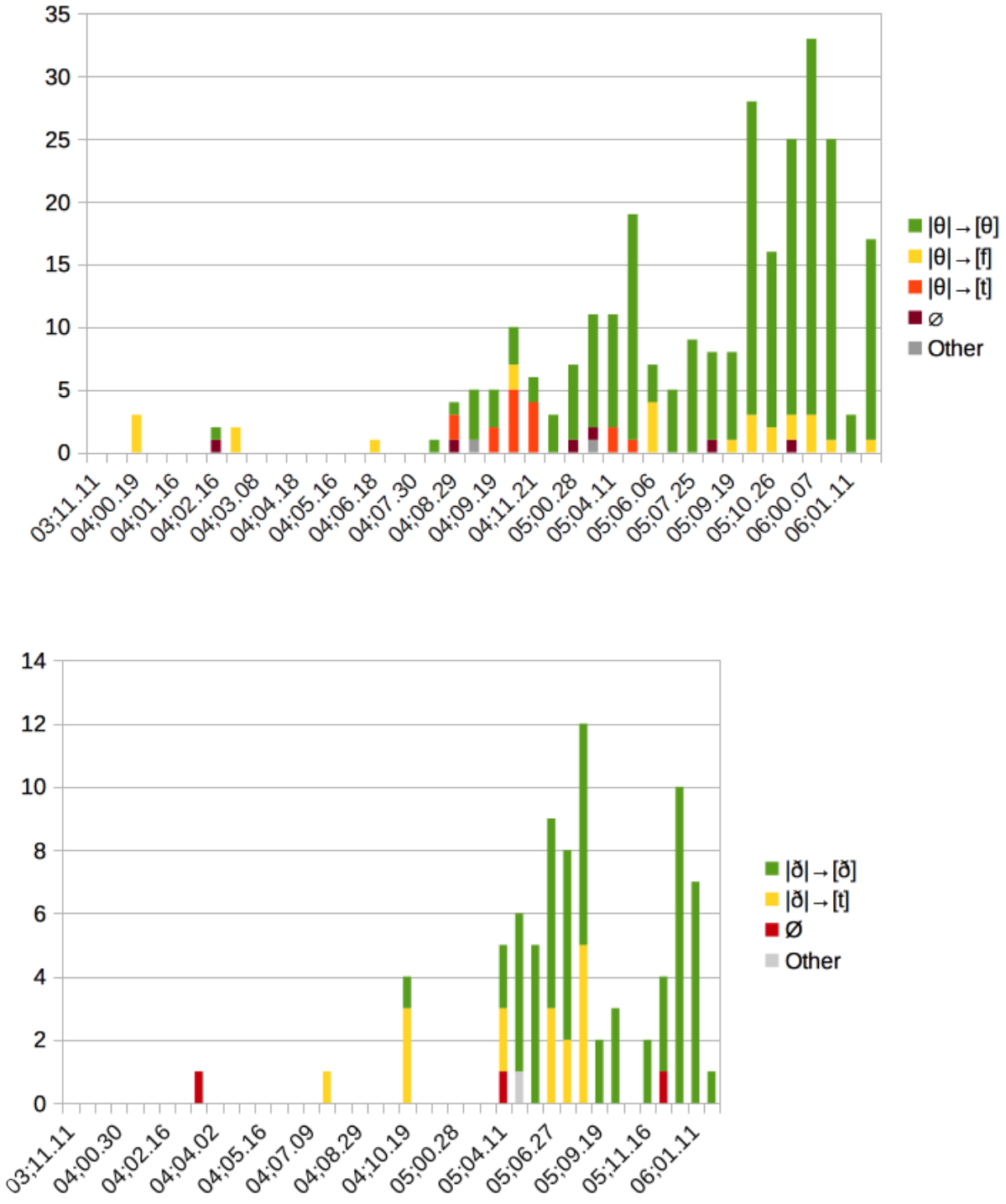
and |ð| at the initial stage (i.e., [s] for |θ|; stops for |ð|). In addition, Nura mastered |θ, ð| in different positions at different stages. Specifically, she mastered word-initial |θ| by 4;08.13; word-medial |θ| as well as word-initial |ð| by 6;01.25, and she had not fully mastered word-medial |ð| by the end of our documentation.

Table 119: Positional Differences of |θ| and |ð| in Singleton Onset

		3;11-4;03.04	**4;03-4;08.13**	**4;08.13-6;01.25**
|θ|	Word-initial	[s] 64% Accurate 8%	Accurate 74% [s] 17%	Accurate 98%
	Word-medial		[s] 53% Accurate 32%	Accurate 73% Stopping 26%
		3;11-5;05.09		**5;05.09-6;01.25**
|ð|	Word-initial	Stopping 60% Accurate 38%		Accurate 83% Stopping 17%
	Word-medial	Stopping 43% Accurate 41%		Accurate 51% Stopping 4%

Similarly, we have observed noticeable variation concerning Nura's acquisition of |θ| and |ð| in singleton coda, as shown in Figure 59 (repeated from Chapter 4, section 2.1 for convenience). In a nutshell, Nura substituted coronal stops and [f] for |θ| in singleton coda, whereas her main substitution pattern observed for |ð| in singleton coda was stopping.

Figure 59: Nura's Acquisition of |θ| and |ð| in Singleton Coda



In addition, we can see from these data that Nura had many fewer attempts at the interdentals in syllable coda; she also displayed lexically-influenced patterns of variation

in this context.[31] As illustrated in Table 120, Nura's substitutions of word-final |θ| by [f] between 3.11.11 and 4;07.30 all came from the word *month*. Similarly, all her cases of |ð| substitutions by stops in word-final position between 3.11.11 and 5;02.16 came from the preposition *with*. These observations should however not detract us from the fact that Nura's overall acquisition of the English interdentals was generally consistent with patterns observed in previous studies.

Table 120: Positional Differences of |θ| and |ð| in Singleton Coda

		3;11.11 - 4;07.30	**4;08.13 - 4;11.21**	**4;11.21 - 6;01.25**
|θ|	Word-medial	No data	Few attempts (=5); Accurate 100% (all from *bathroom*)	Accurate 94% [f] substitution 6%
	Word-final	Few attempts (=8) [f] 75% (all from *mouth*); Accurate 15%	Stopping 50% (all from *with*); Accurate 35%	Accurate 89%; [f] 7%
		3;11.11 - 5;02.16		**5;04.11 - 6;01.25**
|ð|	Word-medial	No data		
	Word-final	Very few attempts (=6); Stopping 66% (all from *with*); Accurate 17%		Few attempts (=74); Accurate 80%; Stopping 16% (all from *with*)

In conclusion, impoverished acoustic and related auditory properties of interdental fricatives in English, combined with the absence of the phonetic feature [interdental] from Nura's L1 representations resulted in acquisition challenges for her development of |θ| and |ð| in English.

31 . As we mentioned previously, Anrrich (2008) also reported lexical effects affecting the acquisition of |θ| and |ð| in English.

2.3 |ɹ|

In this section, we discuss Nura's development of |ɹ| of English. It is documented that the liquid consonants /ɹ/ and /l/ are typically acquired late by L1 learner of English because these consonants involve lingual configurations and movements that are generally more complex than those involved in other sounds. Indeed, the articulation of these sounds involves the coordination of multiple independent tongue shapes and articulatory gestures (Ingram 1989, Gick et al. 2008). During L1 acquisition, children often reduce and simplify the articulatory complexity of |ɹ| and |l| in ways that result in 'glided' productions (e.g. *rabbit* produced as [wæbɪt] or, at times, [jæbɪt]; Smit 1993). Although our current study is about child L2 acquisition, we have observed that Nura substituted |ɹ| with [w], and that this pattern is more prominent in the word-initial position, particularly during between 5;04.11 and 6;01.11.

In the context of L2 acquisition, substitution patterns at the initial stage of acquisition imply that the L2 learners are actually identifying, even if arguably not always perfectly, the presence of these non-native phones in the L2 language input they are exposed to. Schmidt (1996) studied Korean speakers' perception of English consonants, and reported that both English /l/ and /ɹ/ were perceived as Korean /l/.[32] This suggests that L2 learners replace the non-native phones by L1 phonemes they perceive to be most similar (Weinreich 1957). This hypothesis is partially supported by Nura's data.

In addition, studies have shown that the more perceptually distant an L2 sound is from the corresponding (or closest) L1 speech sound, the more learnable the L2 sound will

32. There are no /l/ and /ɹ/ in Korean phonemic inventory. However, word initial /l/ does occur in borrowed words, and it is produced as a flap in Korean (Schmidt 1996).

be. For example, Aoyama et al. (2004) examined the perception and production of English /l/, /ɹ/ and /w/ by adults and child native speakers of Japanese. These speakers perceptually assimilated both English liquids to Japanese /ɾ/,[33] which is phonetically an apico-alveolar tap [ɾ]. More specifically, the results of this study show that the discrimination of /ɹ/ was markedly better than the discrimination of /l/, presumably due to the fact that English /ɹ/ is more dissimilar phonetically from Japanese /ɾ/ than is English /l/ (Aoyama et al. 2004:234).

Recall that there is a potentially corresponding consonant in the Kazakh phonemic inventory for English /ɹ/, which is a liquid trill /ɾ/. Both English /ɹ/ and the Kazakh trill are rhotic speech sounds. Although English and Kazakh contrast /l/ and /ɹ/ in their phonemic inventories, these respective contrasts involve different places and manners of articulation. According to Brown (1998), when non-native contrasts are similar to ones present in the learner's L1, the L2 learner will categorize them into the phonemic categories corresponding to those of his/her L1 at the initial stage of acquisition. However, we did not observe any substitutions of trills for English /ɹ/ in Nura's acquisition. Building on Aoyama et al. (2004), we argue that this may have been caused by the fact that Nura's perception of /ɹ/ in English and the trill in Kazakh are phonetically quite dissimilar; these two phones were not perceived by Nura as the same or even as that similar.

Apart from developmental characteristics between L1 and child L2 acquisition, as well as L2 learners' perception of the non-native contrasts, as we discussed extensively

33. The phonemic inventory of Japanese contains one liquid (flap /ɾ/) which is not identical to the central approximant /ɹ/ in English (Maddieson 1984).

above in the context of the other English consonants, representational features of the L1 grammar play a crucial role in L2 segmental acquisition. Recall that Brown (1998) proposes that the phonological features of the L1 grammar will affect perception of the non-native contrasts present in the L2, and guide the mapping of the acoustic signal on to discrete L1 phonological categories. Concerning liquid consonants, Brown (1998) investigated the acquisition of the English /l-ɹ/ contrast by Japanese and Mandarin Chinese speakers.[34] The different results from these two populations of L2 learners indeed depend on whether their native languages involve the phonological feature [coronal] to distinguish /l/ and /ɹ/ in their representation. Specifically, the Chinese learners are able to perceptually discriminate and master the contrast between /l/ and /ɹ/ because the feature [coronal] involved in this contrast exists in Chinese, as it is also involved in other contrasts such as that between alveolar and retroflex fricatives (/s/ and /ʂ/). On the other hand, the Japanese learners, lacking the feature [coronal] in the absence of similar liquid contrasts in their native phonemic inventories, were unable to acoustically discriminate /l/ from /ɹ/. These findings suggest that a speaker's L1 featural system may actually prevent the L2 learner from acquiring a non-native phonemic contrast (Brown 1998).

Following Clements (1985), and Sagey (1986), the feature set relevant to /ɹ/ in English, listed in (80), includes [coronal, +anterior, -distributed, +continuant, -lateral], in addition to the major class and laryngeal features specifying the manner and voicing attributes of this consonant. Focusing more specifically on place of articulation, the features [+anterior] and [-distributed] combine as dependent place features under the [coronal]

34. As we have mentioned before, the phonemic inventory of Japanese contains one liquid (flap /ɾ/), while Mandarin Chinese inventory contains the lateral approximant /l/.

node. The manner features [+approximant] and [-lateral] describe how the articulators to modify the airflow as it passes through the oral cavity. [+approximant] is produced with a continuous airflow devoid of audible turbulence, while [-lateral] differentiates the rhotic /ɹ/ from the lateral /l/.

(80) Phonological Features: /ɹ/

/ɹ/
+consonantal
+sonorant
+approximant
+voice
coronal
+anterior
-distributed
+continuant
-lateral

From the perspective of phonological features, the English rhotic /ɹ/ in (80) is thus similar to the rhotic of Kazakh, in spite of the phonetic differences that exist between these two consonants. As we can see in Table 121, both English and Kazakh involve the place features [+anterior] and [-distributed] as well as the manner features just described.

Table 121: English vs. Kazakh ([+anterior][-distributed])

	English	Kazakh
[+anterior]	t, d, n, l, s, z, θ, ð	t, d, n, l, s, z
[-distributed]	t, d, n, l, s, z, ɹ	t, d, n, l, s, z, r

Building on (Brown 1998), feature recombination at the phonological level should thus be readily possible for Nura's acquisition of |ɹ|. However, in addition to representing this

consonants through abstract phonological features, Nura had to learn the exact articulatory constrictions involved in the production of English /ɹ/, also across different phonological positions such as syllable onsets and codas. The pronunciation of /ɹ/ in English indeed involves the front part of the tongue approaching the alveolar ridge, with the tongue-tip gradually curling back towards the roof of the mouth (retroflexion) or more generally retracting backward (bunching) (Lawson, Stuart-Smith & Scobbie 2018, King & Ferragne 2020). As described by Keyser & Stevens (2006), this lingual movement is also enhanced by degrees of lip protrusion, whose effect is to enhance the perceptibility of the lingual movement, through a general extension of the resonance space created by the tongue gesture in the front of the oral cavity.

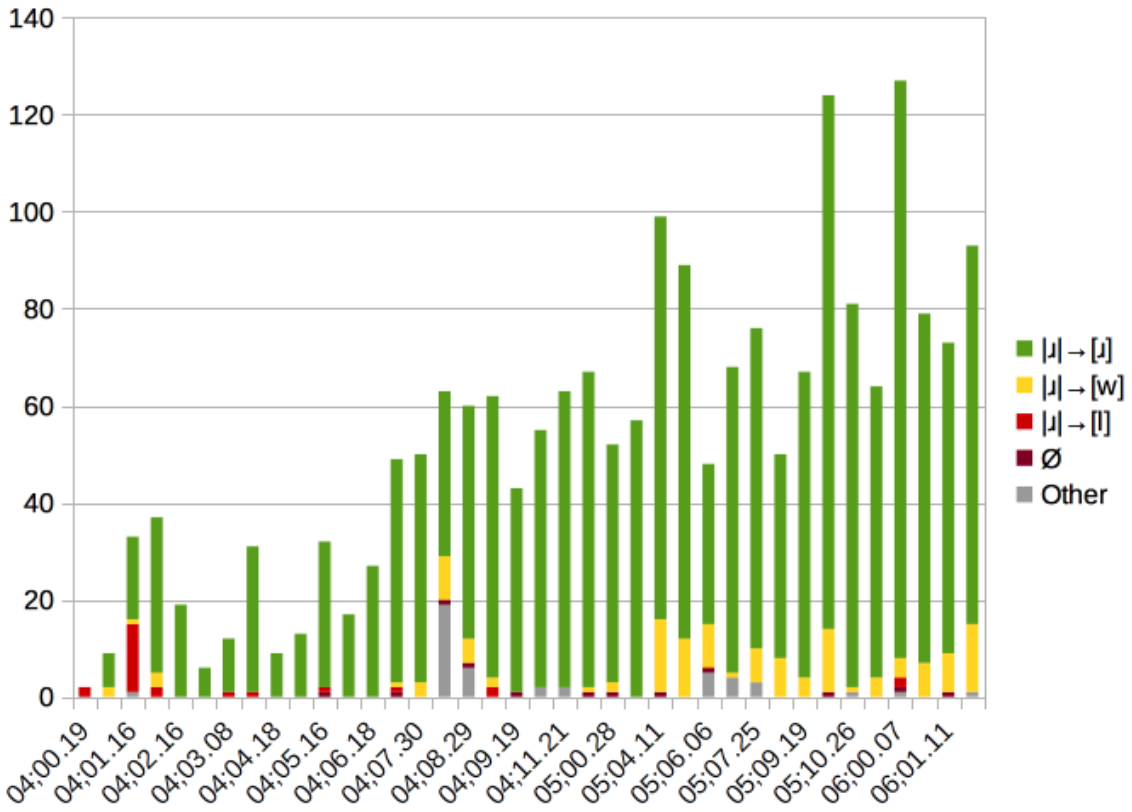
From a positional perspective, research has shown that there is a cross-linguistic tendency for rhotics in syllable codas to lenite, vocalize or undergo deletion. For example, Lawson, Stuart-Smith & Scobbie (2018) investigated coda /ɹ/ weakening and deletion. They identified changes in gesture timing that cause tongue gestures to be auditorily masked, at times to the point of becoming fully covert. This suggests generally weaker cues to the place and manner of articulation for /ɹ/ in syllable codas. Such observations are in line with those gathered through the current study. Indeed, as we have seen in Nura's data, target /ɹ/ in singleton codas presented a pattern of deletion throughout the observation period. In contrast, no such pattern was observed in singleton onsets.

In sum, while Nura was featurally equipped to learn the phonological contrast between /l/ and /ɹ/ in her L2, she was faced with challenges, especially in her acquisition of /ɹ/. Above we noted the presence of variable perceptual cues in syllable codas as well as

the overall articulatory complexity involved in the production of this consonant, which arguably contributed to her performance throughout the observation period.

As we can see in Figure 60, repeated from Figure 5 for convenience, the first recordings of Nura's attempts at the target phone took place when she was 4;00.19, where she presented a high degree of accuracy already. Early on, she also displayed brief patterns of variation characterized by [l] and [w] substitutions (between 4;00.19 and 4;02.02), followed by longer period of accurate production (between 4;00.30 and 5;00.28). She then displayed a high proportion of substitutions to [w] (between 4;07.30 and 6;01.11).

Figure 60: Nura's Acquisition of |ɹ| in Singleton Onset



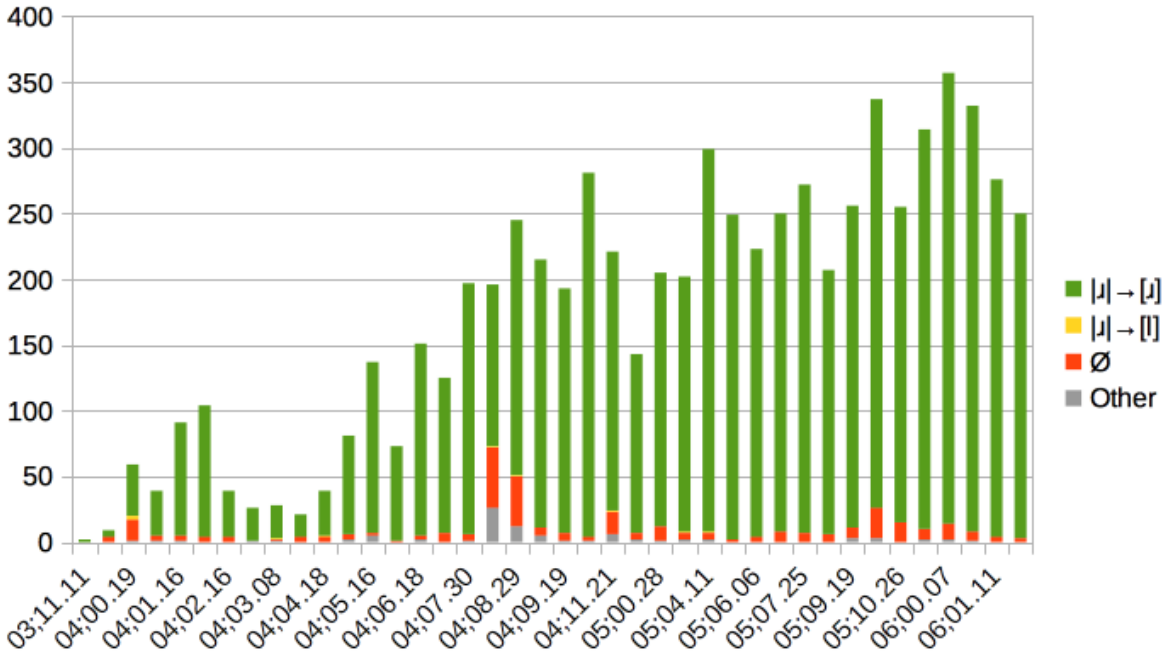
In terms of positional differences, we can see in Table 122 that Nura produced /ɹ/ in both word-initial and word-medial onsets at relatively similar rates, however with [w] realizations more prominently found in word-initial position.

Table 122: Positional Differences of /ɹ/ in Singleton Onset

		3;11-4.00.19	**4;00.19-5;02.16**	**5;04.11-6;01.11**
/ɹ/	Word-initial	No data	Accurate 89%; [w] 5%; [l] 1%	Accurate 85%; [w] 13%
	Word-medial		Accurate 97%	Accurate 95%; [w] 4%

Concerning her acquisition of /ɹ/ in singleton coda (as shown in Figure 61), similar to what we observed in onsets, Nura was also very proficient, however with variable patterns of deletion observed throughout most of the observation period.

Figure 61: Nura's Acquisition of |ɹ| in Singleton Coda



Also similar to our observations in syllable onsets, Nura's patterns were relatively similar across both medial and final positions, however with a slightly higher rate of deletion in codas than in onsets, and also with slightly more deletions in final than medial codas.

Table 123: Acquisition of |ɹ| in Singleton Coda

		3;11.11 - 6;01.11
|ɹ|	Word-medial	Accurate 92%; Deletion 7%
	Word-final	Accurate 85%; Deletion 4%

We attribute Nura's rapid acquisition of English |ɹ| to the fact that she had in her L1 system all the phonological features needed for this development. We also note her

rapid development of the lingual articulation to produce the phone expected in English, across all positions within the syllable.

On the other hand, the minor patterns of variation observed within the data can be attributed to the phonetics of /ɹ/ production in English. Starting with deletion, we straightforwardly attribute the slightly larger proportion of deletion in syllable codas to differences in the robustness of cues across syllabic positions noted above. More intriguing is the increase of [w] substitutions noted during the later period of /ɹ/ production in syllable onsets. We attribute the late emergence of this variable pattern to Nura's fine tuning of the full articulatory routine required for the accurate production of /ɹ/ in English. In a nutshell, we argue that Nura was then both incorporating the lip protrusion gesture inherent to English /ɹ/ and synchronizing it with rhotic lingual movement, with slight mis-timings between these movements variably resulting in labialized productions for the target consonant.

In sum, the overall behaviours observed in Nura's productions were fully in line with an understanding of L2 phonological development operating through phonological feature transfer and recombination, as proposed by Brown (1998). At a more microscopic level, the variation observed in the data can be explained through perceptual constraints, which operate variably across different phonological contexts, in combination with subtle articulatory gestures involved precisely in the production of the English rhotic.

2.4 /ʃ/

In this section, we discuss Nura's development of /ʃ/ in her English word productions. (Recall that /ʒ/ will not be analyzed due to lack of data.) In terms of its phonemic

inventory, Kazakh does include the alveo-palatal fricative /ʃ/ (in addition to the alveolar fricative /s/). Studies of speech perception have shown that both English L1 and L2 child learners have difficulties differentiating |ʃ| from |s| during the initial stages of acquisition. Nittrouer (2002) compared English-speaking adults and children (age 4-8) in their perception of fricative /ʃ/ and /s/, and found that children weigh formant transitions involved in the acoustic signal of the two fricatives, while adults appear to pay general attention to the overall noise spectrum of the consonants (Nittrouer 2002:712). In a separate study, Li, Edwards & Beckman (2009) examined the acoustic characteristics of voiceless sibilant fricatives (/ʃ/ and /s/) in English and Japanese adults and children (2-3 years old). Although both languages contrast /ʃ/ and /s/ phonemically, Li et al. uncovered an asymmetry concerning general patterns of substitution among children speaking each of these languages. In a nutshell, while English-learning children tend to substitute [s] for |ʃ| in their speech, the most common error pattern for Japanese-speaking children was the opposite, as they tended to produce [ʃ] for target |s| (Li, Edwards & Beckman 2009:115). This suggest language-specific conditioning of the perceptual ambiguity involved between these two phones and, more generally, in the acquisition of coronal fricatives by children.

Johnson & Babel (2010) used a perceptual similarity rating task to study Dutch and English speakers' perception of /ʃ/ and /s/. The contrast between these two sounds is non-phonemic in Dutch. Although Dutch speakers have experience with phonetic [ʃ] (as realized in allophones of /s/ and in loanwords), the experiment by Johnson & Babel shows that Dutch listeners rated [s] and [ʃ] as more perceptually similar to each other than English speakers did. This suggests that the phonemic vs. allophonic relationship

between segments in the L1 may have an impact on L2 speech perception. At some level of perceptual processing, the raw auditory contrast is interpreted in ways driven by linguistic experience, even when the listeners have experience with the ‘physical’ sounds in their native language (Johnson & Babel 2010: 135).

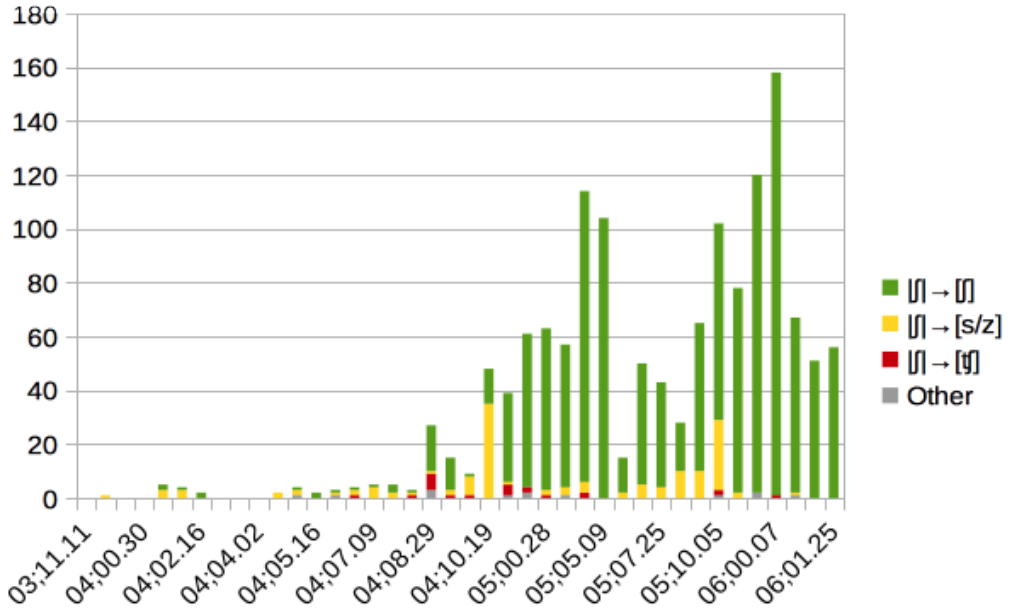
Together, the studies reported above suggest that the perception of the contrast between /s/ and /ʃ/ is challenging for both L1 and L2 learners, even for the latter when these segments are present in their L1. In addition, these studies show that the phonological status of /ʃ/ (as either a phonemic or allophonic variant) can impact speech perception. As we discuss next, Nura’s acquisition of /ʃ/ in English was in line with the essence of these studies.

As mentioned already, Nura’s first language does contrast /s/ and /ʃ/ phonemically. In spite of the availability of these two phones in the inventory of her native language, however, Nura went through an initial stage of substitution for this consonant (during which she substituted [s] for |ʃ|), also showing different patterns across different phonological positions. For example, during the initial stage (between 3;11.28 and 4;10.19), Nura showed 26% substitution to [s], and 13% substitution to [ʧ] in the word-initial context, whereas her substitution to [s] was as high as 75% in word-medial positions. During the same initial stage (3.11.11-5;02.16), Nura presented 40% substitution to [s] in singleton coda, all of which occurred in word-final positions. In fact, Nura behaved in ways consistent with that of English learners, as reported by Li et al. (2009) as well as Smit (1993). Importantly, this substitution was also observed in Nura’s acquisition of /ʃ/ in her L1 acquisition during the same period. For example, she was

producing the Kazakh word |nɑʁɑʃɑpɑ| as [nɑʁɑsɑpɑ] *grandmother* at 4;01.20.[35] This indicates Nura had not mastered the /ʃ/~/s/ contrast in her L1 and, as such, was not in a position to transfer this knowledge to her L2.

As reported in Chapter 4, section 2.6 (repeated below in Figure 62 for convenience), the most noticeable pattern for Nura's acquisition of |ʃ| in singleton onset during the initial stage, between 3;11.28 and 4;10.19, was substitution to [s].

Figure 62: Nura's Acquisition of |ʃ| in Singleton Onset



This substitution pattern was observed in both word-initial and word-medial singleton onsets. As shown in Table 124, Nura showed 26% substitution to [s] (and 13% substitution to [ʧ]) in word-initial onsets between 3;11.28 and 4;10.19.

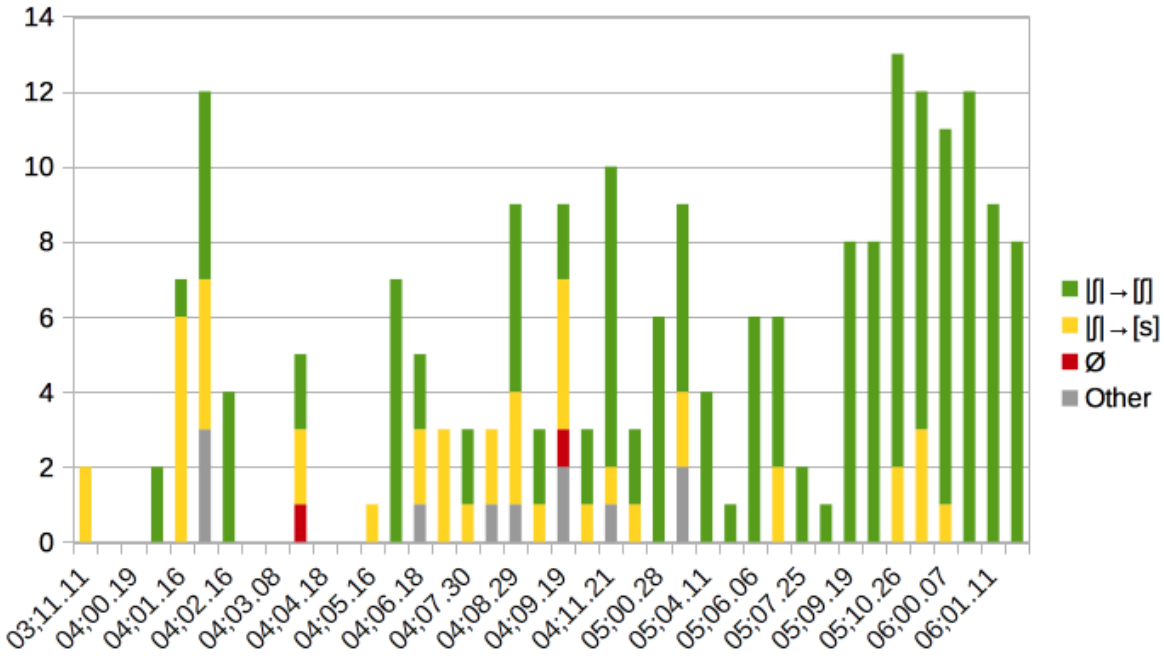
35. We have informally built a small set of recordings documenting Nura's linguistic productions in Kazakh during the first few months covered by the current study of her acquisition of English. As we will see below, this mini-documentation became nicely insightful in the context of the current discussion.

Table 124: Positional Differences in Nura's Acquisition of |ʃ| in Singleton Onset

		3;11.11-3;11.28	3;11.28-4;10.19	4;11.21-6;01.25
|ʃ|	Word-initial	No data	Accurate 54%; [s] 26%; [tʃ] 13%	Accurate 98%
	Word-medial		Accurate 25% [s] 75%	Accurate 77%; [s] 22% (from *actually*)

Similarly, this general substitution pattern (|ʃ| produced as [s]) was variably observed in syllable codas, as shown in Figure 63.

Figure 63: Nura's Acquisition of |ʃ| in Singleton Coda



All of the substitution to [s] (40%) observed in syllable codas occurred in word-final position, as shown in Table 125.

Table 125: Positional Differences in the Acquisition of |ʃ| in Singleton Coda

		3;11.11-5;02.16	5;04.11-6;01.11
|ʃ|	Word-medial	No data	Accurate 100%
	Word-final	Accurate 54% [s] 40%	Accurate 92% [s] 8%

Such positional differences observed in Nura's acquisition of |ʃ| in singleton onset and codas are consistent with their segmental distribution in Kazakh. As mentioned in Chapter 4, section 2.6, /ʃ/ in Nura's dialect of Kazakh is optionally realized as [ʧ] in word-initial position. This allophonic property of /ʃ/ in Nura's L1, in conjunction with its more general (cross-linguistic) perceptual ambiguity with /s/, nicely mirrors the substitution patterns observed in Nura's data. This observation is also in line with Brown (1998), who claims that the process of contrast perception in L2 acquisition is initially filtered by the learner's L1 system. Moreover, according to (2021) categorization of the non-native contrasts is influenced by the potential for recombination of features present in the L1. It is thus important to consider what phonological features or feature combinations were present in Nura's L1.

As we can see in (81), the phonological features of /ʃ/ includes [-anterior, +distributed], which together specify the place of articulation of the target consonant within the coronal area. In English, [-anterior] encodes the fine contrast between the alveo-palatal /ʃ, ʒ/ and the other coronal fricatives, while the feature [+distributed] encodes that the fricative airflow for |ʃ| involves a significant portion of the tongue blade at the point of constriction.

(81) Phonological Features: /ʃ/

	/ʃ/
+consonantal	
-sonorant	
-approximant	
-voice	
-anterior	
+distributed	
-continuant	

Since Kazakh has /ʃ/ in its inventory, the phonological features and feature combinations (shown in Table 126) were either already present or at least developing within Nura's L1 (Brown 1998; Martinez, Goad & Dow 2021).

Table 126: English vs. Kazakh ([-anterior][+distributed])

	English	Kazakh
[-anterior]	ʃ, ʒ	ʃ
[+distributed]	θ, ð, ʃ, ʒ	ʃ

Recall that Nura was substituting [s] and [tʃ] for |ʃ| in her Kazakh productions, and that her patterns of production in English mirrored this behaviour. This evidence suggests that she basically transferred her developing Kazakh knowledge at the time, which formed the basis of her behaviours in English. She had already mastered the representation for the major place of articulation ([coronal]) as well as the manner feature (fricative), but had not yet mastered the finer articulatory distinctions between /ʃ/ and /s/, themselves related to the features [-anterior] and [+distributed].

2.5 |ʧ|

In this section, we discuss Nura's acquisition of English |ʧ|. As mentioned in Chapter 2, the Kazakh phonemic inventory includes the affricate /ʤ/, which involves the manner feature delayed release [+DelRel], as well as features such as [-sonorant] and [+strident]. Thus, at the level of featural representation, Kazakh offered all the necessary features and feature combinations needed for Nura's acquisition of |ʧ|.

In addition, recall that Kazakh does include [ʧ] in its phonetic inventory, as an allophonic variant of /ʃ/ in word-initial onsets (as also discussed in the previous section). Although this phone has a limited distribution in the language, Nura was thus familiar with it as part of her L1. This is evidenced by data on Nura's production of Kazakh during the first few months after her arrival in Canada. As we can see in the examples in (82), she was able to articulate word-initial |ʧ| accurately in her Kazakh word productions.[36]

(82) Nura's Accurate Production of Word-initial |ʧ| in Kazakh

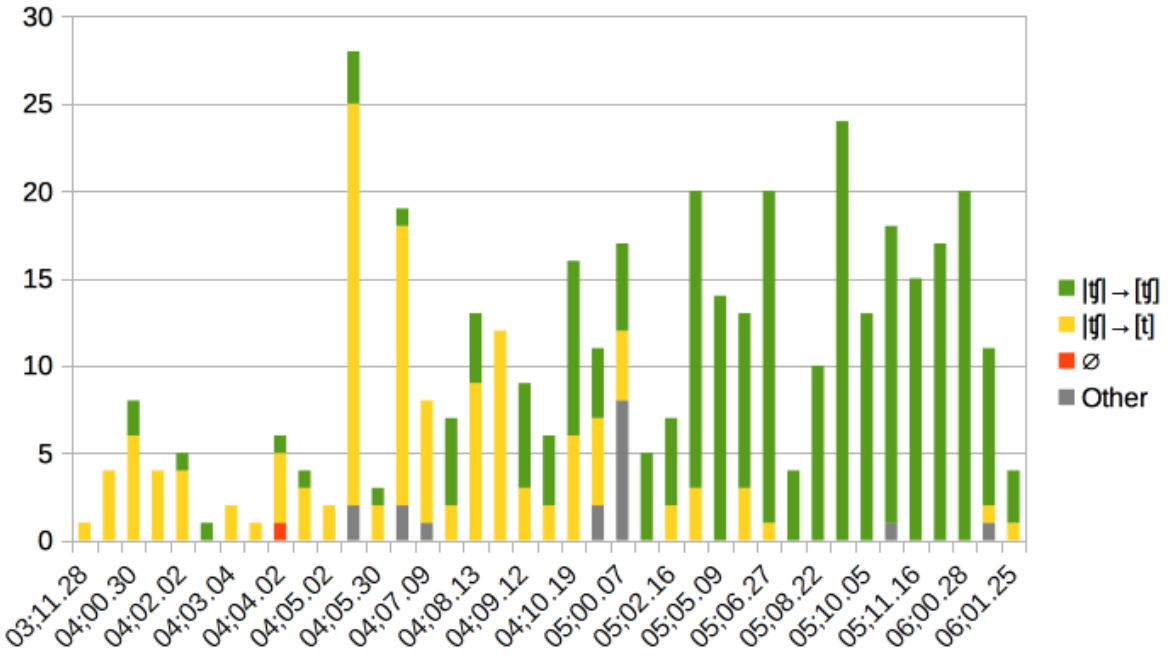
a.	/ʧæʃ-ɪm/	my hair	(4;00.20)
b.	/ʧənə/	cup	(4;01.06)
c.	/ʧæj/	tea	(4;01.06)

According to Brown (1998), when there is a similar or corresponding segment for an L2 phones, the L2 learner should perceive and categorize this L2 phoneme based on it. Given this, and in light of her accurate productions of |ʧ| in Kazakh, we were expecting Nura to show no issue in her acquisition of English |ʧ|. However, to our surprise, Nura presented us with a different pattern. In a nutshell, she displayed difficulties with |ʧ| in

36. The author of the current thesis is the mother of Nura. As a primary caregiver, she had first-hand experience of Nura's acquisition of Kazakh (and English).

word-initial onsets, while she was able to rapidly master |ʧ| in singleton codas. As we can see in Figure 64, Nura replaced |ʧ| in singleton onset by stops almost categorically from 3;11.28 to 5;02.16. After that, she started to produce |ʧ| in singleton onsets more consistently and accurately.

Figure 64: Nura's Acquisition of |ʧ| in Singleton Onset



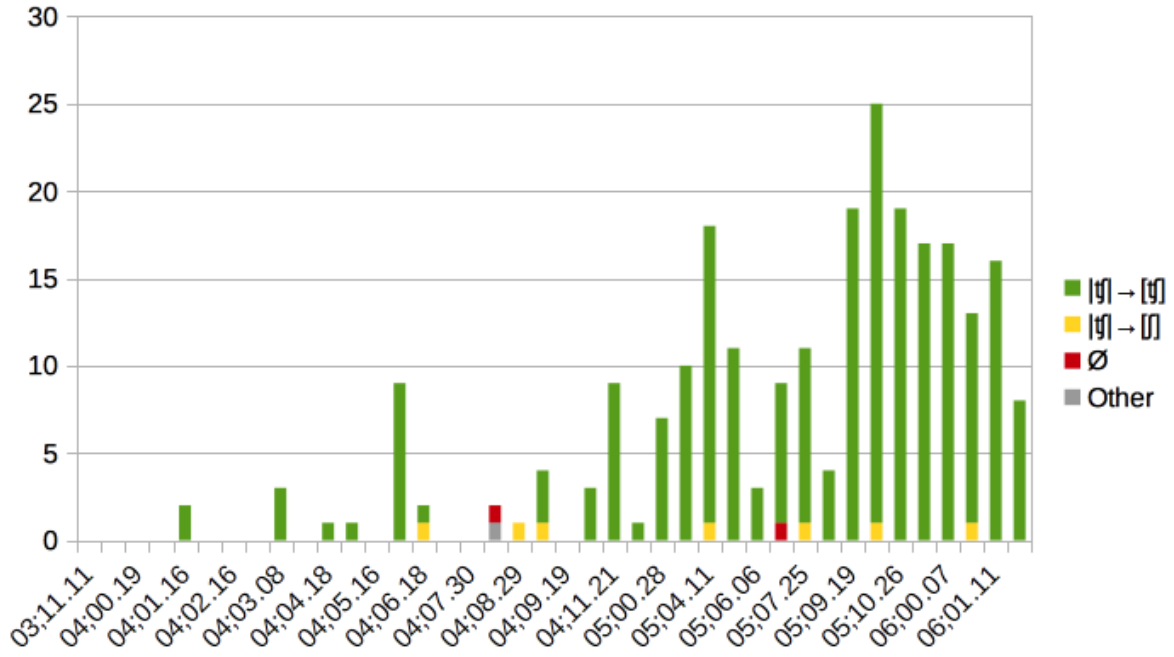
In addition, as we can see Table 127, Nura deaffricated |ʧ| to stops in both word-initial and word-medial singleton onsets between 3;11.28 and 5;02.16. These patterns are not aligned with the distribution of |ʧ| in Kazakh.

Table 127: |ʧ| in Singleton Onset (Substitution to Stops)

		3;11.11	3;11.28-5;02.16	5;04.11-6;01.25
|ʧ|	Word-initial	No data	Accurate 36% Stopping 63%	Accurate 98%
	Word-medial		Accurate 26% Stopping 62%	Accurate 90%

In contrast to her acquisition of |ʧ| in singleton onsets, Nura had basically already mastered the consonant in singleton coda by the beginning of the observation period, as shown in Figure 65.

Figure 65: Nura's Acquisition of |ʧ| in Singleton Coda



Although this does not reflect the distribution of |ʧ| in Kazakh either, we can account for this pattern based on the proposal by Martinez, Goad & Dow (2021) that the L2 learner

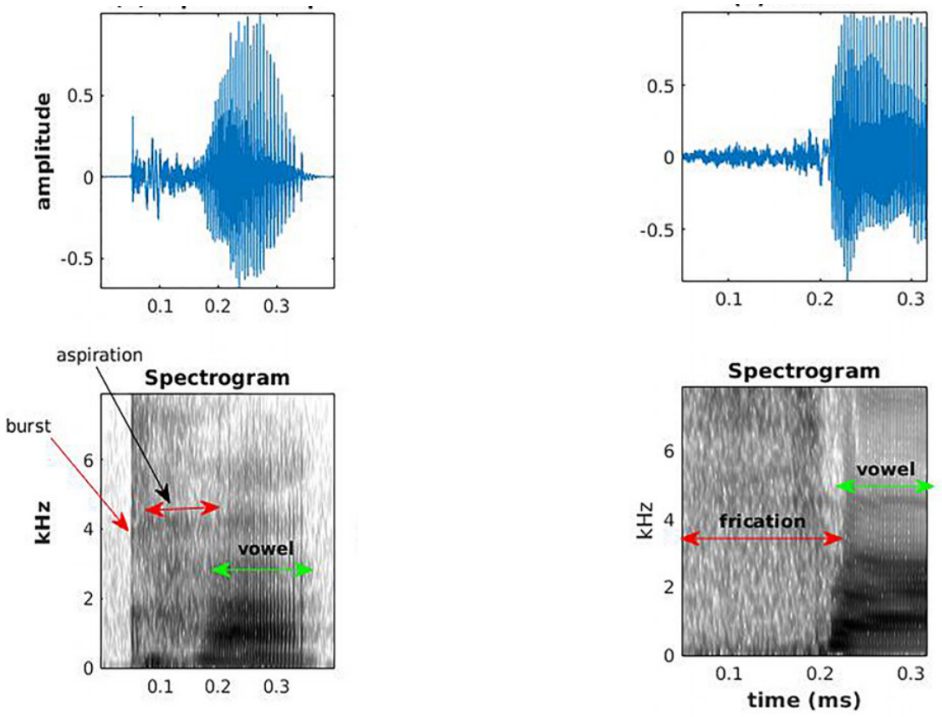
can extend the use of an allophonic variant present in his/her L1 as a contrastive unit in the L2 grammar, given the availability of all relevant features and feature combinations.

However, we are left to contend with Nura's asymmetrical behaviour in syllable onsets, given that the description of this behaviour thus far appears to conflict with our current approach to L2 acquisition, at least from a superficial point of view. Indeed, why would Nura have mastered /ʧ/ in syllable codas so quickly but not in syllable onsets, given that this phone is only present in (initial) onsets in her L1? In order to address this challenge, we first returned to the primary data which, as we can recall from section 2.5 of Chapter 3, were transcribed by native speakers of English. Recall from section 2.8 of Chapter 4 that Nura's deaffricated productions of /ʧ/ in syllable onsets were transcribed as [t] or [t^h]. After careful reexamination of Nura's attempts at word-initial /ʧ/, we found that Nura consistently produced the word-initial stopped outcomes with very heavy aspiration (which was not consistently transcribed, outside of the [^{h}] diacritic appearing on a subset of the forms). Even the forms transcribed as accurate [ʧ] during this period display a noticeable degree of heavy aspiration, whose cues were combined with that of the affricate release, in something that can be described in lay terms as emphatic affrication.

Together, these observations highlight that Nura's word-initial stopped outcomes for target affricates were not plain stops, as suggested through the original data depiction repeated in Figure 64. These productions virtually all involved a strong degree of aspiration, combined with more or less audible affrication, where drawing a line between the aspirated and the affricated components of the sound is at times rather difficult. As documented in the literature, frication and aspiration are indeed quite similar in terms of

their acoustic properties, as illustrated in Figure 66 below; they are both characterized by aperiodic noise resulting from turbulent airflow (Rabha, Sarmah & Prasanna 2019). Further, we note that this strong affrication effect was absent from Nura's productions of |ʧ| in syllable codas, which sound much more native-like in comparison. In sum, emphatic deaffrication for target |ʧ| positionally determined, limited to syllable onsets.

Figure 66: Aspirated Stop vs. Fricative (Rabha, Sarmah & Prasanna 2019: 615)



/kʰa/ /sa/

In light of this, the emphatic affrication we observed in Nura's attempts at |ʧ| in syllable onsets may in fact relate to another aspect of her L2 development of English, as opposed to that of |ʧ| proper, namely at the level of prosody. In addition to aperiodic cues involved in frication and the fricative release of affricates, English onsets also display aperiodic cues to aspiration, themselves particularly relevant to voiceless stops.

Among other details, onsets of stressed syllable are the primary locus of aspiration, while obstruent stops in word-initial unstressed syllables may also display more aspiration than non-initial onsets of unstressed syllables. In the context of L1 English development, Inkelas & Rose (2003; 2007) have indeed described stressed and (stressed or not) word-initial onsets as ‘prosodically strong’, in comparison to ‘prosodically weak’ positions such as word-medial unstressed onsets and syllable codas. In light of this dichotomy, we propose that, in syllable onsets, Nura was contending with the various systems of phonemic frication and affrication as well as allophonic (aspiration) contrasts that English presents, as she was arguably in the process of making generalizations not only about the sounds of English but also about its prosodic properties as well. While a study of Nura’s development of English prosody transcends the scope and methods of the current dissertation, we hypothesize that Nura had difficulties combining the fricative release of |ʧ| with her expressing a form of rule of strengthening of aspiration in syllable onsets. In this view, the pattern we described above as emphatic affrication emerged as the result of Nura’s attempts at combining frication and aspiration as part of the consonant release. As noted above, this strong release was not present in Nura’s productions of |ʧ| in syllable codas, which we interpret as the absence of prosodic strengthening in this context.

This proposal is in fact similar to that by Inkelas & Rose (2003; 2007) in their analysis of the processes of positional stopping and velar fronting in English. These are two patterns of substitution often observed in the acquisition of English whose contextualization often mirrors that of the prosodically strong vs. weak prosodic dichotomy defined above. Note, however, that the present substitutions are

contextualized somewhat differently, in that Nura also produced emphatic affrication in word-medial onsets of unstressed syllables, a weaker context according to Inkelas & Rose (2003; 2007). In order to address Nura's behaviours across each context in more detail, we should ideally describe the data in more detail by means of acoustic measurement, also looking into her productions of obstruent stops, showed the current description hold, it may also be that Nura's emerging rule was delineated based on an onset-coda distinction more than by the otherwise relatively intricate aspects of the English stress system. We leave the investigation of these possibilities for further research, as they raise questions and methods that extend beyond the scope of the current work.

In the spirit of Brown (1998) and Martinez et al. (2021), it would be tempting to further hypothesize that Nura's acquisition of a rule of strengthening in syllable onsets may have been influenced by the presence of her rule of fricative strengthening to an affricate affecting /ʃ/ in word-initial position in Kazakh. However, this further hypothesis would be difficult to support based on our current descriptions, especially given that we do not have evidence that Nura was using the rule of strengthening in Kazakh productively, or was merely using the allophonic forms resulting from this rules in an accurate fashion. Note as well the fact that the stress system of Kazakh is rather different from that of English, given its consistent stress on word final syllables; arguably, no correlations could be drawn between the two systems by the child. In sum, we prefer to limit our hypothesis to the child's early prosodic development of her L2, for which Kazakh may have served more as a point of contrastive reference than as a model to carry over into the interlanguage grammar.

In conclusion, Nura's acquisition of /ʧ/ was not constrained by the phonological features or feature combinations involved in this consonant. Rather, we hypothesize that Nura's productions of /ʧ/ in syllable onsets were hindered by her application of a prosodic generalization driven by the allophonic rule of aspiration in syllable onsets of English. This hypothesis however calls for additional investigation, for example concerning potential variation between syllable onsets across different prosodic positions (e.g. initial vs. medial; stressed vs. unstressed), combined with further characterizations of the release burst of obstruent stops observed in each of these contexts, ideally obtained through acoustic analysis. In the interim, the analysis we propose accounts for all of the observations assembled through the current study, and is consistent with the general prosodic properties of English.

2.6 Summary

This concludes our analysis of Nura's segmental development of English. As we highlighted throughout this discussion, many factors appear to have interacted in the unfolding of the data produced by Nura. While our analyses provide general support for the *Phonological Interference Hypothesis* originally proposed by Brown (1998), and further expanded by Martinez et al. (2021), we argued that feature-based analyses of L2 acquisition must also be modulated in light of properties of speech from segmental phonetics's to prosodic patterning.

In the next chapter, we follow similar logic and consider these potential influencing factors to analyze Nura's acquisition of inflection (tense and agreement) of English.

Chapter 7: Analysis of Nura's L2 Acquisition of English Inflection

Developing a new language not only requires the acquisition of its sounds and sound combination system; it also requires the acquisition of its morphological units, which themselves connect to syntactic structure, and so on. Morphological acquisition has been one of the most widely-studied domains in L2 research, including in the area of verbal morphology. Optionality in the use of verbal morphology, as is commonly observed in the speech of both first and second-language learners, enables us to make comparisons between L1 and L2 acquisition. This topic also has important theoretical and clinical implications for our understanding of language learning and language impairment.

In this chapter, we discuss Nura's productions with such questions in mind. We begin with a summary of Nura's acquisition of tense and agreement inflections in English. We then discuss these findings in light of previous research on the topic. As we will see, very much in accordance with the current body of research, Nura presented no obvious difficulties in her transfer of tense and agreement grammatical features. However, she did display significant difficulties in the expression of these features, especially in contexts where the morphological system of English can be described as relatively opaque, or complex.

1. Summary of Nura's Acquisition of Inflection in English

In this section, we summarize the current observations about Nura's morphological development. First and foremost, we note in Table 128 that Nura was generally more proficient at nominal inflection than at verbal inflection.

Table 128: Acquisition of Inflectional Morphology

Inflections	Nominal	Verbal		
	Plural *-s*	Copula *be*	Past tense *-ed*	Third person *-s*
Deletion rate	7.6% (25/330)	9% (339/3616)	18% (27/154)	28% (100/352)
Accuracy rate	92% (303/330)	88% (3182/3616)	82% (127/154)	70% (246/352)

Within the category of verbal inflection, Nura's overall performance with the copula *be* was higher than with either of the affixal inflections we described in Chapter 5, section 3.3, (i.e., third person *-s* and past tense *-ed*). For example, as also shown in Table 128, Nura's overall deletion rate for noun plural *-s* was only 7.6%, while deletion rates for most verbal inflections were much higher (28% for third person singular *-s*; 18% for past tense *-ed*; 9% for copula *be*). Recall as well that the differences in performance we noted between copulas and affixal markers are consistent with similar observations by Ionin & Wexler (2002) based on a group of L1 Russian children acquiring English.

Second, this time from the perspective of development over time, we note that Nura's deletion rates for all affixal inflections were noticeable higher during the initial stages of development, as shown in Table 129, with omission rates ranging from 56% to 67% across the different target inflections. These data suggest that Nura had virtually no knowledge of English morphology at the beginning of the observation period, and that she successively acquired each inflection in the ensuing months (plural *-s* first, by 4;08.29, and then past tense *-ed* by 4;10.19, quickly followed by third person singular *-s* by 5;00.07).

Table 129: Deletion of Inflections during Stage 1 (4;00.30 to 4;08.29)

Inflections	Nominal	Verbal Affixal	
	Plural *-s*	Past tense *-ed*	Third person *-s*
Mastery (age)	4;08.29	4;10.19	5;00.07
Deletion rate	56% (23/41)	67% (12/18)	57% (66/115)
Accuracy rate	39% (16/41)	33% (6/18)	39% (45/115)

Third, as mentioned already, Nura mastered copulas very early on, and she mastered present tense copulas earlier than any of her affixal inflections. As shown in Table 130, Nura mastered copula *am* by 4;01; copula *is* by 4;03, copula *are* by 4;07, and copula *was* by 5;04.[37] Across all types of copulas, her overall deletion rate was very low and accuracy rate was very high.

Table 130: Acquisition of Copula *be* (Overall)

	Copula *am*	Copula *is*	Copula *are*	Copula *was*
Mastery (age)	4;01	4.03	4;07	5;04
Deletion rate	1.5% (9/589)	6% (143/2377)	6% (17/278)	4% (8/202)
Accuracy rate	98% (576/589)	91% (2154/2377)	93% (258/278)	96% (194/202)

Together, the observations in Table 129 and Table 130 are consistent with the earlier observation, based on the study of Russian child L2 learners of English, that “morpheme omission was much greater for inflectional affixes than for forms of *be”. (*Ionin & Wexler 2002:107). In addition, we have also documented Nura’s overgeneralization errors for verbal affixal inflections.[38] As reported in Table 131, Nura’s rate of overgeneralization for

37. Nura’s acquisition of copula *was* also shows similar pattern: lower deletion rate and higher accuracy rate. Nura mastered it by 5;04.11, due to the fact that copula *was* is a complex copula (combination of copula *be* and past tense). Thus it is expected to be mastered later in acquisition.

38. No overgeneralization patterns for copulas were documented since Nura produced copulas accurately and consistently very early on.

third person singular *-s* was 7%, and 4% for past tense *-ed*. These relatively marginal errors also mostly occurred during later stages of development, between 5;04.11 and 6;01.11 for third person singular *-s*; and between 5;06.06 and 6;01.11 for past tense *-ed*. This is also consistent with Ionin & Wexler (2002), who found very few tense/agreement errors in their data. We discuss the marginal errors further below.

Table 131: Overgeneralization Errors (Overall)

	Third person *-s*	Past tense *-ed*
% overgeneralization	7% (27/379)	4% (6/160)

This concludes our summary of Nura's acquisition of plural *-s*, third person singular *-s*, past tense *-ed*, and all types of copulas.

In the next section we summarize the relevant literature on the topic. Throughout this review, we highlight both similarities and differences between Nura's developmental patterns and those observed in previous findings.

2. Morphological Acquisition in L1 and L2 acquisition

During the course of L1 acquisition, children between 2-4 years of age who are learning non-null subject languages[39] typically go through a special stage during which they alternate between finite and nonfinite verbs in declarative main clauses which require finite predicates (e.g., *she <u>likes</u> chocolate* vs. *she <u>like</u> chocolate*). In English, the infinitival form is not morphologically marked; there is thus no clear difference between the infinitival form and its corresponding (correct) uninflected form (e.g., *to <u>like</u>* vs. *I <u>like</u>*).

39. Non-null subject, or non pro-drop languages as well as the languages in which finiteness is expressed exclusively by number (e.g. Dutch).

Rice, Wexler & Hershberger (1998) documented data from a variety of Romance and Germanic languages where the nonfinite form can be morphologically distinguished from the form used in most of the present-tense paradigms. For example, data from French show that finite verbs always occur to the left of the negative particle *pas* (83a) whereas nonfinite verbs remain in situ to the right of *pas* (83b). Researchers have also shown that the Optional Infinitive stage is absent or, at best, rarely observed in pro-drop languages such as Spanish, Italian, Turkish, Modern Greek or Romanian.

(83) French data (Pollock 1989)
  a. *marche pas*
     goes pas
  b. *pas manger la poupée*
     pas eat-inf the doll

In sum, the omission of inflections (i.e., **she like*) is not simply the result of a phonological deletion; it is the production of an inaccurate structure observed across many languages during L1 acquisition. This stage is commonly referred to as the Optional Infinitive (OI) stage (Gibson & Wexler 1994; Rizzi 1993), during which children use finite and nonfinite/uninflected forms interchangeably, the latter often more frequently than the former (Haznedar & Gavruseva 2008; Rice, Wexler & Hershberger 1998).

Aside from the characteristics of variable usage of the inflectional morphemes on verb forms, the OI stage in L1 acquisition often manifests itself during the period when children produce root verbal forms without subjects and also make case errors in pronoun usage, for example using accusative pronouns in subject positions (e.g. him

cry).[40] In order to allow a unifying account of optional inflection and non-nominative subjects attested in child English OI constructions, Schütze & Wexler (1996) proposed the Agreement/Tense Omission Model (ATOM).[41]Although we do not focus on case assignment in this thesis, agreement is of importance, in particular concerning the acquisition of the grammatical inflections marked by third person singular *-s* and nominal plural *-s*. In mainstream models of syntax, it is often assumed that tense and agreement features occupy the same 'inflection' node (INFL), while alternative models may involve separate nodes under inflection for tense and agreement, for example under the *Split Inflection Hypothesis* (Johnson, de Villiers & Seymour 2005).[42] Following the logic of this latter model, it is possible that agreement marking and verb tense marking involve different patterns of development, while the former models predict some form of integration in the development of the two processes.

Wexler (1998) proposes a maturational account for the OI stage whereby the early absence of obligatory tense/agreement markings are understood to be part of biologically-determined characteristics of language acquisition, and consistent with the Universal Grammar hypothesis. Wexler argues that "certain aspects of morphosyntactic inflectional development emerge somewhat late, although they are not learned. Thus a certain amount of inflectional development unfolds over time according to a genetic

40. There are extensive studies on the correlation between the OI stage and subject case assignment and/or subject drop. Keeping with the scope of this thesis, we do not address this topic; rather we focus on the acquisition of tense and agreement morphology.

41. Wexler (2003) posits that because children during the OI stage have not yet mastered agreement in their language, they assign the default accusative case to the subjects and make case assignment errors such as *her like*.

42. Tense and Agreement fuse into a single morpheme or terminal node in English, but remain separate in German, Russian, Turkish (Halle & Marantz 1993).

blueprint" (Wexler 1998: 26). Under this hypothesis, we would not expect older learners to pass through an OI stage given that these older learners are assumed to be beyond this biologically-determined stage.

In another study, Zobl & Liceras (1994) found that related verbal inflectional elements (such as affixal and suppletive inflectional morphemes) cluster close together during the course of L1 development, and away from other morphemes such as the nominal plural morpheme *-s.* This suggests that L1 learners acquire affixal verbal morphemes (i.e *-s, -ed,* etc.) and suppletive morphemes (i.e copula *be*, auxiliary *be,* etc.) as part of the same general system, while they process verbal and nominal morphemes as part of distinct sub-systems.

A stage similar to the OI stage of L1 development has also been observed in L2 learners' productions, however in ways which differ from L1 development. Prévost & White (2000) examined variability in the use of verbal inflection (both tense and agreement) in spontaneous production data from two Moroccan Arabic adult L2 learners of French and two (Spanish and Portuguese, respectively) adult learners of German. They reported that the inaccurate use of finiteness in nonfinite contexts (such as following a preposition, an auxiliary, another verb, or with respect to a negator)[43] is very rare. The data in fact suggest that the L2 learners are able to distinguishing between finite and nonfinite morphology. In addition, Prévost & White found little evidence of agreement errors. These findings form the basis of the *Missing Surface Inflection Hypothesis* (MSIH) (Prévost & White 2000). Prévost & White argue that "L2 learners

43. The adult L2 learners in this study systematically precede the negator (*pas* in French and *nicht* in German) in their productions.

have abstract features for finiteness and agreement in their interlanguage representation, as evidenced by the syntactic and morphological behaviour of finite verbs. They do, however, exhibit problems with the surface morphological realization of particular forms" (Prévost & White 2000:127).

Similar findings emanate from child L2 research. For example, Ionin & Wexler (2002) examined the developmental distinctions of affixal (third person singular *-s*, past tense *-ed)* and suppletive finiteness (the use of copula and auxiliary *be* forms) in obligatory contexts[44] in child L2 grammar, based on spontaneous production data from L1 Russian children acquiring English as a second language. They found that: (1) omission of inflection was high across categories, but more prominently in affixal inflections (78% for third person singular *-s*; 58% for past tense *-ed*) than in suppletive inflections (33% for auxiliary *be* auxiliary, and 16% for copula *be*); (2) there were very few to no incorrect finiteness or tense/agreement errors (e.g. *I likes*) in the children's productions (5% for third person singular *-s*; 7% for auxiliary *be*; 9% for copula *be*; no past tense errors were attested). In sum, the child L2 learners were more sensitive to the copula/auxiliary *be* forms than to any of the affixal inflections. Together, these results suggest that child L2 learners master suppletive inflection earlier than affixal inflection. This is different from L1 acquisition, where both affixal and suppletive inflections are arguably mastered around the same time (Zobl & Liceras 1994).

Ionin & Wexler (2002) show that the high rate of omission of verbal affixal inflection is not phonologically conditioned. They support this claim through developmental differences between third person *-s* and plural *-s*, which are identical in their phonetic

44. The obligatory contexts are where the morpheme would normally be used in adult English.

forms. In a nutshell, the same learners who omitted verbal *-s* had no difficulties producing the nominal plural marker.

Ionin & Wexler (2002) further argue that the use of suppletive inflection cannot be the effect of direct transfer from the learners' L1, since Russian lacks an overt *be* copula in the present tense and has no *be* auxiliary in any tense except for the compound future tense. Rather, Ionin & Wexler (2002) argue that "the L2 learners are not in the OI stage [...] our findings suggest fully specified functional categories coupled with difficulties in acquiring certain morpheme types (i.e., affixal agreement morphemes)" (Ionin & Wexler 2002:128). This is in accordance with the *Missing Surface Inflection Hypothesis* proposed by Prévost & White (2000). In addition, Ionin & Wexler (2002) argue that the differences in suppletive and affixal inflection were due to "a generalization that ties morphological agreement to verb-raising [...] children take a long time to learn language-specific rules governing morphological expression of features that are checked covertly" (Ionin & Wexler 2002:128).

In another study, Helland & Álvarez (2007) examined the longitudinal data (based on personal interviews and oral narratives) from five Catalan and Spanish child L2 learners of English in the Barcelona public school. Their data suggests that: (1) finite and nonfinite forms do not alternate freely, the former being almost non-existent; (2) copula and auxiliary forms of *be* appear correctly; (3) nominative pronouns are not replaced by accusative ones (different from L1 development in English); finally, (4) errors occurred in the semantic content of tense morphemes, such as employing the past tense when replying to a question about the future. In a nutshell, Helland & Álvarez suggest, based on their observations, that the hypothesis that children do not understand tense during

the OI stage does not hold true in child L2 data, as also predicted by the fact that the children they studied were on average 8;9 years old. Helland & Álvarez instead propose that the L2 learners' knowledge of English verbal inflectional morphology is limited, due to the fact that they have not yet mapped verbal morphological markers onto their syntax, also in line with the *Missing Surface Inflection Hypothesis* (Prévost & White 2000).

Similarly, Haznedar (2007) documented longitudinal data from a Turkish child L2 learner of English. The high incidence of the correct use of copula *be*, *do*-support and the lack of non-pronominal case errors indicate the availability of tense in the child's L2 grammar.

Finally, in a study of children with specific language impairment (SLI), Paradis et al. (2008) found similar but longer-lasting OI profiles. In a nutshell, SLI children appear to need more time to acquire the verbal morphology of their languages, which implies longer period during which they optionally interchange finite forms with infinitives. This study "reinforced the assumption underlying the (extended) optional infinitive profile that internal constraints on the acquisition of tense could be a component of L1 development, with and without SLI" (Paradis et al. 2008:689). Although OI constructions are a characteristic of the incomplete stage of English acquisition among all these populations, including L1 learners (with and without SLI) and L2 learners, this study shows "that the tense acquisition patterns for the English L2 children were more compatible with a MSIH than an (E)OI profile" (Paradis et al. 2008:717).

In summary, the literature summarized above concerning L1 and L2 verbal morphological development suggests fundamental differences between the OI stages

observed during L1 and (child) L2 acquisition. As summarized in Table 132, first, L2 children are generally older than their L1 counterparts, which prevents comparisons on purely maturational grounds. Second, while the two groups of learners optionally omit inflections in their productions, L1 learners appear to acquire verbal tense and agreement during the same developmental period, while L2 learners acquire suppletive inflections before affixal ones. Finally, L2 learners make fewer tense/agreement overgeneralization errors than do L1 learners.

Table 132: OI Stage Differences between L1 and L2 Acquisition

OI stage	Age	Optional deletion of inflections	Thematic vs. suppletive
L1	(2-4 years)	Both tense and agreement are optionally deleted	Mastered at the same time
L2	Older than 4 years	a. Deletion was prominent in affixal inflection b. Fewer tense/agreement errors	Suppletive prior to Affixal

From a theoretical standpoint, the patterns revealed by L1 acquisition data suggest that children, during the OI stage, are in the process of developing their syntax in relation to semantics. However, the patterns observed in the interlanguages of L2 learners suggest that these learners already have in their L2 grammar abstract functional categories/features (i.e. tense), while the variability they display in morphology reflects difficulties in mapping the underlying functional features to their surface morphological forms.[45] In sum, L2 learners are primarily faced with a morphological challenge, as

45. On the other hand, some researchers argue that L2 grammars suffer from impairment in the functional domain (Eubank 1993; Meisel 1997). Such impairment proposals have however not received broad support within this body of literature.

opposed to a syntactic one. Given the context of L2 acquisition, it is thus reasonable to assume that the availability of syntactic knowledge (i.e., underlying functional categories/features of inflection) comes from the learners' L1.[46] Consequently, a unified account of L2 morpho-syntactic acquisition must incorporate L1 morpho-syntactic knowledge. In the following section, we offer an analysis of Nura's acquisition of inflection of English along those lines.

3. An Analysis of Nura's Verbal Inflection in English

Within the domain of verbal morphology, we have focused on Nura's acquisition of copula *be,*[47] third person singular *-s*, past tense *-ed*. Table 133 summarizes the morphological and syntactic contents that Nura needed to master for her successful acquisition of inflection in English. For example, for the acquisition of past tense *-ed*, Nura not only needed to master the syntactic category 'INFL' (tense) and its [+past] feature, but also needed to master the surface morphological realization expressing this knowledge, the suffix *-ed.*

Table 133: Morphosyntactic Features under Investigation

Morphology			Syntax	
Surface realization		Morpheme type	Grammatical categories	Grammatical features
Verbal	*Copula*	Free	Inflection (tense, agreement)	[-past], person, number
	-ed	Bound (suffix)	Inflection (tense)	[+past]
	-s	Bound (suffix)	Inflection (tense, agreement)	[-past], 3sg

46. Direct or indirect access to UG offers another plausible explanation. However, transfer of the categories/features of L1 to the interlanguage is consistent with the logic we developed in the previous chapter.

47. As we mentioned before, we did not document Nura's acquisition of auxiliary *be.* However, her acquisition of copula *be* and thematic verbs is sufficient to address the central issues at hand.

Recall from the previous section that L2 learners are primarily faced with a morphological, as opposed to a syntactic challenge (Prévost & White 2000, Ionin & Wexler 2002). In line with these studies, our data suggest that Nura had knowledge of grammatical categories and features (i.e., tense and agreement), particularly within the copula *be* paradigm. In addition, Nura's early omission and late acquisition of suffixal inflections (i.e, *-ed* and *-s)* suggest that Nura encountered morphological acquisition challenges. [48] In the following subsections, we discuss these observations in more detail.

3.1.1 Copula *be*

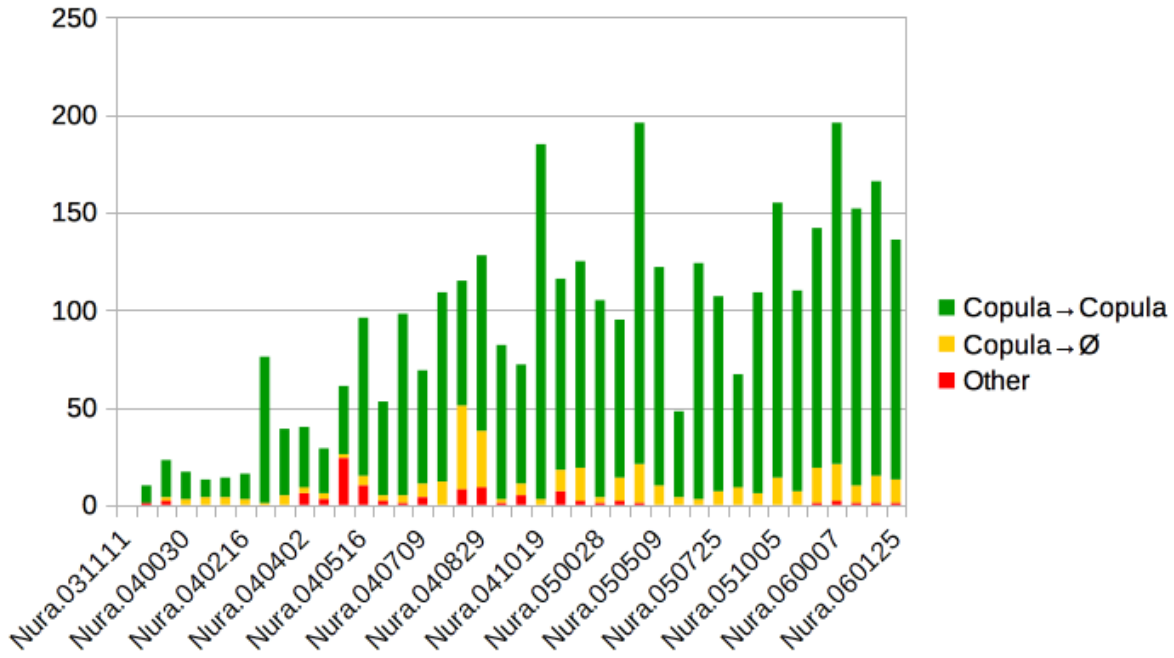
As we have described in Chapter 5, section 3.3, Nura presented a higher accuracy rate for copula *be* across all morphemes representing this copula. For example, the overall[49] accuracy rate for copula *am* was 98% (vs. 91% for copula *is*, 93% for copula *are*, 96% for copula *was*), well above her performance on suffixal inflections during the initial stage of acquisition (i.e., 39% for third person singular *-s* and 33% for past tense *-ed)*. Nura's omission rates for all copulas were thus much lower than that those for suffixal inflections. These observations are consistent with Ionin & Wexler (2002), Helland & Álvarez (2007) and Haznedar (2007), all of whom show that child L2 learners are more sensitive to suppletive inflections (i.e., copula) than suffixal inflections.

48. Nicoladis, Song & Marentette (2012) also suggest that preschool bilingual children exposed to naturalistic speech acquire the past tense (in English) much like monolinguals do, but only later and with some effects, most likely morpho-phonological in nature.

49. The accuracy rate for suppletive inflections was given as an overall performance percentage, because Nura mastered them quickly and with high accuracy, and there is no distinct developmental stages as we observed for suffixal inflections, where the accuracy rate was given for the initial stage of acquisition.

Since Nura presented very similar acquisition patterns for all copula types (i.e., *am, is, are*), we will not analyze them separately, but look at them as a whole. The graph provided in Figure 67 (repeated from Figure 46 for convenience) shows that accurate production was the dominant pattern in Nura's acquisition of copulas. As we described in Chapter 5, section 3.3, all copulas were mastered by 4;07, prior to her acquisition of third person singular *-s* (5;00.07) and past tense *-ed* (4;10.19).[50] In addition, very few omissions and marginalized productions were attested throughout the documentation.

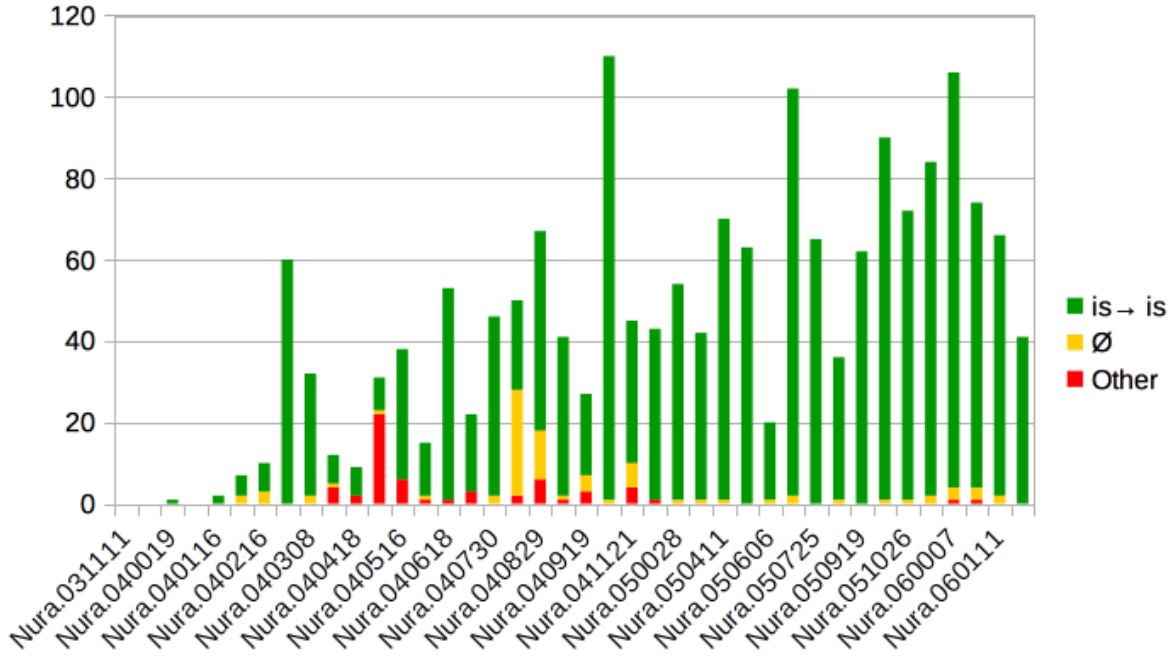
Figure 67: Nura's Acquisition of Copula (All Types)



50. Except for copula *was*, which is not a simple copula *be* form, but a combination of past tense and copula. Although Nura had fewer attempts at copula *was* (202 cases in total), and mastered it later (by 5;04.11), her overall accuracy rate (96%) and deletion (4%) pattern were consistent with that of the other copulas.

The variable productions between 4;03.08 and 4;05,16, as well as the deletion period observed between 4;07.30 and 4;08.29 in the graph above came from Nura's acquisition of copula *is,* as illustrated in Figure 68 (repeated from Figure 50). In a nutshell the non-contracted morphological form of copula *is* (i.e., *he is*) was slightly more challenging for Nura than other forms of copulas (i.e, *am, are*, and the contracted form *there's*).

Figure 68: Nura's Acquisition Non-contracted Copula *is*



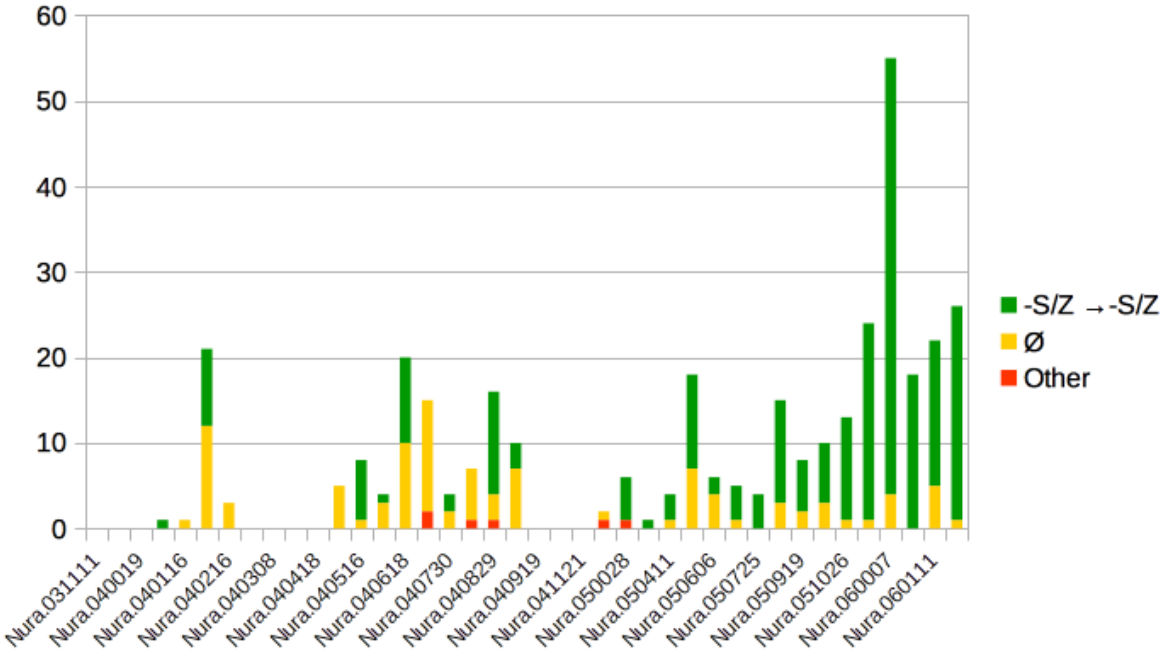
In the next section, we describe Nura's development of suffixal inflections.

3.1.2 Suffixal Inflections

Nura mastered suffixal inflections later than those expressed through copulas, and she presented many omissions during the early stages of acquisition; meanwhile she displayed relatively few overgeneralizations or other types of errors in production. As

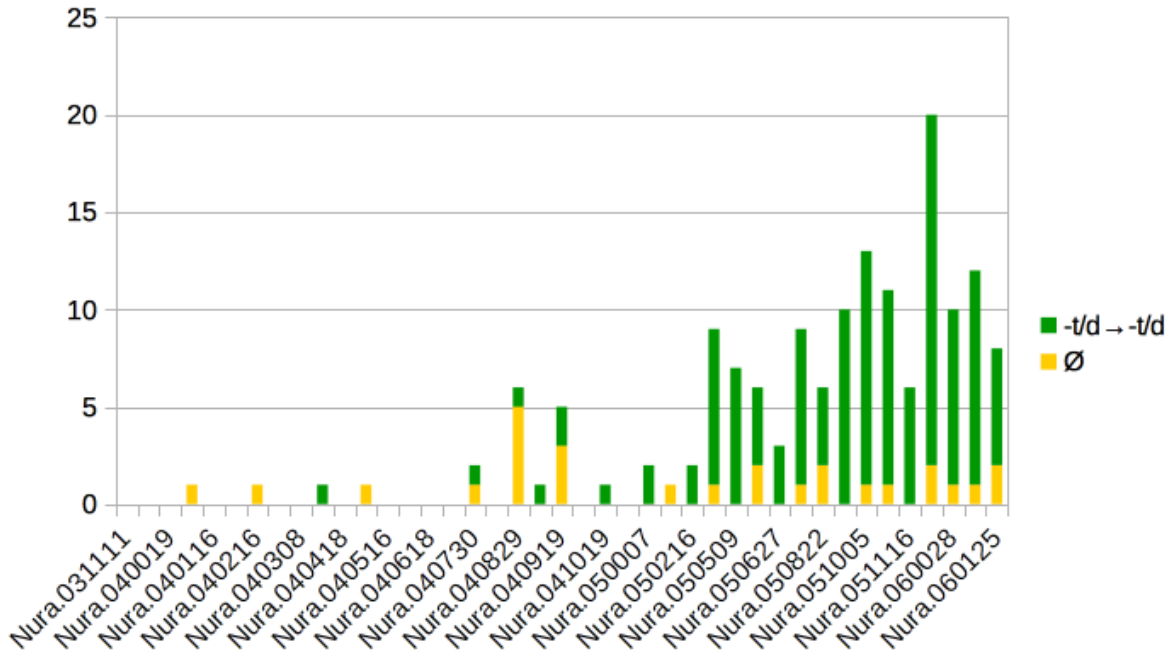
shown in Figure 69 (repeated from Figure 42 for convenience), Nura did not attempt the third person singular *-s* until 4;00.30. From then, she went through an optional deletion stage until 4;09.12. Recall as well from Chapter 5, section 3.1.1.1, that the overall deletion rate during this period was 57%. There were also no data attested between 4;09.12 and 5;00. From the evidence available we can conclude that Nura had mastered *-s* by 5;00.28.

Figure 69: Nura's Acquisition of Third Person Singular (Obligatory Contexts)



Similar patterns were observed concerning Nura's acquisition of past tense *-ed*. As shown in Figure 70 (repeated from Figure 44 for convenience), Nura had relatively few attempts at *-ed* during the initial stage (between 4;00.30 and 4;09.19). Recall as well from Chapter 5, section 3.2 that 67% of her attempts during this period underwent deletion. Nura mastered past tense *-ed* of English by 4;10.19.

Figure 70: Nura's Acquisition of Simple Past Tense *-ed*



Although Nura omitted suffixal inflections (both third person singular *-s* and past tense *-ed*) during the early stage, and mastered them late, she did not make substantial overgeneralization errors, in either stage. This suggests that Nura was not using inflections randomly. For example, as described in Chapter 5, section 3.1.2, only 7% of the data suggest overgeneralizations (27 cases out of 379) in her acquisition of third person singular *-s*, which in fact were more noticeable during the later stage, between 5;04.11 and 6;01.11. Similarly, we found an only 4% rate of overgeneralization (6 out of 160) in the context of Nura's acquisition of past tense *-ed*, as described in Chapter 5, section 3.2.2, with all these cases also occurring during the later developmental period, between 5;06.06 and 6;01.11. Note as well that these overgeneralization errors, which

took the form of incorrect use of finiteness, were all found in syntactically complex sentences involving such operations as *wh*-movement, *do*-insertion, or the presence of a subordinate clause (i.e., **does she walks*; **Did we passed it). Exhaustive lists of* Nura's such productions were provided in examples (70), and (76) in Chapter 5, section 3.2.2.

These observations are also consistent with that of Ionin & Wexler (2002), who observe that child L2 learners of English are more proficient at copulas than at suffixal inflections. In their general embrace of the *Missing Surface Inflection Hypothesis* (Prévost & White 2000), Ionin & Wexler (2002) argue that while child L2 learners have fully specified functional categories (i.e., tense and agreement), difficulties lie in the morphological mapping of these categories into spoken forms. In this view, both Nura's early accurate productions of copula *be* and the relative dearth of overgeneralization errors are due to the presence of functional categories in the child's system, while the patterns of omission of suffixal inflections are due to issues in the acquisition of the morphological system that expresses these functional categories in speech.

In the context of L2 acquisition, the existence of syntactic categories for tense or agreement may trace back to the grammatical properties of the learner's L1. In spite of the fact that they are expressed in very different ways in Kazakh than in English, these syntactic categories are clearly present in Nura's L1.[51] As shown in (84), all the syntactic

51. For example, some languages have only two distinct tenses, such as past and non-past, and some languages make finer tense distinctions, such as remote past and recent past. Similarly, languages differ in terms of how agreement is expressed within the system, such as whether verbs conjugate with one grammatical category (i.e., person) or many grammatical categories (i.e., person, number, case, gender) (Jabbari 2013).

features relevant to the current discussion —present and past tense features; agreement features— exist and are morphologically expressed in Kazakh.

(84) Tense and agreement in Kazakh

a. Simple present tense

men	konde	bar	-a	-min/-m
I	everyday	go	[future present]	[1st sg.]

"I go there everyday."

b. Past tense

men	kyl	-di	-m
I	smile	[+past]	[1st sg]

"I smiled."

In short, Nura, as a child L2 learner of English, already had grammatical knowledge about tense and agreement available from her L1. However, the morphological (phonetic) expression of these categories is very different across the two languages; Nura thus had to learn an entirely new system of morphological expression. This fact may also explain why Nura learned the English system in a way that resembles learners from other languages, in all cases these learners had to acquire entirely new systems of morphological expression. For example, Nura, just like the learners coming from different L1 backgrounds (Ionin & Wexler 2002; Helland & Álvarez 2007; Haznedar 2007) was very proficient with the copula *be* paradigm, although there is no such overt copulas (*am, is, are*) in Kazakh. As shown in (85), the copula *am* in the English translation is absent from the Kazakh surface form.[52]

52.There are morphologically-marked copulas in Kazakh, such as *boly* and *bar*. The former expresses general infinitive copula *be* (i.e., to *be* joyful), and the latter expresses expletive structure (i.e., there *is*).

(85) Copula in Kazakh

men	ohushi	-min
I	student	[1st sg.]

I am a student.

This general pattern of early mastery of the copula *be* system of English thus more probably relates more to its inherent morphological properties than to transfer effects, in relative independence of the underlying system of functional features.

Also in line with Ionin & Wexler (2002), the learning of the target morphological system of expression from virtual scratch correctly predicts Nura's high rate of omission during the initial stage as well as her later mastery of suffixal inflections, given the absence of morphological forms from her system at the beginning of her L2 acquisition process and the fact that the system of English inflections is arguably more complex to acquire than its system of copular expressions. Consider in this respect the examples in Table 134, where third person singular *-s* of English marks present tense in terms of its syntactic function, which indicates an action that occurs regularly or repeatedly, in addition to [3rd person] subject person and [singular] number agreement. On the other hand, simple past tense in English only encodes the [+past] tense feature,[53] but does not express agreement information. As such, it can co-occur with any subjects.

53. The past tense *-ed* is morphologically realized as a suffix attached to the stem; it is an inflection marker specified for the tense feature [+past] (Radford 2004).

Table 134: Third Person Singular in English and Kazakh

	Morphology	Syntactic function/Inflection		Examples
		Tense	Agreement	
English	Tense and Agreement: suffixal -*s/z*	[+present]	Subject Agreement(she/he/it)	*she walks*
English	Tense: suffixal *-ed* Agreement: no	[+past]	No subject agreement	*I/she/we/ smiled*

In summary, Nura's acquisition of English verbal morphology presented similar patterns with many other child L2 acquisition studies by (Ionin & Wexler 2002; Helland & Álvarez 2007; Haznedar 2007). In all case, the behaviours point to rapid acquisition of the relevant syntactic features through transfer from the learner's L1s, the early expression of which is however hampered by difficulties related to the morphological system of expression of these categories in English.

This concludes our discussion of Nura's development of English morphology. In the next chapter I bring together the topics addressed in this dissertation and briefly discuss their broad implications for theories of second language acquisition.

Chapter 8: Discussion

In this last chapter, we briefly elaborate on the proposals offered in the previous two chapters, and discuss them in the broader context of child L2 acquisition. We also take advantage of this broader discussion to address some of the limitations of the current work and offer avenues for future work.

Throughout this dissertation, we have discussed the first two years of the language acquisition journey of Nura, a Kazakh child, through the first stages in her acquisition of English phonology and morphology. More specifically, at the level of phonology, we focused on Nura's development of the English segments |f, v, θ, ð, ɹ, ʃ, ʧ|. At the level of morphology, we discussed Nura's acquisition of copula *be*, third person singular *-s*, and past tense *-ed*. Given the longitudinal nature of this work, we were in a position to identify more or less variable patterns of acquisition across different developmental periods, which together gave us an understanding of Nura's developing interlanguage grammar throughout the period studied.

Nura's patterns suggest that both her phonological and morphological development of English were influenced to some degree by her L1 (Kazakh) grammar, also under the expectation that L1 grammatical features are maximally transferred in the interlanguage of L2 learners. For example, in the area of phonology, following the feature-based proposal by Martinez, Goad & Dow (2021) we could formulate a general interpretation of Nura's acquisition of the phonological contrasts of English based on her L1 phonological knowledge. Nura's data also enabled us to provide a general verification of Brown's (1998) original hypothesis that the L2 acquisition of phonological contrasts can be

facilitated by the redistribution and recombination of L1 featural units. However, we also uncovered limitations to this phonological approach, which in turn highlight the need to consider of other factors, including perceptual constraints which may yield confusion between acoustically-similar target forms (here, especially among coronal fricatives), prosodic influences on segmental development, which may yield contextual variation in the acquisition of certain sounds (here, positional differences in the acquisition of affricate consonants), and the precise motor plans associated to given phonological features and feature combinations, which vary from language to language also in light of language-specific systems of contrasts (here, concerning Nura's acquisition of interdentals).

Similarly, Nura's acquisition of the verbal morphology of English was largely dependent on the availability and transfer of L1 syntactic categories (in particular, in the context of the current study, the features expressing tense and agreement in English). Again here, a feature-based analysis of the data enabled us to capture Nura's general patterns of development. As proposed by Prévost & White (2000) and Ionin & Wexler (2002), child L2 learners have already established grammatical categories in their L1s. This hypothesis is supported through Nura's rapid mastery of the copula *be* system of English as well as by her more gradual development of suffixal inflections. Again here, while a feature-based approach offers reliable grounds for analysis, the system of overt expression of these features played a central role in these patterns, due to the challenge of how to express underlying syntactic knowledge as part of the relatively opaque system of English inflection.

Because of limitations imposed by the scope of this thesis, however, we skipped over both descriptions and analyses of many other aspects of Nura's English. For example, we did not discuss Nura's acquisition of the prosodic properties of her L2 while, and because of time and space constraints, we barely discussed the data on consonant clusters, the analysis of which we now leave for future work. Similarly, at the morphosyntactic level, we did not document Nura's acquisition of auxiliary *be*, which, based on Ionin et al. (2012), we should expect to display patterns similar to that of copula *be*. We also generally ignored other aspects of Nura's syntactic development, for example concerning different types of phrase and sentence structures in English. Although both the copula *be* and suffixal inflections are intimately associated to syntactic inflection, we focused on the distinct acquisition patterns observed for each type of inflection, which we interpreted in terms of morphological difficulties of suffixal inflections in English. However, further research on Nura's patterns of syntactic development may reveal additional subtleties, for example concerning the use of particular inflections within given syntactic or discursive contexts.

In order to make possible the lines of research outlined just above, we have made the current research corpus publicly available, through its simultaneous publication through the CHILDES and PhonBank web-accessible data repositories within TalkBank (https://phon.talkbank.org/access/Biling/ChildL2.html). It is our hope that this empirical contribution will serve these and many additional lines of inquiry into language and language acquisition in the future.

References

Abrahamsson, Niclas & Kenneth Hyltenstam. 2009. Age of Onset and Nativelikeness in a Second Language: Listener Perception Versus Linguistic Scrutiny. *Language Learning* 59(2). 249–306. https://doi.org/10.1111/j.1467-9922.2009.00507.x.

Anrrich, Graciela M. 2008. *Substitutions for English Consonants by Adult Speakers of Cuban Spanish*. Washington, D.C: Georgetown University.

Aoyama, Katsura, James Emil Flege, Susan Guion, Reiko Akahane-Yamada & Tsuneo Yamada. 2004. Perceived Phonetic Dissimilarity and L2 Speech Learning: The Case of Japanese /R/ and English /L/ and /R/. *Journal of Phonetics* 32(2). 233–250. https://doi.org/10.1016/S0095-4470(03)00036-6.

Bassetti, Bene, Paola Escudero & Rachel Hayes-Harb. 2015. Second Language Phonology at the Interface Between Acoustic and Orthographic Input. *Applied Psycholinguistics* 36(1). 1–6. https://doi.org/10.1017/S0142716414000393.

Bernhardt, Barbara H. & Joseph P. Stemberger. 1998. *Handbook of Phonological Development from the Perspective of Constraint-Based Nonlinear Phonology*. San Diego: Academic Press.

Brannen, Kathleen. 2002. The Role of Perception in Differential Substitution. *The Canadian Journal of Linguistics / La revue Canadienne de Linguistique* 47(1/2). 1–46.

Brannen, Kathleen J. 2013. *The Perception and Production of Interdental Fricatives in Second Language Acquisition.* Ottawa: Library and Archives Canada.

Brown, Cynthia A. 1997. *Acquisition of Segmental Structure: Consequences for Speech Perception and Second Language Acquisition*. McGill University Ph.D. Dissertation.

Brown, Cynthia A. 1998. The Role of the L1 Grammar in the L2 Acquisition of Segmental Structure. *Second Language Research* 14(2). 136–193. https://doi.org/10.1191/026765898669508401.

Brown, Cynthia A. & John Matthews. 1993. The Acquisition of Segmental Structure. *McGill Working Papers in Linguistics* 9. 46–76.

Brown, Roger. 1973. *A First Language: The Early Stages*. Cambridge, MA: Harvard University Press.

Bulambayeva, Algerim. 2017. *Kazakhstan to Switch to Latin Alphabet by 2025*. The Astana Times. Astana, Kazakhstan.

Carden, Guy, Andrea Levitt, Peter W. Jusczyk & Amanda Walley. 1981. Evidence for Phonetic Processing of Cues to Place of Articulation: Perceived Manner Affects Perceived Place. *Perception & Psychophysics* 29(1). 26–36. https://doi.org/10.3758/BF03198837.

Chomsky, Noam. 1957. *Syntactic Structures*. The Hague: Mouton.

Chomsky, Noam. 1980. *Rules and Representations*. New York: Columbia University Press.

Chomsky, Noam. 1986. *Knowledge of Language: Its Nature, Origin, and Use*. New York: Praeger.

Clements, George N. 1985. Compensatory Lengthening and Consonant Gemination in Luganda. In Leo Wetzels & Engin Sezer (eds.), *Studies in Compensatory Lengthening*, 37–77. Dordrecht: Foris Publications.
Cook, V. 1985. Language Functions, Social Factors, and Second Language Teaching. *IRAL: International Review of Applied Linguistics in Language Teaching* 13(3). 177–96.
Cooze, Alysha. 2020. Learning English as a second language during childhood: A longitudinal case study. Memorial University of Newfoundland M.A. Thesis.
Corder, S.P. 1967. The Significance of Learners' Errors. *International Review of Applied Linguistics in Language Teaching* 5(4). 161–170.
De Lacy, Paul V. 2007. *The Cambridge Handbook of Phonology*. Cambridge: Cambridge University Press.
Dekydtspotter, Laurent, Rex A. Sprouse & Bruce Anderson. 1997. The Interpretive Interface in L2 Acquisition: The Process-Result Distinction in English-French Interlanguage Grammars. *Language Acquisition* 6(4). 297–332. https://doi.org/10.1207/s15327817la0604_2.
Dulay, Heidi C. & Marina K. Burt. 1974. Errors and Strategies in Child Second Language Acquisition. *TESOL Quarterly* 8(2). 129. https://doi.org/10.2307/3585536.
Dušková, L. 1969. On Sources of Error in Foreign Language Learning. *International Review of Applied Linguistics in Language Teaching* 7(1). 26.
Eubank, Lynn. 1993. On the Transfer of Parametric Values in L2 Development. *Language Acquisition* 3(3). 183–208. https://doi.org/10.1207/s15327817la0303_1.
Flege, James E. 1991. Age of Learning Affects the Authenticity of Voice-Onset Time (vot) in Stop Consonants Produced in a Second Language. *The Journal of the Acoustical Society of America* 89(1). 395–411. https://doi.org/10.1121/1.400473.
Flege, James E. 1999. Age of Learning and Second Language Speech. In David Birdsong (ed.), *Second Language Acquisition and the Critical Period Hypothesis*, 101–131. Hillsdale, NJ: Lawrence Erlbaum Associates.
Flege, James E., Naoyuki Takagi & Virginia Mann. 1995. Japanese Adults Can Learn to Produce English /I/ and /L/ Accurately. *Language and Speech* 38(1). 25–55. https://doi.org/10.1177/002383099503800102.
Fletcher, Paul & Michael Garman. 1986. *Language Acquisition: Studies in First Language Development*. 2nd edition. Cambridge: Cambridge University Press.
Fries, Charles C. 1945. *Teaching and Learning English as a Foreign Language*. Ann Arbor: University of Michigan Press.
Fries, Charles C. 1963. Linguistic and Reading. New York: Holt, Rinehart and Winston.
Gibson, Edward & Kenneth Wexler. 1994. Triggers. *Linguistic Inquiry* 25(3). 407–454.
Gick, Bryan W., Penelope Bacsfalvi, Barbara May Bernhardt, Sunyoung Oh, Slade Stolar & Ian Wilson. 2008. A Motor Differentiation Model for Liquid Substitutions in Children's Speech. *Proceedings of Meetings on Acoustics* 1. 1–9.

Goad, Heather & Lydia White. 2004. Ultimate Attainment of L2 Inflection: Effects of L1 Prosodic Structure. *Eurosla Yearbook* 4. 119–145.
Goad, Heather & Lydia White. 2006. Ultimate Attainment in Interlanguage Grammars: A Prosodic Approach. *Second Language Research* 22(3). 243–268.
Goad, Heather & Lydia White. 2009. Articles in Turkish/English Interlanguage Revisited: Implications of Vowel Harmony. In María del Pilar García Mayo & Roger Hawkins (eds.), *Language Acquisition and Language Disorders*, vol. 49, 201–232. Amsterdam: John Benjamins Publishing Company. https://doi.org/10.1075/lald.49.13goa.
Gussenhoven, Carlos & Haike Jacobs. 2011. *Understanding Phonology, 3rd Edition*. London: Hodder Education.
Halle, Morris & Alec Marantz. 1993. Distributed Morphology and the Pieces of Inflection. In Kenneth Hale & Samuel Jay Keyser (eds.), *The View from Building 20*, 111–176. MIT Press.
Haznedar, Belma. 2007. The Acquisition of Tense—Aspect in Child Second Language English. *Second Language Research* 23(4). 383–417. https://doi.org/10.1177/0267658307080330.
Haznedar, Belma & Elena Gavruseva. 2008. Recent Perspectives in Child Second Language Acquisition. In *Current Trends in Child Second Language Acquisition a Generative Perspective* (Language Acquisition & Language Disorders 46). Amsterdam: John Benjamins Publishing Company.
Helland, Corinne & Esther Álvarez. 2007. The Optional Infinitive Stage and Child L2 English. *Barcelona English Language and Literature Studies* 16. 1–14.
Herschensohn, Julia Rogers & Martha Young-Scholten (eds.). 2013. *The Cambridge Handbook of Second Language Acquisition* (Cambridge Handbooks in Language and Linguistics). Cambridge: Cambridge University Press.
Ingram, David. 1989. *First Language Acquisition: Method, Description, and Explanation*. Cambridge: Cambridge University Press.
Inkelas, Sharon & Yvan Rose. 2003. Velar Fronting Revisited. In Barbara Beachley, Amanda Brown & Fran Conlin (eds.), *Proceedings of the 27th Annual Boston University Conference on Language Development*, 334–345. Somerville, MA: Cascadilla Press.
Inkelas, Sharon & Yvan Rose. 2007. Positional Neutralization: A Case Study from Child Language. *Language* 83(4). 707–736.
Ionin, Tania, Soondo Baek, Eunah Kim, Heejeong Ko & Kenneth Wexler. 2012. That 's Not so Different from The: Definite and Demonstrative Descriptions in Second Language Acquisition. *Second Language Research* 28(1). 69–101. https://doi.org/10.1177/0267658311432200.
Ionin, Tania & Kenneth Wexler. 2002. Why Is 'Is' Easier Than '-s'?: Acquisition of Tense/Agreement Morphology by Child Second Language Learners of English. *Second Language Research* 18(2). 95–136.

Ionin, Tania, María Luisa Zubizarreta & Vadim Philippov. 2009. Acquisition of Article Semantics by Child and Adult L2-English Learners. *Bilingualism: Language and Cognition* 12(03). 337. https://doi.org/10.1017/S1366728909990149.
Jabbari, Mohammad Jafar. 2013. Time and Tense in Language. *International Journal of Linguistics* 5(5). 243. https://doi.org/10.5296/ijl.v5i5.4518.
Johnson, Keith & Molly Babel. 2010. On the Perceptual Basis of Distinctive Features: Evidence from the Perception of Fricatives by Dutch and English Speakers. *Journal of Phonetics* 38(1). 127–136. https://doi.org/10.1016/j.wocn.2009.11.001.
Johnson, Valerie E., Jill G. de Villiers & Harry N. Seymour. 2005. Agreement Without Understanding? The Case of Third Person Singular /s/. *First Language* 25(3). 317–330. https://doi.org/10.1177/0142723705053120.
Keyser, Samuel Jay & Kenneth N. Stevens. 2006. Enhancement and Overlap in the Speech Chain. *Language* 82(1). 33–63. https://doi.org/10.1353/lan.2006.0051.
King, Hannah & Emmanuel Ferragne. 2020. Loose Lips and Tongue Tips: The Central Role of the /R/-Typical Labial Gesture in Anglo-English. *Journal of Phonetics* 80. 100978. https://doi.org/10.1016/j.wocn.2020.100978.
Ladefoged, Peter & Ian Maddieson. 1996. *The Sounds of the World's Languages*. Cambridge, MA: Blackwell.
Lado, Robert. 1957. *Linguistics Across Cultures: Applied Linguistics for Language Teachers*. Ann Arbor, University of Michigan Press.
Lawson, Eleanor, Jane Stuart-Smith & James M. Scobbie. 2018. The Role of Gesture Delay in Coda /r/ Weakening: An Articulatory, Auditory and Acoustic Study. *The Journal of the Acoustical Society of America* 143(3). 1646–1657. https://doi.org/10.1121/1.5027833.
Leal Méndez, Tania & Roumyana Slabakova. 2014. The Interpretability Hypothesis Again: A Partial Replication of Tsimpli and Dimitrakopoulou (2007). *International Journal of Bilingualism* 18(6). 537–557. https://doi.org/10.1177/1367006912448125.
Levitt, Andrea, Peter W. Jusczyk, Janice Murray & Guy Carden. 1987. Context Effects in Two-Month-Old Infants' Perception of Labiodental/Interdental Fricative Contrasts. *Haskins Laboratories Status Report on Speech Research* 91. 31–43.
Li, Fangfang, Jan Edwards & Mary E. Beckman. 2009. Contrast and Covert Contrast: The Phonetic Development of Voiceless Sibilant Fricatives in English and Japanese Toddlers. *Journal of Phonetics* 37(1). 111–124. https://doi.org/10.1016/j.wocn.2008.10.001.
Long, Michael H. 1990. Maturational Constraints on Language Development. *Studies in Second Language Acquisition* 12(03). 251. https://doi.org/10.1017/S0272263100009165.
Maddieson, Ian. 1984. *Patterns of Sounds*. Cambridge: Cambridge University Press.
Martinez, Ruth Maria, Heather Goad & Michael Dow. 2021. L1 Phonological Effects on L2 (non-)naïve Perception: A Cross-Language Investigation of the Oral–Nasal Vowel

Contrast in Brazilian Portuguese. *Second Language Research* 1–37. https://doi.org/10.1177/02676583211044953.
Meisel, Jürgen M. 1997. The Acquisition of the Syntax of Negation in French and German: Contrasting First and Second Language Development. *Second Language Research* 13(3). 227–263. https://doi.org/10.1191/026765897666180760.
Meisel, Jürgen M. 2011. *First and Second Language Acquisition*. Cambridge University Press.
Mielke, Jeff. 2012. A Phonetically Based Metric of Sound Similarity. *Lingua* 122(2). 145–163. https://doi.org/10.1016/j.lingua.2011.04.006.
Mitchell, Rosamond & Florence Myles. 1998. *Second Language Learning Theories*. Oxford University Press, New York.
Nicoladis, Elena. 2006. Cross-Linguistic Transfer in Adjective–Noun Strings by Preschool Bilingual Children. *Bilingualism: Language and Cognition* 9(1). 15–32. https://doi.org/10.1017/S136672890500235X.
Nicoladis, Elena, Jianhui Song & Paula Marentette. 2012. Do Young Bilinguals Acquire Past Tense Morphology Like Monolinguals, Only Later? Evidence from French–English and Chinese–English Bilinguals. *Applied Psycholinguistics* 33(3). 457–479. https://doi.org/10.1017/S0142716411000439.
Nittrouer, Susan. 2002. Learning to Perceive Speech: How Fricative Perception Changes, and How It Stays the Same. *The Journal of the Acoustical Society of America* 112(2). 711–719.
Oliver, Rhonda & Agurtzane Azkarai. 2017. Review of Child Second Language Acquisition (sla): Examining Theories and Research. *Annual Review of Applied Linguistics* 37. 62–76. https://doi.org/10.1017/S0267190517000058.
Owolabi, Dare. 2012. Production and Perception Problems of English Dental Fricatives by Yoruba Speakers of English as a Second Language. *Theory and Practice in Language Studies* 2(6). 1108–1113.
Paradis, Johanne. 2010. Bilingual Children's Acquisition of English Verb Morphology: Effects of Language Exposure, Structure Complexity, and Task Type: Bilingual Children's Acquisition of English. *Language Learning* 60(3). 651–680. https://doi.org/10.1111/j.1467-9922.2010.00567.x.
Paradis, Johanne & Ruiting Jia. 2017. Bilingual Children's Long-Term Outcomes in English as a Second Language: Language Environment Factors Shape Individual Differences in Catching up with Monolinguals. *Developmental Science* 20(1). 1–15. https://doi.org/10.1111/desc.12433.
Paradis, Johanne, Mabel L. Rice, Martha Crago & Janet Marquis. 2008. The Acquisition of Tense in English: Distinguishing Child Second Language from First Language and Specific Language Impairment. *Applied Psycholinguistics* 29(4). 689–722. https://doi.org/10.1017/S0142716408080296.
Paradis, Johanne, Brian Rusk, Tamara Sorenson Duncan & Krithika Govindarajan. 2017. Children's Second Language Acquisition of English Complex Syntax: The

Role of Age, Input, and Cognitive Factors. *Annual Review of Applied Linguistics* 37. 148–167. https://doi.org/10.1017/S0267190517000022.
Polka, Linda. 1991. Cross-Language Speech Perception in Adults: Phonemic, Phonetic, and Acoustic Contributions. *The Journal of the Acoustical Society of America* 89(6). 2961–2977. https://doi.org/10.1121/1.400734.
Pollock, Jean-Yves. 1989. Verb Movement, Universal Grammar, and the Structure of IP. *Linguistic Inquiry* 20(3). 365–424.
Prévost, Philippe & Lydia White. 2000. Missing Surface Inflection or Impairment in Second Language Acquisition? Evidence from Tense and Agreement. *Second Language Research* 16(2). 103–133. https://doi.org/10.1191/026765800677556046.
Rabha, Saswati, Priyankoo Sarmah & S. R. Mahadeva Prasanna. 2019. Aspiration in Fricative and Nasal Consonants: Properties and Detection. *The Journal of the Acoustical Society of America* 146(1). 614–625. https://doi.org/10.1121/1.5116566.
Radford, Andrew. 2004. *Minimalist Syntax: Exploring the Structure of English*. 2nd ed. edition. Cambridge: Cambridge University Press.
Rezzonico, Stefano, Ahuva Goldberg, Trelani Milburn, Adriana Belletti & Luigi Girolametto. 2017. English Verb Accuracy of Bilingual Cantonese–English Preschoolers. *Language, Speech, and Hearing Services in Schools* 48(3). 153–167. https://doi.org/10.1044/2017_LSHSS-16-0054.
Rice, Mabel L., Kenneth Wexler & Scott Hershberger. 1998. Tense Over Time: The Longitudinal Course of Tense Acquisition in Children With Specific Language Impairment. *Journal of Speech, Language, and Hearing Research* 41(6). 1412–1431. https://doi.org/10.1044/jslhr.4106.1412.
Rizzi, Luigi. 1993. Some Notes on Linguistic Theory and Language Development: The Case of Root Infinitives. *Language Acquisition* 3(4). 371–393. https://doi.org/10.1207/s15327817la0304_2.
Sagey, Elizabeth Caroline. 1986. *The Representation of Features and Relations in Non-Linear Phonology*. MIT Ph.D. Dissertation.
Schmidt, Anna Marie. 1996. Cross-Language Identification of Consonants. Part 1. Korean Perception of English. *The Journal of the Acoustical Society of America* 99(5). 3201–3211. https://doi.org/10.1121/1.414804.
Schütze, Carson T & Kenneth Wexler. 1996. Subject Case Licensing and English Root Infinitives. In *BUCLD 20 Proceedings*, 670–681. Cascadilla Press.
Seliger, Herbert. 1978. Implications of a Multiple Critical Periods Hypothesis for Second Language Learning. In *Second Language Acquisition Research, Issues and Implications*, 11–19. W.C. Ritchie. New York: Academic Press.
Selinker, Larry. 1972. Interlanguage. *International Review of Applied Linguistics in Language Teaching* 10((1-4)). 209–232.
Smith, Bruce L. & Rachel Hayes-Harb. 2011. Individual differences in the perception of final consonant voicing among native and non-native speakers of English. *Journal of Phonetics* 39(1). 115–120. https://doi.org/10.1016/j.wocn.2010.11.005.

Splendido, Frida. 2016. Phonetic-Phonological Development of Early Second Language French Support for a Child Second Language (cl2) Mode of Acquisition in Phonology. *Linguistiques* 2. 19–32.
Thomas, Margaret. 1991. Universal Grammar and the Interpretation of Reflexives in a Second Language. *Language* 67(2). 211–239.
Thomas, Margaret. 2013. History of the Study of Second Language Acquisition. In *The Cambridge Handbook of Second Language Acquisition*, 26–45. Cambridge: Cambridge University Press.
Unsworth, Sharon. 2013. Assessing Age of Onset Effects in (early) Child L2 Acquisition. *Language Acquisition* 20(2). 74–92. https://doi.org/10.1080/10489223.2013.766739.
Vainikka, Anne & Martha Young-Scholten. 1994. Direct Access to X'-Theory: Evidence from Korean and Turkish Adults Learning German. In Teun Hoekstra & Bonnie D. Schwartz (eds.), *Language Acquisition and Language Disorders*, vol. 8, 265. Amsterdam: John Benjamins Publishing Company. https://doi.org/10.1075/lald.8.13vai.
Vainikka, Anne & Martha Young-Scholten. 1996. The Early Stages in Adult L2 Syntax: Additional Evidence from Romance Speakers. *Second Language Research* 12(2). 140–176. https://doi.org/10.1177/026765839601200202.
Weinberger, Steven H. 1988. Theoretical Foundations of Second Language Phonology. University of Washington, ms.
Weinreich, Uriel. 1957. On the Description of Phonic Interference. *Word* 13. 1–11.
Werker, Janet F. & Richard C. Tees. 1984. Cross-Language Speech Perception: Evidence for Perceptual Reorganization During the First Year of Life. *Infant Behavior and Development* 7(1). 49–63.
Wexler, Ken. 1998. Very Early Parameter Setting and the Unique Checking Constraint: A New Explanation of the Optional Infinitive Stage. *Lingua* 106(1–4). 23–79. https://doi.org/10.1016/S0024-3841(98)00029-1.
Wexler, Ken. 2004. Lenneberg's Dream: Learning, Normal Language Development, and Specific Language Impairment. In *Variation and Universals in Biolinguistics* (North Holland Linguistic Series: Linguistic Variations), vol. 62, 239–284. Brill.
Zdorenko, Tatiana & Johanne Paradis. 2007. The Role of the First Language in Child Second Language Acquisition of Articles. In *Proceedings of the 2nd Conference on Generative Approaches to Language Acquisition North America (GALANA),ed. Alyona Belikova, Luisa Meroni, and Mari Umeda*, 483–490. Somerville, MA: Cascadilla Press.
Zobl, Helmut & Juana Liceras. 1994. Functional Categories and Acquisition Orders. *Language Learning* 44(1). 159–180. https://doi.org/10.1111/j.1467-1770.1994.tb01452.x.

Appendix

1. Kazakh consonants (adapted and modified from Bulambayeva 2017)

IPA	Cyrillic	Arabic[54]	Latin	Examples
/p/	П/п	پ	P/p	pɑrtɑ 'table' ʤup 'pair, couple'
/b/	Б/б	ب	B/b	bɑlɑ 'child' bølu 'divide'
/t/	Т/т	ت	T/t	tætʲe 'mother' tætɯ 'sweet'
/d/	Д/д	د	D/d	dʲemɑlɯs 'rest' dæstyr 'tradition'
/k/	К/к	ك	K/k	kɪrpɪk 'eyebow' kɪr 'come in'
/g/	Г/г	گ	G/g	gyl 'flower' nʲegɯz 'basis'
/q/	Қ/қ	ق	Q/q	qɑtʲe 'wrong' qɯr 'countryside'
/ʁ/	Ғ/ғ	غ	G'/g'	ʁɑlɯm 'scientist' ʁɯlʁm'knowledge'
/s/	С/с	س	S/s	bɑstɑ 'start' sɪdɪr 'zip'
/z/	З/з	ز	Z/z	zɯmɯran 'rocket' zʲejɪn 'attention'
/ʃ/ ~ /ʧ/	Ш/ш Ч /ч	ش چ	S'/s' C'/c'	ʧæygɪm 'teapot' ʧæʃ 'hair' ʧʲemudɑn 'box'
/ʒ/ ~ /ʤ/	Ж/ж	ج	J/j	ʤɑz 'summer' ʤɯl 'year'
/m/	М/м	م	M/m	mʊz 'ice' mʊrɑ 'heritance'
/n/	Н/н	ن	N/n	nɑn 'bread' nʊr 'light'
/ŋ/	Ң/ң	ڭ	N'/n'	ɑŋ 'animal' mʊŋ 'sadness'

54. Depending on its position within a word or a syllable, Kazakh Arabic alphabet changes just like in Arabic. For example, the isolated form for /t/ is 'ت ', but its initial form could be 'تـ', medial form is 'ـتـ', as well as its final form is 'ـت'. Only the isolated form is given in the chart.

/l/	Л/л	ل	L/l	lɑpɑs 'vestiule' bɑl 'honney'
/r/	Р/р	ر	R/r	rʷomɑn 'novel' ɯrɑs ‘true, right’
/w/	У/у	ۋ	Y’/y’	ɑwɯl 'hometown' wɑqɯt 'time'
/j/	Й/й	ي	I’/i’	jɯq 'shoulder' ʷoj 'idea, thought'

In addition to the original Kazakh consonants shown above, there are a few borrowed marginal phones from Russian, English or Arabic

2. Marginal phonemes

/h/[55] ~ /χ/	Н/h	ھ ح	H/h	xɑhɑrmɑn 'hero' Allɑh 'Allah'
/f/	Ф/ф	ف	F/f	fɑntɑn 'fountain' fæks'fax'
/v/	В/в	ۇ	V/v	vɑgzɑl 'railway station' vɑgon 'wagon'
/t͡s/	Ц/ц			t͡sirkul 'circle' χuɑt͡sʲɑ 'Huaxia'

55. The highlighted sounds (/h, x, f, v/) are mostly used in loan words. [f] is taken as the free variant of /p/ in some dialect of Kazakh.