LARYNGEALIZATION AND THE PHONOLOGICAL REPERTOIRE OF A DEAF MEXICAN ADOLESCENT: COMPARISONS TO DEAF SPEECH AND THE PHONATION OF SOCIALLY ISOLATED CHILDREN

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by

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ABSTRACT

This thesis is a discussion of universal and innate features of phonology. Specifically, it looks at the speech of a deaf teenage Mexican immigrant who had no formal education and no access to a language which he could use as his first language. His speech, though difficult to analyze or understand, contained strong laryngeal features which could not be explained through language-specific rules.

First, the thesis reviews Mexican Spanish phonology and compares it to the phonology of the subject's speech. It then compares his speech to that of deaf speakers who normally learn language upon entering a school system. The opportunity to learn a language i.e., sign language or speech, was not available to him, and so he grew up in a form of linguistic isolation. The laryngeal characteristics of his speech could not be accounted for using the literature on deaf speech; however, similar laryngeal characteristics are discussed in the literature on infant speech sounds. Thus, these qualities in his speech can be found in the first sounds produced by humans, before they develop language-specific phonological systems. The unique case of "Genie", an isolated, traumatized child who is eventually taught to speak, reveals that her initial vocalizations were also very laryngeal, but that this feature was quickly lost as her speech improved.

Finally the thesis hypothesizes on the innate quality of laryngealization in speech, and the natural occurrence of laryngeals in terms of physiology, as well as the justification of their appearance through feature geometry. The proposal propounded in this thesis is that the use of laryngeals is universal and constant until they are replaced with subsequent language-specific phonological features. If this does not occur during "normal" language acquisition stages, then the features remain in speech until such a time as they are finally supplanted.

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Chapter One

1.0 Introduction

This thesis is a study of some of the innate aspects of phonology. I have used data from individuals who have not been exposed to regular linguistic input in childhood, and have examined their speech for unique characteristics. My primary informant is an individual who, because of his deafness, has had extremely little verbal and only some linguistic[1] input. (My informant will be called E. for the remainder of the thesis.) I have investigated the phonological systems to which he has been exposed and compared his resulting system to the phonological systems of other deaf individuals. As a result of this investigation and comparison, my attention has been focused on a certain phonological feature ([Laryngeal]) whose widespread occurrence cannot be simply accounted for. I have examined the research which has been done on socially isolated children and pre-speech infants for references to use of this feature. Finally, I hypothesize on the possible reason(s) for its prevalence in only certain phonological systems.

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1 The term 'verbal' is used to refer to speech, while 'linguistic' in this context refers to language in general, which would include languages like ASL.

1.1 Scope and Objectives

Many researchers have argued over the question of the innate features of language and/or speech. Determining which facets of language are innate and which are learned is a complicated business, as most concrete forms of testing would require isolation from language (an ethically unsound proposition). This would have to be done to newborn children, so that they would have no linguistic input, even at that early age. Greater understanding of the innate features of language could certainly tip the balance in favour of a theory of Universal Grammar. Isolated children who have had little or no linguistic input represent a unique opportunity to analyze various language features to see which features are present, and which are not. By removing all processes which can be attributed to outside (i.e. learned) influences, it is possible that a few fundamental features of language or speech may remain which cannot be accounted for without looking at the possibility of innateness. This is the task I set out to complete; however, the end product does not result in any broad conclusions. Rather the final focus of the thesis is on only a single phonological feature.

This thesis analyzes the speech of E., a deaf, Spanish-speaking, 16 year old Mexican teenager from a small *pueblo* in west-central Mexico. I compare

both the phonetic and phonological aspects of his speech to the speech of deaf individuals, as described in the literature (see section 1.2.2). As E. was raised in a uniquely isolated environment, I also compare his speech to that of Genie, a child subjected to extreme social deprivation and abuse for some 13 years, and have explored possible overlaps (in Chapter 5, section 2). Furthermore, in chapter 5, I use feature geometry to restate in a simpler and more convincing manner certain phonological rules which emerged from my investigation of E.'s speech.

This thesis examines this uneducated deaf child's speech and Genie's speech, both at similar ages, to explore the possibility that they may share similarities that are not features of educated deaf nor of unisolated hearing children's speech, and, which may, further, be illustrative of Universal Grammar (in particular Universal Phonology). I also investigate E.'s phonological patterns to isolate those properties which are not features of Spanish or deaf speech. I investigate these questions through the literature on deaf speech, the phonology of Mexico City Spanish, phonological feature universals and acquisition, and Genie's linguistic production.

This thesis is particularly suited to my linguistic background, as I have in the past studied not only phonetics and phonology, but also the Spanish language, ASL, deaf culture, and language acquisition.

1.2 Major Findings from Previous Research

The following sections present previous findings on which I have based my original research.

1.2.1 Mexican Spanish

This thesis provides a description of the dialect of spoken Mexican Spanish to which my informant had visual (and limited auditory) access. Resnick (1975), Kvavik (1980), Lombardi and Peters (1981), and Canfield (1981) and all describe, with varying amounts of detail, the dialects of Mexican Spanish from a phonological perspective. By using the dialect maps in the above sources and information from E. and his family, I have been able to identify the particular dialect of E.'s (extended) family (see map in Appendix A, and vocabulary list in Appendix B). I have provided a phonetic and phonological description of the dialect of Mexican Spanish spoken by E.'s (extended) family (i.e., Mexico City Spanish). From this point onward, I will refer to his extended family as *la familia*; this is the Mexican Spanish term used which includes family members who are not parents or siblings. The cultural network of Mexican families is small and tight: it includes only

extended family and godparents (Rothman, Gant and Hnat 1985:201). As I am using E.'s uncle and grandmother as native consultants, the linguistic comparisons to E. are relevant as a result of this cultural phenomenon.

1.2.2 Deaf Speech

Deaf speech has been well-documented through this century. The literature I use is not of the most recent date (thus: Hudgins and Numbers (1942), Jones (1967), Angelocci (1962), and Nickerson (1975)). Nevertheless, it is entirely adequate for my purposes, as it includes detailed phonetic and phonological descriptions. Furthermore, searches for newer work on the subject reveal the overwhelming change in focus from deaf speech analysis to the analysis of sign language (ASL), after (about) 1980. Note also that more recent phonetic and/or phonological studies tend to focus on rather minute details of acoustic and aerodynamic analyses of deaf speech (e.g., Brown and Goldberg (1980)), and on the effects of cochlear implants on deaf speech, rather than on more comprehensive descriptions of the speech of deaf individuals.[2]

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2 I have extensively searched three databases which are available for bibliographic searches in Linguistics, Psychology, and General Topics. I used the following versions: *MLA* 1963-February 1995, copyright Modern Languages Association; *PsycLIT* 1974-March 1995, copyright American Psychological Association; and *Current Contents* September 1992-December 1994, copyright Institute for Scientific Information. These searches revealed no additional articles

Deaf children of hearing parents have also been discussed in detail by various researchers, in particular Susan Goldin-Meadow and Carolyn Mylander, who look at the home sign systems created by these children (Goldin-Meadow and Mylander 1984). In an article on the syntactic features of home signs they discuss the speech of deaf children whose parents expose them only to verbal language:

> "However, 90% of deaf children are not born to deaf parents who could provide early exposure to a sign language. Rather, they are born to hearing parents who quite naturally expose their children to speech (Hoffmeister and Wilbur, 1980). It is extremely uncommon for deaf children with severe to profound hearing losses to acquire the spoken language of their hearing parents naturally, that is, without intensive instruction. Even with instruction, the children's acquisition of speech is markedly delayed when compared either to the signs of deaf children of deaf parents or to the speech of hearing children of hearing parents. By age 5 or 6, and despite intensive early training programs, the average profoundly deaf child has only a very reduced oral linguistic capacity at his disposal (Conrad 1979; Meadow 1968; Mindel and Vernon 1971)" (Goldin-Meadow and Mylander 1984:41).

1.2.3 Children in Social Isolation

Various researchers in the field of psychology have labelled children exposed to various types of neglect as being in "social isolation" (e.g.

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or books of a more recent date which were also precisely relevant to my thesis topic.

Backenroth (1986); Corsini (1994)). The literature on Genie describes her as an "extremely socially isolated child" (Curtiss, Fromkin, Krashen, D. Rigler, and M. Rigler 1974:528), who did not begin to learn her first language (English) until the age of 13.5 years. Literature about deaf children describes a particular class of deaf children as "isolated deaf children"; they are defined as "deaf youngsters, isolated both from a sign language (because their hearing parents [do] not know one) and from a spoken language (because they [are] deaf)" (L. Gleitman, H. Gleitman, Landau, Wanner 1988:150). For these children isolation normally ends around the age of five, when they learn a language at school. But, if the child does not have access to an education (eg. for financial or political reasons) then the isolation continues. E. is just such an isolated deaf child.

Curtiss (1977) describes in detail the phonetic and phonological features of Genie's speech; as well, there is earlier mention of these in Curtiss *et al.* (1974) and in Fromkin, Krashen, Curtiss, D. Rigler, and M. Rigler (1974). The articles written soon after her discovery (in 1971) are actually of greater value to the investigation in this thesis, because it is at this point that Genie had, as yet, little exposure to speech, thus, providing a greater similarity to E.'s situation.

Goldin-Meadow and Mylander (1991) look at the syntactic and morphological properties of home sign. However, this work, along with

Goldin-Meadow *et al.* (1984), is broadly based, and, thus, opens the door to other aspects of linguistic "resilience" research, such as the "robustness"[3] of phonological features.

> "Language is a robust phenomenon mastered by children experiencing a wide range of environments (cf. Wimsatt, 1989). Despite great variability in patterns of child-caretaker communications (e.g., Miller, 1982; Ochs, 1982; Pye, 1986; Schieffelin, 1979), virtually all children in all cultures master the language to which they are exposed. However, there do appear to be limits on the robustness of language development in children. If, for example, a child is not raised by humans (e.g., Lane, 1977) or is raised by humans under inhumane conditions (e.g., Curtiss, 1977), severe breakdowns in language development will occur.
>
> "Moreover, not all properties of language appear to be equally robust in the face of variations in environmental conditions. Certain properties of language have been found to develop in environments that deviate dramatically from typical language-learning environments, while other properties of language have not" (Goldin-Meadow and Mylander, 1991:315).

As the result of my research, I propose that only the phonological place of articulation feature [Laryngeal] is present in infancy, but that it is obliterated by the acquisition of additional supralaryngeal features in infants

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3 Although the terms 'robust' and 'resilient' refer to features of language which may also be considered to be a part of Universal Grammar by some linguists, Goldin-Meadow and Mylander do not make such a claim. Rather, their use of these terms refers to characteristics of language which occur (and/or persist) in all but the most hostile environments.

with linguistic input; thus [Laryngeal] is not persistently "robust" due to language-specific interference.

1.3 Significance of Research

The resource literature I have used includes some older work (e.g. research on Genie and on deaf speech), some newer work on Mexican Spanish phonology, modern feature geometry articles, and some original research on E. and his extended family. This combination raises various concerns which must be addressed; for instance, there is no literature on Spanish deaf speech[4]. I have accessed articles on deaf speech and on spoken Spanish, but I could not locate any research that combined the two. Thus, this thesis is an original contribution in this area. The phonological research has been chosen so that no language-specific issues arise.

A similar concern raised by this work is that Genie spoke English, not Spanish. Accordingly, this thesis eliminates English-specific rules and

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4 There is a dissertation entitled *Language use in Spanish-speaking families with deaf children* (Garcia 1993); however, it is a sociolinguistically oriented thesis on American hispanic families.

sounds from consideration.[5] As well, Genie is not deaf. However, since she lived for some 13 years with very little linguistic input, her earliest speech repertoire reveals some traits similar to E.'s, who also had limited linguistic input for some 15 years. The emotional deprivation and abuse suffered by Genie cannot be (and has not been, in the literature) given a factor value with which to calculate its effect on her various cognitive abilities. Nevertheless, Genie learned many new skills with remarkable speed, and apparently had quite competent receptive abilities. This implies very resilient human abilities for many cognitive and physical skills. However, her phonetic and phonological improvement over 10 years[6] was very limited. This suggests either that it is only language production abilities which can be permanently damaged by psychological abuse and neglect, or that Genie was too old to learn language natively by the age of 13.5 years. I am assuming the latter (for this, see Goldin-Meadow 1985:241-2), and so feel justified in comparing her to E. However, I only mention this 'critical period' inference for the purpose of comparing these two teenagers' speech. This work does not make any conclusions about a critical period for language acquisition.

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5 As I do look at infant speech sounds it is interesting to note that Ollers and Eilers (1982:565) find: "results show that in spite of gross phonetic differences between the adult phonologies of Spanish and English, babies from both groups produce [very similar vocalizations]".

6 From the ages of 13 to 23.

1.3.1 Social Isolation

Studies documenting social isolation and resultant speech limitations are abundant and span decades of research on a fairly small number of individuals (see Feldman, Goldin-Meadow and Gleitman 1978; McNeil, Polloway and Smith 1984; Backenroth 1986; Scovel 1988; Mayberry and Eichen 1991; Corsini 1994). Backenroth (1986:125) describes deaf individuals who are not part of a deaf community nor using a sign language as "psycho-socially isolated". Gleitman *et al.* (1988:150) use the term "isolated" to describe deaf children prior to their attending school. Curtiss *et al.* (1974:528) describe Genie's situation as "extreme social isolation".

I have looked at the use of the term "isolated" both with respect to deaf children and to abused children (such as Genie), in order to prove the validity of comparison between these groups and my informant.

1.3.2 Deaf Speech

Unlike E., deaf speakers mentioned in studies have had oral and/or sign language training through the school systems from at least the age of five. Phonetic and phonological properties commonly associated with deaf

speech are also noticeable in E.'s speech. Issues such as sporadic voicing patterns, denasalization of nasal stops, lack of stress/monotone speech, vowel neutralization — all are common to many deaf speakers, regardless of the language through which these properties are exposed. E., however, shows additional traits not discussed in deaf speech literature, some of which are documented as being part of Genie's speech repertoire. This opens the door to comparing the phonological features unattested by deaf speech phonology with those of Curtiss' subject.

1.3.3 Innate Speech Characteristics

Studies discussing the sounds produced by pre-speech infants (both hearing and deaf) all share common findings: glottals are present in the sounds produced by infants from birth to several months of age, at which point a gradual division occurs between the vocalizations of deaf *versus* hearing infants. Various researchers have published studies documenting vocalization inventories of pre-speech infants; some have compared those with vocalizations of pre-speech deaf infants (see Holmgren, Lindblom, Aurelius, Jalling, and Zetterstöm 1984; Ingram 1989; Lach, Ling, Ling, and Ship 1970; Smith 1973; Stoel-Gammon and Otomo, 1986; Stoel-Gammon 1988). The one common feature these researchers found is the

overwhelming use of glottals by infants in their first months of life. E. and Genie seem to have had an unusual preference for laryngeals (of which the glottal stop is one), but this was observed most commonly during the first few months of their return from isolation. Subsequently E. received hearing aids, and Genie returned to regular human interaction; thus, both individuals were now able to hear and partake of regular verbal interaction and communication.

1.4 The Informant

1.4.1 Clarification of Translations

This chapter contains statements such as "E. explained that" and "he tells", etc., which, at first glance, seem to contradict my statements about his linguistic abilities. However, E. was able to communicate quite well using his (primarily non-verbal) sign/pantomime/speech communication system. His ability to get meaning across was surprisingly clear once his system was learned. E.'s receptive vocabulary was, in my opinion, much larger than his productive one. He and I learned to get meanings across to one another quite well, and we both looked for regular confirmation from one another, resorting to diagrams and theatrics when necessary. My statements are based on many hours of interview sessions and the validity of my translations were

confirmed by E. Some of the vocabulary I use to describe comments made by him may seem complex for someone of his limited linguistic abilities, but the actual words came from my transcribed/translated notes as the best terms I could find to describe the meaning imported by E.

1.4.2 Background Information

E. was sixteen years old at the time of my analysis. He came to Canada at the age of 15, in May 1991, by bus with his grandmother, on a three-month visitor's pass. During my research, he was in Canada on an extended visitor's visa. E. had received two years of formal education in Mexico: one year in a hearing classroom (age 8), and one year in a deaf classroom (age 12). E. explained that these were not very productive years of learning for him, in that he did not like the environment nor did he understand much. In November 1991 (at age 15), E. was taken to a hearing aid clinic by *la familia*, where, several months later, he was fitted with devices that augmented his hearing. His unaided hearing put him in a hard-of-hearing category. Without hearing aids he had 80-90 dB hearing loss (he could hear only extremely loud noises and some low frequency sounds). Although he had previously been fitted with hearing aid devices in Mexico, these were primitive, and E. said either they did not work well, or were uncomfortable

and he did not wear them.

E. received an extremely limited education in Mexico. He tells of the time he was at a hearing school with a hearing aid that did not work. He did not like that experience, and his family moved after a year. So, at the age of 9 he had completed one year of schooling in an oral setting (at age 8 he was assessed as having 15 words in his verbal production inventory). The next time he was at school, at age 12, was again for one term. That had been a deaf classroom, where he learned to fingerspell, to improve his lipreading, and to learn to read simple Spanish words. His family moved again and he went to work in a factory. When he arrived in Canada, his aunt began giving him Spanish reading lessons which I later taught.

At the time of my research,[7] E. spoke only Mexican Spanish, with a total vocabulary of about 50 words; he gestured with a sort-of 'home sign' language, and he pantomimed. He spoke and communicated very little at first, and needed the encouragement of his extended family to answer a question or discuss an issue. He had been taken from his nuclear family (termed *la casa* in Mexico) to live with his grandmother, uncle, and aunt, who were all from the same region in Mexico as his parents. They spoke

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7 I was asked to join a team of researchers in various fields at the University of Waterloo who were examining E., and attempting to assess his situation. I worked with E. for three months.

some English, but only Spanish was spoken at home. None of his extended family used signs with him. My first taping session occurred in their living room, with his grandmother and uncle urging him to tell stories. E. combined spoken Spanish words with signs and looked very uncomfortable. During my further sessions with him we were alone; I chose to speak Spanish as well as use gestures and signs to better communicate my meanings. The use of non-verbal communication, in particular, seemed to relax him, as he communicated more and offered more spontaneous utterances in my presence.

1.4.3 Description of E.'s Deafness and Linguistic Abilities

In Mexico E. was given a "hearing box". According to E., the hearing box was ineffective and cumbersome so he stopped wearing it. At the deaf school, when he was 12, he learned a few basic signs (recognizable by anyone who has studied A.S.L.), but otherwise spoke to his family with his limited ability and vocabulary. They, in turn, raised their voices and repeated statements a number of times when speaking to him. This was the same method used by *la familia* in Hamilton.

E. is the oldest son in a family of four children; the youngest child is a girl who has the same hearing problem as E. A great-aunt also had some

degree of hearing loss; thus, there is a family history of deafness. In Mexico, E. communicated with his family members verbally and with his deaf sibling in some sort of home sign, and did some lip-reading. He had minimal auditory feedback from spoken language. His own verbal communication was very difficult to understand, but it gradually improved after receiving hearing aids.

Other researchers had done some psychological analysis of E.'s abilities before I joined the team. They had done cognitive testing and assessed his intelligence quotient using standardized tests. Some of these results were:

IQ estimated to be: 83 by TONI-2
87 by WISC-R

This gave us a better idea of how much of a factor his cognitive abilities were in the delay in development of his speech. So, averaging his IQ to be approximately 85, he falls 15% below the norm. This is not a dramatic difference, so it rules out language delay due to mental inability.

1.5 Theoretical Approaches

This thesis has a multi-dimensional approach, examining aspects of phonetics, phonology, deaf culture, Spanish dialectology, and language acquisition. Although this paper deals with phonology, it does not focus on issues of phonological theory. Rather, phonology is simply the tool which

the thesis uses to analyze and compare the speech of the various linguistically-limited individuals mentioned.

Standard structural phonemic analysis has been used. However, when such analysis can provide additional insights, some of the processes have been described in terms of contemporary phonological theory, such as the Halle-Sagey model of feature geometry (Kenstowicz 1994:452).

I have used the same approach as Curtiss (1977) and those researchers who documented the phonological characteristics of deaf speech (see section 1.2.2). They often took notes and elicited various types of utterances. Curtiss often got little response, so her team was forced to write things down whenever Genie made a sound. Johnston, Miller, Curtiss and Tallal (1993:974) discuss methods for interview protocol with children: "Miller (1981 p. 10), for example, urges caution in asking questions: 'When interacting with the child it is best for the adult to be interested without being pushy. Asking questions . . . and giving commands should be kept to a minimum . . .' ". They further explain that "Crystal (1982, p. 9) similarly advises that clinicians 'may use whatever sampling strategy proves feasible . . . as long as full notes are kept of the sampling situation . . .' ".

My work with E. was a three-month summer volunteer project, so I did not have the time to look at his speech from a longitudinal standpoint; thus, the thesis will be a synchronic study. The intent was to study his speech

before he had gained much phonological information from auditory input via the new hearing-aids he had received before the first videotaping session.[8] In order to compare his speech with that of a similarly verbally isolated individual, I will compare it to Genie's speech from the earliest studies by Curtiss; thus, the data will primarily illustrate Genie's speech before she had had extensive linguistic contact and interaction.

1.6 Methodology

As this is an empirical study, the various methods and procedures for collecting data are outlined below.

1.6.1 *La Familia* (Extended Family)

In order to adequately compare E.'s speech to that of his hearing counterparts, I will document the phonology of the Mexican Spanish dialect spoken by his family. I have videotape evidence of two hearing family members: his grandmother and uncle. The grandmother and uncle were recorded on videotape for one hour during a scheduled meeting between the researchers and the members of the household. Their speech was then

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[8] His hearing had improved somewhat with the hearing aids, although he was constantly adjusting them. The amount of hearing experience E. had prior to my study is difficult to measure, but his family did not see marked improvement in his speech or comprehension during that period.

transcribed from the tape by the researcher, and reviewed by another Spanish-speaker.

In order to complete the phonological rule system for the referential group of speakers I have also done dialectal research on the area of Mexico from which E.'s family stems. This, along with the recorded data, will provide a framework of the hearing communities' phonological rules and phonetic inventory. From this I can show the deviations in E.'s speech.

1.6.2 Deaf Children

The studies done on the speech of deaf children used mainly word-list or sentential reading tasks in order for the transcribing team to have adequate environments for all phonemes. Hudgins and Numbers (1942), and the other studies mentioned in section 1.2.2, all used these methods, and some also used informal conversations. This is often the only method available with children who have not yet learned to read. I used word-lists and informal conversations, as E.'s reading skills were quite poor, and he was uncomfortable reading aloud. The word-list I used with him was familiar to him, so he was not too uncomfortable reading it.

1.6.3 Genie

The team of psychologists who originally introduced me to E. needed someone who could communicate with him, as well as provide a linguistic commentary. Their goal was to compare his linguistic and cognitive abilities to those of Genie, the child who had been found in California after 13 years of traumatic isolation. Susan Curtiss, the author of a book and a coauthor of a number of articles on Genie, developed linguistic tests for her. Curtiss also did a thorough analysis of Genie's phonological patterns which are detailed in the book: *Genie: A Psycholinguistic Study of a Modern-Day 'Wild Child'* (Curtiss 1977). Curtiss explains her method of data collection for Genie's speech:

> " ... Because of Genie's special problems associated with speech, especially her reluctance to speak unless required to do so, the tape recordings that were made consist largely of either silence or of someone other than Genie talking. Thus, although tape recordings of Genie continue to be made, they have not served as a principal means of collecting speech data. ...
>
> The primary source of data for Genie's productive language has been detailed notes taken on the spot, during our sessions with Genie."
> (Curtiss 1977:46-7).

The precedent set here by Curtiss reveals the problem associated with

recording informants who produce few spontaneous utterances, and respond to direct questions hesitantly. The few utterances uttered are noted and described on the spot, so as not to lose the information. This was also the situation with which I was faced in the case of E.

1.6.4 E. - Data Collection

On my part, the research involved eliciting conversation, as well as developing a rapport with E. in order to get more linguistic output from him. Often our sessions took place in parks, a library, or my home. He disliked video- and audio-taping sessions, so I was often confined to a great deal of note-taking and simultaneous transcribing.

With data which were on tape, I was able to transcribe at my leisure. However, there were also instances when I did not use a tape recorder; at such times, whenever I was asking E. to read, I would have him repeat a word several times until I was comfortable with the accuracy of my transcription. I would explain that he was not to speak slower or differently, but simply to repeat. All of the material was then re-checked for transcription accuracy (where possible), and analyzed for his phonetic repertoire, as well as for phonological rules.

1.7 Conclusion

I have chosen to begin the analysis by comparing E.'s phonology with the phonology of Mexican Spanish, which, in some senses, may be considered to have the 'broadest', most extensive phonological system. This comparison reveals processes not discovered in the speech of his hearing counterparts. Consequently, I compare his phonology to that of deaf individuals. This reveals many similarities and one interesting difference. I then discuss this unique feature in terms of other isolated children and pre-speech vocalizations in order to provide substance to my theory. In other words, this thesis proceeds from the broadest viewpoint, a view of Mexican Spanish, and continually narrows, eventually focusing in on only a single feature.

Chapter Two

2.0 The Phonology of Mexico City Spanish

At the time I was interviewing him, E. spoke only a few dozen words; he spoke no English, only Mexican Spanish. This section presents the dialect of Mexican Spanish which was spoken around him during his childhood, the dialect spoken in and around Huetamo and Mexico City, Mexico.[9] This is the dialect which provided for him visual and minimal auditory input of a spoken language. In this section, I present example words, articulatory descriptions, and phonological distributions for the sounds of this dialect.

In order to make the description of the dialect as accurate as possible, I have researched the phonology of the region of Mexico from which both he and his Canadian relatives came, as well as that of Mexico City which is where his family had lived for several years, and where he went to school. I am calling this Mexico City Spanish as that is the name of the area's dialect.[10]

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9 See Appendix A for a map of the region.

10 Some phonemes in this chapter are realized in the same way in many Spanish dialects, and more commonly only in the Spanish dialects spoken in North, Central, and/or South America. Unless more specifically named, I will call these 'dialects of the Americas'.

My sources for this research are Canfield (1981), Cressey (1978), and Perissonotto (1975). By combining these and using *la familia's* phonology as the deciding factors, I feel I have established an accurate description of the phonology of his family, and will assume that E. would have used this version had he been hearing.[11] I have used only IPA symbols for all the transcriptions, including those given by other authors; i.e. when I quote someone I have changed the symbol used to the corresponding IPA symbol in order not to add confusion.

The phonological rules of the dialect of Spanish E.'s family uses are the framework to which I will compare his phonology. Without engaging in this step, I would be unable to separate the language-specific phonological rules he has acquired from the unique rules he has developed.

2.1 Consonants[12]

The stops of Spanish have different voice onset times (VOT) than

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11 Primarily, the conversation transcripts of *la familia* were used for example words for each phoneme; additional examples come from Canfield (1981), Cressey (1978), and Perissonotto (1975).

12 A complete consonant chart of Mexico City Spanish is presented in section 2.1.18.

English stops. As a result, there is an overlap between voiced Spanish stops and voiceless English stops. However, the language still has voiced/voiceless pairs, so that they are still represented with the same symbols as English stops. Since this is true for all Spanish stops, it will suffice to mention it only once, before the discussion of any individual stops.

2.1.1 /p/

[papá]	*papá*	'father'
[práðo]	*prado*	'meadow'
[kópa]	*copa*	'cup'
[kompás]	*compás*	'rhythm'

This voiceless bilabial stop occurs in word initial position and intervocalically, but has only one phone. It is represented by a 'p' in the orthography. The phoneme is a universal feature of Spanish having the same pronunciation in all dialects.

Thus, the distribution is entirely straightforward: /p/ : [p]

2.1.2 /β/

[bárko]	*barco*	'boat'
[bómba]	*bomba*	'bomb'
[bombón]	*bombón*	'chocolate'
[kámbjo]	*cambio*	'change'
[káβe]	*cabe*	'fit'
[káβa]	*cava*	'cellar'
[álβa]	*alba*	'dawn'

[laβárβa]	*la barba*	'the chin'
[elβárko]	*el barco*	'the boat'
[laβáka]	*la vaca*	'the cow'

The voiced bilabial fricative phoneme is pronounced as a stop at the beginning of a phrase and following a nasal consonant. In all other environments it is a fricative. This distribution is also found in other dialects of Spanish. Orthographically it is a 'b' or 'v'.

Thus, the distribution: /β/ : [b] / #__ or /ŋ__
: [β] / ...

2.1.3 /t̪/

[t̪óðo]	*todo*	'all'
[t̪u]	*tu*	'your'
[est̪áðo]	*estado*	'state'
[komét̪a]	*cometa*	'comet'

The voiceless dental stop occurs in all positions and is orthographically a 't'. Unlike English which has an alveolar 't', this is a dental in many dialects of Spanish, including this one.

Thus, the distribution is: /t̪/ : [t̪]

2.1.4 /ð/

[d̪í]	*dí*	'say!'
[dé]	*de*	'of'
[d̪ónd̪e]	*donde*	'where'

[d̪es̪ðén]	*desdén*	'scorn'
[kwándo]	*cuando*	'when'
[t̪ánd̪a]	*tanda*	'series'
[sélda]	*celda*	'cell'
[fálda]	*falda*	'skirt'
[kald̪éra]	*caldera*	'boiler'
[sjuðáð]	*ciudad*	'city'
[os̪kuriðáð]	*oscuridad*	'obscurity'
[t̪óðo]	*todo*	'all'
[merkáðo]	*mercado*	'market'

The phoneme /ð/ is represented by a voiced dental stop, orthographically 'd'. It has two alternates: [d̪] and [ð]; both are interdental, but the former is a stop and the latter a slit fricative. I have chosen the fricative *eth* as the underlying representation because it occurs in more environments than the stop. In this dialect of Spanish, the stop is produced word-initially, and after [n] or [l]. According to Canfield (1981:11), the *eth*, occurs in all other environments OR it is lost altogether between vowels or word-finally. He says it is "preserved most in highland Mexico ..." which is the area under analysis here. However, E.'s relatives on occasion replaced it with an [s] in word-final position. So instead of [us̪t̪éð] or [us̪t̪é] they had [us̪t̪és̪] in an environment where the following word begins with a vowel: [us̪t̪éšabland̪o]. Nonetheless, the slit fricative was the norm.

Thus, the distribution is: /ð/ : [d̪] / #__ or / n,l__
: [ð] / ...

2.1.5 /k/

[kón]	*con*	'with'
[kwándo]	*cuando*	'when'
[kósa]	*cosa*	'thing'
[kjére]	*quiere*	'want'
[kámera]	*kamera*	'camera'
[kílo]	*kilo*	'kilo'
[akí]	*aquí*	'here'
[eskrí̪to]	*escrito*	'written'
[áŋkla]	*ancla*	'anchor'

Orthographically 'c', 'qu', and 'k' (in loan-words), are represented by a single phoneme which has one phone: a voiceless velar stop - [k]. This sound and its distribution pattern is repeated in other Spanish dialects.

Thus, the distribution is: /k/ : [k]

2.1.6 / ɣ /

[géra]	*guerra*	'war'
[gáʝo]	*gallo*	'rooster'
[gɾánde]	*grande*	'big'
[méŋgua]	*mengua*	'decrease'
[máŋga]	*manga*	'sleeve'
[eŋgóro]	*engorro*	'bother'
[la ɣára]	*la garra*	'the claw'
[dóɣo]	*dogo*	'bulldog'
[eksíɣwo]	*exiguo*	'meagre'

The phoneme / ɣ/ is always some type of voiced velar obstruent. It is realized either as a stop or as a slit fricative. It occurs solely as a 'g' orthographically, but only certain CV combinations like 'gu' and 'ga' belong to this phoneme ('ge' and 'gi' will be discussed in Section 2.1.10). The stop occurs word-initially and after /n/, which is then realized as [ŋ]. The fricative occurs in all other environments. This phoneme has the same distribution in many other hispanic dialects.

Thus, the rule: / ɣ / : [g] / #__ or / [ŋ]__
: [ɣ] / ...

2.1.7 / ɸ /

([fálda]	*falda*	'skirt')
[ɸálda]	*falda*	'skirt'
[ɸálta]	*falta*	'deficient'
[ɸásil]	*fácil*	'easy'
[diɸísil]	*difícil*	'difficult'

The labial fricative qualities of this phoneme are regular in Hispanic dialects. The dialect-specific aspect of this phoneme lies in the exact articulatory positioning: standard Spanish dialects often have only the labiodental [f]. Research into the dialect of Mexico being studied suggests that all positions of this phoneme are in fact bilabial [ɸ], as well as "in much of America"

(Canfield 1981:11). He states that [f] is used "in careful urban speech," otherwise only [ɸ] is used (1981:11). Whatever the allophone, there is a single orthographic representation: 'f'. The phoneme is limited in its distribution, as it never occurs word finally. However, its only allophone is [ɸ].

Thus, the distribution is just: / ɸ / : [ɸ]

2.1.8 /s/

[síŋko]	*cinco*	'five'
[súsja]	*sucia*	'dirty'
[eskwéla]	*escuela*	'school'
[kása]	*casa*	'house'
[mésa]	*mesa*	'table'
[présjo]	*precio*	'cost'
[mɨezmo]	*mismo*	'me'
[dézde]	*desde*	'since'
[lazɣéras]	*las guerras*	'the wars'

This voiceless predorsoalveolar fricative is orthographically 's' or 'c'. Throughout the Americas, it is realized as an [s], or, before a voiced consonant, it is also voiced.

Thus, the distribution is simply: /s/ : [z] /___ C [+voice]
: [s] / ...

2.1.9 / ʄ͡ʝ /

[ʄ͡ʝó]	*yo*	'I'
[ʄ͡ʝáɣa]	*llaga*	'wound'
[ʄ͡ʝérβa]	*hierba*	'grass'
[elʄ͡ʝóro]	*el lloro*	'the crying'
[elʄ͡ʝélo]	*el hielo*	'the ice'
[kónʄ͡ʝuɣe]	*cónyuge*	'spouse'
[laʄérβa]	*la hierba*	'the grass, herb'
[laʄeβó]	*la llevó*	'the rain'
[aʄér]	*ayer*	'yesterday'
[óʄa]	*olla*	'pan'
[aʄúd̪a]	*ayuda*	'help'

"In [all of Mexico], [orthographic 'y'] and [orthographic 'll'] have been levelled to one phoneme, ..." (Canfield 1981:62). Phonetically, these sounds are represented by [ʎ] and [ʈ] (respectively) in many Spanish dialects.[13] Perissinotto (1975:51) also mentions these phonemes: "Moreover, there is no mention that Mexican Spanish doesn't have the phoneme /ʎ/, which has been confused with /ʝ/ for a long time. The phone [ʎ] exists only as a variation of position for /l/ before a palatal." In the Americas unlike Mexico, in addition to these two phones several others occur as well. Here, use of friction in this phoneme is gradated according to age, code, and class. Audible

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13 These, as commonly known, are a voiced palatal lateral approximant and a voiced velarized alveolar lateral approximant, respectively, and are listed in the consonant inventory chart in section 2.1.18.

friction is considered *fino hablar* ("fine talk") by native teachers (Canfield 1981:63). So, "in Mexican Spanish dialects, orthographic 'll' represents the same phoneme" as orthographic 'y', although in other American Spanish dialects phonemic distinctions still exist here (Canfield 1981:12).

The phoneme in this dialect of Mexican Spanish represents voiced prepalatal friction, with an affricate and a slit fricative as its phones. The affricate occurs word-initially and following [n] or [l]. The fricative [ʝ] occurs only in intervocalic position.

Thus, the distribution is: / ʄ͡ʝ / : [ʝ] / V__ V
: [ʄ͡ʝ] / #__ or n,l __

2.1.10 /x/

[çénjo]	*genio*	'nature'
[çénṯe]	*gente*	'people'
[çíra]	*gira*	'trip'
[méçiko]	*México*	'Mexico'
[deçenerasjón]	*degeneración*	'degeneration'
[álçiðo]	*álgido*	'icy'
[xamón]	*jamón*	'ham'
[xóβen]	*joven*	'young'
[xúɣo]	*jugo*	'juice'
[dexár]	*dejar*	'to leave'
[exóte]	*ejote*	'green bean'
[naránxa]	*naranja*	'orange'

Although orthographically a 'j' (in Spanish *jota*), an 'x' and sometimes a 'g'

('ge' and 'gi' only), this phoneme is always manifested as some type of voiceless fricative in this dialect. "The *jota* of Mexico is generally prepalatal or postpalatal, depending on the vocalic environment. In recordings ... the *jota* ... wavers between ..." [ç] and [h] (Canfield 1981:62). "The sound is produced with a great deal more friction than English h" (Cressey 1978:159). However, in my research I have found that this slit fricative phoneme alternates between the palatal and velar positions, depending on the following vowel; that is, front vowels get a palatal or prepalatal and non-front vowels get the velar. This type of assimilation does not occur in all dialects, or occurs to different degrees. I found no proof of the use of [h] in this dialect, so will only include two phones.

Thus, the distribution is: /x/ : [ç] /__ V[+high]
: [x] / ...

2.1.11 / c͡ç /

[c͡çát̪o]	*chato*	'flat'
[c͡çákra]	*chacra*	'smallholding'
[c͡çínc͡çe]	*chinche*	'bug'
[c͡çósa]	*choza*	'shack'
[c͡çíc͡ça]	*chicha*	'maize liquor'
[múc͡ço]	*mucho*	'much'
[kóc͡çe]	*coche*	'car'

This voiceless dorsoprepalatal affricate is orthographically 'ch' (Perissinotto

1975:50-1). Chessey (1978:159) calls it a palatoalveolar, so both authors indicate that it may occasionally be somewhat more fronted than a purely palatal affricate.

The distribution is simply: / c͡ç / : [c͡ç]

2.1.12 /m/

[mí]	*mí*	'my'
[marléna]	*Marlena*	'Marlena'
[mamá]	*mamá*	'mother'
[mú̪n̪do]	*mundo*	'world'
[kómpra]	*compra*	'purchase'
[embáte]	*embate*	'beating'
[káma]	*cama*	'bed'

The voiced bilabial nasal is written 'm' in Spanish, and is consistently [m].

Thus, the distribution is simply: /m/ : [m]

2.1.13 /n/

[négro]	*negro*	'black'
[kanásta]	*canasta*	'basket'
[korasón]	*corazón*	'heart'
[umpéso]	*un peso*	'a/one peso'
[umbéso]	*un beso*	'a/one kiss'
[umpa̪trón]	*un patrón*	'a/one boss'
[t̪rambi̪ea]	*tranvía*	'tram'
[embjár]	*enviar*	'to send'
[un̪do̪kt̪ór]	*un doctor*	'a/one doctor'
[un̪̪táksi]	*un taxi*	'a/one taxi'

[uŋ̟̈seɲór]	*un señor*	'a/one man'
[muŋ̟̈do]	*mundo*	'world'
[unníɲo]	*un niño*	'a/one child'
[uɲɲóɲo]	*un ñoño*	'a silly (person)'
[uŋɣáţo]	*un gato*	'a cat'
[uŋkoɾ̟̈te]	*un corte*	'a cut'
[uŋxéfe]	*un jefe*	'a chief'

This phoneme can probably best be represented as an archisegment of voiced nasality, and whose default place of articulation is alveolar. Orthographically it is 'n', but has a variety of phones. Basically, it is a nasal which assimilates place completely to the following sound. This is most clearly evident in the phrase "one ___"; note the examples above. I have only shown the labial, dental, alveolar, palatal, and velar here. Before a vowel, 'n' retains its alveolar position; as is normal practise in phonology, I therefore choose this allophone to represent the phoneme.[14]

Thus, the distribution is: /n/ : [m] /__ C [+bilabial]
: [n̪] /__ C [+dental]
: [n] /__ C [+alveolar]
: [ɲ] /__ C [+palatal]
: [ŋ] /__ C [+velar]
: [n]/ ...

14 Prevocalic environments provide no opportunity for the nasal to assimilate its place of articulation.

2.1.14 /ɲ/

[ɲóɲo]	*ñoño*	'silly'
[níɲo]	*niño*	'child'
[ɲáto]	*ñato*	'snub-nosed'
[greɲúd̪o]	*greñudo*	'dishevelled'
[ríɲa]	*riña*	'brawl'
[enɛ̯eɲár]	*enseñar*	'to learn'

Orthographically 'ñ', the voiced palatal nasal must be considered a separate phoneme, since it contrasts with other nasals.

Thus, the distribution is simply: /ɲ/ : [ɲ]

2.1.15 /l/

[láβ̞jos]	*labios*	'lips'
[lécc̞e]	*leche*	'milk'
[lokál]	*local*	'place'
[él]	*él*	'he'
[kóla]	*cola*	'tail'
[pálo]	*palo*	'stick'
[kul̪túra]	*kultura*	'culture'
[kál̪d̪o]]	*caldo*	'stock, consummé'
[al̪t̪jémpo]	*al tiempo*	'at the time'
[kóʎcc̞a]	*colcha*	'bedspread'
[eʎcc̞iɐko]	*el chico*	'the small, little (child)'
[eʎʝán̪t̪o]	*el llanto*	'the weeping'

The voiced alveolar lateral approximant phoneme, /l/ is always a 'light' [l]. "Spanish [l] is always 'i-colored' (i.e. pronounced with the body of the tongue high and forward as for [i])" (Cressey 1978:160). However, in a dental or palatal environment, it will be articulated accordingly, so that there are dental

and palatal phones as well. Orthographically the phoneme is expressed only by an 'l'.

The distribution of /l/ : [l̪] / ___ C [+dental]
: [ʎ] / ___ C [+palatal]
: [l] / ...

2.1.16 /ɾ/

[péɾo]	*pero*	'but'
[páɾa]	*para*	'for'
[maɾléna]	*Marlena*	'Marlena'
[t̪ɾaβáxo]	*trabajo*	'work'
[pɾésjo]	*precio*	'cost'
[kɾúse]	*cruce*	'crossing'
[véɾ]	*ver*	'to see'
[ʔabéɾ]	*haber*	'to have'
[paɣáɾ]	*pagar*	'to pay'
[teátro]	*teatro*	'theatre'

This phoneme is difficult to describe because only its place of articulation - the alveolar ridge - is consistent. It is orthographically a single 'r', but is pronounced in several ways. Word-finally, it is either a voiced or voiceless strident alveolar fricative trill. Canfield (1981:13) says that the voiceless version is used more frequently; however, Perissinotto (1975:64) shows both phones in free variation, and Cressey (1978:160) simply calls it voiced and does not mention devoicing. As I only heard voicing in the speech of *la familia*, I have chosen to represent the word-final variants as voiced. In all

other positions where it occurs (it is not found word-initially), there is more or less agreement that 'r' is pronounced as a voiced alveolar flap or a "simple voiced vibrant" (Cressey 1978:160). Occasionally, after a [t] the 'r' is trilled but this tends to be in more oratorical styles.

Thus, the distribution is: /ɾ/ : [ɾ] /___ # or t___

: [ɾ] / ...

2.1.17 /r/

[rápiðo]	*rápido*	'quick'
[réj]	*rey*	'king'
[ríjo]	*río*	'river'
[arós]	*arroz*	'rice'
[péro]	*perro*	'dog'
[ʔeréro]	*herrero*	'blacksmith'
[géra]	*guerra*	'war'

This phoneme represents a voiced apico-alveolar trill, found in most (if not all) Spanish dialects, and deviates only in the duration of the trill due to style and emphasis. It is written as 'rr' or 'r' (only word-initially). The trill only occurs intervocalically or word-initially.

Thus, the distribution is simply: /r/ : [r]

2.1.18 Consonant Inventory Chart

Thus, the complete phonetic inventory of consonants is as shown in the chart on the following page.

Mexican Spanish Consonant Inventory Chart

I.P.A.	Labial	Labio-dental	Dental	Alveo-lar	Post-alveo	Palatal	Velar	Uvular	Phar-yngeal	Glottal
Plosive	p b		t̪ d̪				k g			
Nasal	m		n̪	n		ɲ	ŋ			
Trill				r						
Tap				ɾ						
Frica-tive	ɸ β	f v	ð	s ɾ̞		ç ʝ	x ɣ			
Affric-ate						c͡ç ɟ͡ʝ				
Appro-ximant						j	w			
Lateral approx			l̪	l ɬ		ʎ				

2.2 Vowels

The vowel system is extremely simple, and consists of only five vowel phonemes: /i e a o u /. The following sets of examples illustrate these vowels in extremely similar environments:

2.2.1 /a/

[pán]	*pan*	'bread'
[t̪árðe]	*tarde*	'late'

2.2.2 /e/

[péna]	*pena*	'grief'
[t̪éɾko]	*terco*	'tough'

2.2.3 /i/

[pi̬no]	*pino*	'pine'
[t̪i̬ro]	*tiro*	'throw'

2.2.4 /o/

[póɲc͡ço]	*poncho*	'poncho'
[t̪órðo]	*tordo*	'dappled'

2.2.5 /u/

[púna]	*puna*	'mountain sickness'
[t̪úɾβjo]	*turbio*	'cloudy'

2.3 Diphthongs

Mexican Spanish contains a wide range of diphthongs. Four of the vowel phonemes combine with the labiovelar glide, and four vowels combine with the palatal glide. The two semivowels are [j] and [w]. Both are voiced. Spanish contains both increasing and diminishing diphthongs, i.e. the vowel follows or precedes the glide, respectively. Thus, we have a list of six diminishing diphthongs and eight increasing ones:

2.3.1 Diminishing

[aj]	[bájle]	*baile*	'dance'
[aw]	[páwt̪a]	*pauta*	'line'
[ej]	[aséj̪te]	*aceite*	'oil'
[ew]	[rewɲjón]	*reunión*	'reunion'
[oj]	[ój]	*hoy*	'today'
[ow]	[roβówmβaŋko]	*robó un banco*	'he robbed a bank'

2.3.2 Increasing

[ja]	[pjáno]	*piano*	'piano'
[je]	[pjeðáð]	*piedad*	'pity'
[jo]	[pjóxo]	*piojo*	'louse'
[ju]	[sjuðáð]	*ciudad*	'city'
[wa]	[kwáɳ̪ðo]	*cuando*	'when'
[we]	[pwén̪t̪e]	*puente*	'bridge'
[wi]	[swiðáðo]	*cuidado*	'care'
[wo]	[kwót̪a]	*cuota*	'fee, share'

I have only provided one example for each diphthong, as they appear to be fairly straight-forward.

2.4 Conclusion

The phonological system presented here will serve as a framework for the rules in E.'s language. This description of Mexico City Spanish illustrates the phonology of speakers from the same speech area as that in which E. grew up. These rules are not meant to be narrow, detailed descriptions, but are presented simply to provide a concise, accurate framework of E.'s speech.

Chapter Three

3.0 E.'s Phonology

This chapter illustrates the unique way E. produces and uses speech sounds. E.'s speech is a product of the innate aspects of language (discussed in Chapter 5), visual cues from speakers, very limited auditory input, as well as positive or negative reinforcement by the listener: through a person's facial expressions he quickly knows whether or not a person has understood what he was saying. Some sounds are quite similar to those in his community's speech. Others show neutralization or imprecision in articulation, which he has never corrected.

The total spoken vocabulary used with me during our sessions consisted of 50 separate words, some of which he had learned only during the previous year with his aunt's help. Whenever E. was unable to produce a spoken lexical item, he would produce a sign in its place. From these indications, it appears that these 50 words represent at least 90% of his total spoken vocabulary. All fifty of these words occur in either the word list session or the videotape session.

The biggest factor giving E.'s speech a unique "sound" is his tendency

to keep his velum tense during most speech sounds. This velarization tendency is strongest in certain consonants, but influences all his sounds (both vowels and consonants) to some degree. This characteristic "sound" will be further discussed below.

For the consonants I use all the example words that E. produced (in both sessions); however, I have limited the number of example words for the vowels, since I had a much larger corpus for each vowel phoneme.[15]

In some of E.'s transcribed words stress is not marked; this indicates that there was equal stress on each syllable of the word. The first column is a fairly narrow transcription of E.'s speech; the second is the approximated dialectal version of the same word (for comparison); the third column is the Spanish orthography of the word, and the fourth column is the English gloss.

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15 Some of the examples I use here show only one of the alternate forms used by E., since the other forms do not illustrate any additional variants of that particular phoneme.

3.1 Consonants[16]

3.1.1 /p/

[paɬé?]	[paɾéð]	*pared*	'wall'
[péɬo]	[pélo]	*pelo*	'hair'
[pjeɹʔə]	[pjérna]	*pierna*	'leg'
[pjé]	[pjé]	*pie*	'foot'
[pãn̪ɑɬõɬeʃ]	[pan̪talónes]	*pantalones*	'trousers'
[páɬo]	[pálo]	*palo*	'stick, wood'
[pwéɬn̪a]	[pwéɾn̪a]	*puerta*	'door'
[pɬán̪o]	[plán̪o]	*plato*	'plate'
[sapán̪o]	[sapán̪o]	*zapato*	'shoe'

This voiceless bilabial stop only has one phone: [p]. E. uses it quite often, but most occurrences are word-initial.

Thus, the distribution is entirely straightforward: /p/ : [p]

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16 The complete chart of E.'s consonants is presented in section 3.1.17.

3.1.2 /β/ and /b/

[boɬʃɑ̃]	[bólsa]	*bolsa*	'purse, bag'
[βóqə]	[bóka]	*boca*	'mouth'
[t̪eɬeβizió̪d̪]	[t̪eleβizjón]	*televisión*	'television'
[qobíʕɑ]	[koβíxa]	*cobija*	'blanket'
[nwéβeθ]	[nwéβes]	*nueves*	'nine'
[abɬɑ́ɹ]	[aβlár]	*hablar*	'to speak'

In Mexican Spanish, this voiced bilabial obstruent phoneme is a stop at the beginning of a phrase and following a nasal. In all other environments it is a fricative. E.'s examples do not show this distribution. Although it is difficult to make a firm conclusion from the small number of examples, the distribution of the two phones is so similar, that they appear to be two separate phonemes.

Thus, the distribution is: /β/: [β] and /b/: [b]

3.1.3 /t̪/

[t̪eɬeβizióð̪]	[t̪eleβizjón]	*televisión*	'television'
[t̪eɬéfõno]	[t̪eléɸono]	*teléfono*	'telephone'
[t̪ɹiðguło]	[t̪riãŋgulo]	*triangulo*	'triangle'
[t̪óɾa]	[t̪óða]	*toda*	'all'
[sapát̪o]	[sapát̪o]	*zapato*	'shoe'
[pãt̪ɑɬõɬeʃ]	[pan̪talónes]	*pantalones*	'trousers'
[pɬát̪o]	[plát̪o]	*plato*	'plate'

This phoneme is represented by a voiceless apico-dental stop with velarization. There are no alternate pronunciations for it. E. pronounces it in a manner very similar to that of his family members, except that he consistently adds the velarization. Since this sound is formed quite forward in the mouth, utilizing the tip of the tongue, presumably E. has fairly good visual input for this sound. However, since the tongue body position is not easily visible, it would presumably not be clear to E. that the tongue body should normally be lowered, rather than raised, as it is with velarization.

Thus, the distribution is: /t̪/ : [t̪]

3.1.4 /d̪/

[d̪ed̪o]	[d̪éðo]	*dedo*	'finger'
[d̪oɾˢmˢʔíɾ]	[d̪ormír]	*dormir*	'to sleep'
[t̪óɾa]~[t̪ód̪a]	[t̪óða]	*toda*	'all'
[qɑ́d̪ɑ́d̪a]	[kanad̪á]	*Canadá*	'Canada'
[t̪ód̪o]	[t̪óðo]	*todo*	'all'
[qwat̪ɪo]	[kwád̪ro]	*cuadro*	'square'
[paɬɛ́ʔ]	[paréd̪]	*pared*	'wall'

This apico-dental stop, like the previous one, is always produced with strong velarization. Although normally voiced, in E.'s speech it can lose its voicing (see *cuadro* above). As well, it can (in word-final position) be replaced by a glottal stop (see *pared* above).

Thus, the distribution is: /ɖ/ : [ʔ] /__ #

: [ɖ] - [ʈ] / ...

3.1.5 /q/

[qəmisə]	[kamiɐsa]	*camisa*	'shirt'
[qámɑ]	[káma]	*cama*	'bed'
[qáʕɑ]	[káxa]	*caja*	'box'
[qobíʕɑ]	[koβíxa]	*cobija*	'blanket'
[qaɹo]	[káro]	*carro*	'car'
[qé]	[ké]	*que*	'that'
[qwaʈɹo]	[kwáɖro]	*cuadro*	'square'
[sīʕo]~[sīqo]~[sī]	[sīŋko]	*cinco*	'five'
[aʕí]	[akí]	*aquí*	'here'
[ɛsqwéɬa]	[eskwéla]	*escuela*	'school'
[βóqə]	[bóka]	*boca*	'mouth'
[tsiqoɬo]	[sírkulo]	*circulo*	'circle'

This phoneme is represented only by a voiceless velar stop in the speech of his community, but E. uses phones which are somewhat further back in the mouth: a voiceless uvular stop and a voiced pharyngeal fricative. In word-initial position, he consistently uses the uvular phone, but intervocalically the voiced pharyngeal fricative occurs.

Thus, the distribution is: /q/ : [ʕ] / V__ V

: [q] / ...

3.1.6 /ɢ/

[qa̤to]	[ga̤to]	*gato*	'cat'
[áɢwa]	[áɣwa]	*agua*	'water'
[ɹéɢɬo]	[réɣlo]	*reglo*	'ruler'
[t̪ɹiðɢuɬo]	[t̪riãŋgulo]	*triangulo*	'triangle'

The phoneme /ɢ/ is represented by a uvular stop; it is voiceless at the beginning of a word (as in the unique example *gato*), and voiced in other

environments. Unlike the hearing speakers of Mexico City Spanish who produce both velar fricatives as well as velar stops, E. realizes only a stop here. However, as we have already seen in the previous section, his dorsal stop phonemes are not velar, but are produced further back in the vocal tract.

Thus, the distribution is: /ɢ/ : [q] / #___

: [ɢ] / ...

3.1.7 /f/

[ʇeɬéfõno]~

[ʇeɬéfõʔo]	[ʇeléɸono]	*teléfono*	'telephone'

The labial fricative of Mexico City Spanish is used by E. as well. I only have one example of this phoneme (represented by orthographic 'f'), as it does not occur in any of the other words in his repertoire. Thus, there are no examples of it occurring word-initially, only the single intervocalic form occurs. He repeated it three times for me when we did the word-list analysis, with only minor inconsistencies in pronunciation (which occurred with respect to a

different sound in the word); thus, I am confident of the nature of the sound. His use of the phone [f] intervocalically does not accord with the phonology of Mexico City Spanish — one would expect [ɸ].

Thus, the distribution is: /f/ : [f]

3.1.8 /s/

[sīʔo]	[sīŋko]	*cinco*	'five'
[sapáo̤]	[sapáo̤]	*zapato*	'shoe'
[sijōʔ]	[síʝõn]	*sillon*	'(arm)chair'
[sẽn̤ʇɹɑɬ]	[sẽn̤ʇrál]	*central*	'central'
[ɛskwéɬa]	[eskwéla]	*escuela*	'school'
[meʃə]	[mésa]	*mesa*	'table'
[boɬʃū]	[bólsa]	*bolsa*	'purse, bag'
[ʇeɬeβizióđ]	[teleβizjón]	*televisión*	'television'
[qəmisə]	[kamiɐesa]	*camisa*	'shirt'
[pān̤ɑɬõɬeʃ]	[pan̤talónes]	*pantalones*	'trousers'

[mánoθ]	[mános]	*manos*	'hands'
[nwéβeθ]	[nwéβes]	*nueves*	'nine'
[nəɹˢʔís]	[narís]	*nariz*	'nose'
[ɬəβioʃ]	[láβjos]	*labios*	'lips'

This fricative has many varied phones in E.'s speech. It seemed during analysis that when he was tired or bored this phoneme could be articulated forward or back of its intended position. The voicing was generally quite consistent; [z] occurred only once, intervocalically (see *televisión*). The interdental slit fricative occurred twice, both times word-finally (see *manos* and *nueves*). The post-alveolar occurred in various environments, but never word-initially. The [s] phone was most widespread; it occurred word-initially, intervocalically, and word-finally.

Thus, the distribution is: /s/ : [θ] - [ʃ] - [s] /___ #

: [z] / V__V

: [ʃ] / l___ or V__V

: [s] / ...

3.1.9 /j/

[jõ]	[ʄ͡ʄó]	*yo*	'I'
[sijõʔ]	[sí ʄõn]	*sillon*	'(arm)chair'
[pjeɹʔə]	[pjéɾna]	*pierna*	'leg'
[pjé]	[pjé]	*pie*	'foot'

Unlike Mexico City Spanish, I heard no evidence of an affricate occurring in E.'s speech. Thus, this phoneme is represented by only one phone: a voiced palatal glide. It is often a fricative in the Mexico City dialect, but sounds like an glide when E. produces it.[17]

Thus, the distribution is entirely straightforward: /j/ : [j]

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17 It should be remembered that this is not the same phoneme in Mexico City Spanish as that occurring in diphthongs, nor is it the orthographic 'j'. E. uses it in place of the affricate, the fricative, and in diphthongs; more on this in Section 3.3. So, E. uses only the approximant where his hearing counterparts would use up to three different phones; i.e. the orthographic representation of this phoneme for E. is 'y', 'll', and 'i' before a vowel.

3.1.10 /ʃ/

[qáʃa]	[káxa]	*caja*	'box'
[qobíʃa]	[koβíxa]	*cobija*	'blanket'
[óʃo]	[óxo]	*ojo*	'eye'
[oɹéqə]	[oréxa]	*oreja*	'ear'

In Mexico City Spanish two voiceless fricative phones are used to represent this phoneme (orthographic 'j'): one palatal and one velar (E. has no words in his inventory which correspond the the use of the palatal in Mexican Spanish). E. typically uses a voiced pharyngeal fricative here; however, one form contains instead the voiceless uvular stop (see *oreja*). As noted above for other dorsal obstruents, this dorsal fricative also is produced farther back in the vocal tract than the equivalent one used by hearing speakers.

Thus, the distribution is: /ʃ/ : [ʃ] ~ [q]

3.1.11 /c͡ç/

While this phoneme is found in Mexico City Spanish, there were no

words in E.'s repertoire which contained the sounds corresponding to it (orthographic 'ch'). Thus, it appears that this phoneme does not occur in E.'s consonant inventory.

3.1.12 /m/

[meʃə]~[meʃɑ]	[mésa]	*mesa*	'table'
[mɑ:ɬẽra]	[marléna]	*Marlena*	'Marlena'
[mə̃ɬo]	[máno]	*mano*	'hand'
[mánoθ]	[mános]	*manos*	'hands'
[mãma]	[mamá]	*mamá*	'Mom'
[qəmisə]	[kamɨɐsa]	*camisa*	'shirt'
[qɑ́mɑ]	[káma]	*cama*	'bed'
[d̪oɹˠmˠʔíɹ]	[d̪ormír]	*dormir*	'to sleep'

This bilabial nasal is used the same way in E.'s phonology as in Mexico City Spanish phonology. It normally only has one phone: [m]. However, a pharyngealized version occurs in one word: *dormir*. I argue in section 3.1.16

that this a carry over of the pharyngealization found in some variants of /ɹ/.

Thus, the distribution is: /m/ : [m] (~ [mˤ])

3.1.13 /n/

[nəɹˤʔís]	[narís]	*nariz*	'nose'
[nwéβeθ]	[nwéβes]	*nueves*	'nine'
[t̪eɬéfõno]~ [t̪eɬéfõʔo]	[teléɸono]	*teléfono*	'telephone'
[mánoθ]	[mános]	*manos*	'hands'
[mə̃ɬo]	[máno]	*mano*	'hand'
[pã̪t̪ɑɬõɬeʃ]	[pan̪talónes]	*pantalones*	'trousers'
[sẽ̪t̪ɹɑɬ]	[sẽn̪trál]	*central*	'central'
[t̪ɹiðguɬo]	[t̪riãŋgulo]	*triangulo*	'triangle'
[sĩʕo]~[sĩqo]~[sí][18]	[sĩŋko]	*cinco*	'five'

18 E.'s third use of this word, he simply lost the second syllable including the nasal so that the only remnant was nasality in the vowel. I only have the one example of this, so I have chosen not to include it in my discussion. When this form occurred, he was restating a previously mentioned concept; thus, his use of the abbreviated form may have been an

[mɑːɬẽɾa] [marléna] *Marlena* 'Marlena'

This phoneme occurs in many of the words in E.'s repertoire. Unlike Mexico City Spanish, in E.'s speech this phoneme does not consistently assimilate its place of articulation to the following consonant.

This phoneme has several variants in E.'s speech: [n], [ʔ], [t̪], [ɾ], [d̪]. Word-initially it is always the alveolar nasal. The other consistent pattern is found when the nasal occurs before a consonant. The vowel preceding the nasal becomes nasalized, and the [n] is deleted (note the examples of *pantalones, central, triangulo* and *cinco*).

All of the other examples occur in intervocalic position: in careful speech, the nasal will usually occur (see *teléfono* and *manos*). Otherwise, the lateral is found (see *mano* and *pantalones*). Finally, there is a unique example of an intervocalic glottal stop (*teléfono*), a single example of a flap (*Marlena*), and one pronunciation of 'Canada' using a [d̪].

Thus, the distribution is: /n/ : [n] / # _

: [n]~ [t̪]~[ʔ]~[ɾ]~[d̪] / V__ V

---

attempt to streamline the conversation.

A rule for deletion:	V	n	C	=>	V		Ø	C
	1	2	3		1		2	3
					[+nas]			

3.1.14 /ɬ/

[ɬəβioʃ]	[láβjos]	*labios*	'lips'
[ɬɑ̃ɬo]	[lálo]	*Lalo*	'Lalo'
[pɬáö̯]	[pláö̯]	*plato*	'plate'
[aɬa]	[ala]	*a la*	'to the'
[ö̯eɬeβizióö̯]	[ö̯eleβizjón]	*televisión*	'television'
[ö̯eɬéfõno]	[teléɸono]	*teléfono*	'telephone'
[boɬʃɑ̃]	[bólsa]	*bolsa*	'purse, bag'
[mɑ:ẽɾa]~			
[mɑ:ɬẽɾa]	[marléna]	*Marlena*	'Marlena'
[abɬáɹ]	[aβlár]	*hablar*	'to speak'
[pɑ̃ö̯ɑɬõɬeʃ]	[panö̯alónes]	*pantalones*	'trousers'
[ɛsqwéɬa]	[eskwéla]	*escuela*	'school'
[péɬo]	[pélo]	*pelo*	'hair'

[páɬo]	[pálo]	*palo*	'stick, wood'
[tsiqoɬo]	[sírkulo]	*circulo*	'circle'
[ʇɹiŋguɬo]	[triŋgulo]	*triangulo*	)triangleɻ
[ɹégɬo]	[réʏlo]	*reglo*	'ruler'
[sēʇɹɑɬ]-[sēʇɹɑʔ]- [ʰēʇɹɑʔ]	[sēntrál]	*central*	'central'

E.'s version of this is a voiced velarized alveolar lateral approximant. In Mexico City Spanish this sound is not velarized, and becomes dental and palatal in the respective environments. In E.'s speech, it sounds consistently the same.

In only one instance did he replace it with a glottal stop [ʔ] word-finally; this was the single such pronunciation of that word. Furthermore, E. only had one word in his spoken vocabulary with an 'l' ending; thus, generalizations are difficult. For the proper name *Marlena* 'Marlena', in one of the repetitions he lost the 'rl' completely and simply lengthened the preceding vowel. However, this was a name which he used often and perhaps on occasion he became lazy using it.

Thus, I state the distribution simply: /ɬ/ : [ɬ]

However, an optional deletion rule may be in order:

ɬ -> Ø / V __ V

3.1.15 /ɹ/

[oɹéqə]	[oɾéxa]	*oreja*	'ear'
[pjeɹʔə]	[pjéɾna]	*pierna*	'leg'
[t̪ɹiə̃ɢuɬo]	[t̪riə̃ŋgulo]	*triangulo*	'triangle'
[qwat̪ɹo]	[kwád̪ro]	*cuadro*	'square'
[sẽt̪ɹɑɬ]~[sẽt̪ɹɑʔ]~ [ʰẽt̪ɹɑʔ]	[sẽn̪t̪rál]	*central*	'central'
[paɬéʔ]	[paɾéð]	*pared*	'wall'
[pwéɬt̪a]~[pwét̪a]	[pwéɾt̪a]	*puerta*	'door'
[tsiqoɬo]	[síɾkulo]	*circulo*	'circle'
[mɑːɬẽɾa]	[marléna]	*Marlena*	'Marlena'
[abɬáɹ]	[aβláɾ]	*hablar*	'to speak'
[d̪oɹˢmˢʔíɹ]	[d̪ormíɾ]	*dormir*	'to sleep'

[nəɹˤʔís]	[narís]	*nariz*	'nose'

E. normally uses some type of voiced alveolar liquid for this phoneme. The most common variant is a frictionless continuant approximant [ɹ]. However, [ɬ] is used in two forms (see *pared*, and *puerta*). There is no pattern evident here, thus the two phones appear to be in free variation. As well, occasionally the sound is omitted altogether when it occurs before another consonant (see *puerta, circulo,* and *Marlena*).

Finally, a pharyngealized version of this sound appears in *dormir* and *nariz*. The pharyngealized variants occur word internally, but there is no obvious pattern; thus, this variant must also be considered to be in free variation with the non-pharyngealized ones. These pharyngealized sounds are always followed by a glottal stop, which begins the following syllable; this appears to be a transitional sound which E. finds necessary to link to the next, stressed syllable.

Mexico City Spanish has two 'r' phonemes; however, it appears that E. has only one. In Mexico City the following words are pronounced with a trill; however, E. shows the same pronunciation here as for the previous examples.

[ɹégɬo]	[réʏlo]	*reglo*	'ruler'
[qaɹo]	[káro]	*carro*	'car'

As his pronunciation of all the 'r' phonemes is the same, I have combined them into one phoneme in his phonological system.

Thus, the distribution is: /ɹ/ : [ɹ] ~ [ɬ] ~ [ɹˤ]

As well, there is an optional deletion rule: ɹ -> Ø / V __ C

and a post-pharyngeal glottal stop insertion rule:[19]

Ø -> ʔ / ɹˤ (C)_ V́

3.1.16 /ɲ/

While this phoneme is found in Mexico City Spanish, no words in E.'s vocabulary list contained the sounds corresponding to the orthographic 'ñ'. Thus, it appears that this phoneme does not occur in E.'s consonant inventory.

3.1.17 E.'s complete phonetic inventory of consonants is as shown in the chart on the following page:

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19 The pharyngealization process appears to be a kind of prosody, since it also applies to the [m] which follows a pharyngealized [ɹˤ] in *dormir*. Since this [mˤ] only occurs in a single lexical item, a separate rule is overkill.

E.'s Consonant Inventory Chart

I.P.A.	Labial	Labio-dental	Dental	Alveo-lar	Post-alveo	Palatal	Velar	Uvular	Phar-yngeal	Glottal
Plosive	p b		t̪ d̪					q ɢ		ʔ
Nasal	m mˤ			n						
Trill										
Tap				ɾ						
Frica-tive	β	f	θ	s z	ʃ				ʕ	h
Affric-ate										
Appro-ximant				ɹ ɹˤ		j	w			
Lateral approx				ɬ						

3.2 Vowels

This section will discuss the five vowel phonemes found in E.'s speech. I was unable to offer near minimal pairs for E.'s vowels, due to the limited number of lexical items in his vocabulary. However, I have in all cases tried to show similar environments for all five phonemes.

3.2.1 /ɑ/

[pãn̪ɑɬõteʃ]	[pan̪talónes]	*pantalones*	'trousers'
[paɬéʔ]	[paréð]	*pared*	'wall'
[aɬa]	[ala]	*a la*	'to the'
[meʃə]~[meʃɑ]	[mésa]	*mesa*	'table'
[mãɬo]	[máno]	*mano*	'hand'
[ɬãɬo]	[lálo]	*Lalo*	'Lalo'
[qobíʕɑ]	[koβíxa]	*cobija*	'blanket'

This non-high unrounded vowel phoneme is represented by three phones in E.'s speech: [ɑ], [ə], and [a]. Schwa often occurs in casual, relaxed speech.

The two low vowel phones ([ɑ] and [a]) are more likely to occur in more formal situations, in newly learned words, or careful pronunciation. Word-final variants of the low back phone are usually longer than the initial or medial variants.

No difference in distribution is apparent, thus, all three phones are evidently in free variation.

Thus, the distribution is: /ɑ/ : [ɑ] ~ [ə] ~ [a]

3.2.2 /e/

[oɹéqə]	[oréxa]	*oreja*	'ear'
[meʃə]	[mésa]	*mesa*	'table'
[sẽn̪tɹɑɬ]	[sẽn̪trál]	*central*	'central'
[t̪eɬéfõno]	[teléɸono]	*teléfono*	'telephone'
[ké]	[ké]	*que*	'that'

The unrounded mid front vowel phoneme is primarily represented by a close, tense phone, but which occasionally appears as an open, lax vowel

instead. I see this as free variation partly based on speech speed. E.'s pronunciation of this phoneme corresponds closely to the pronunciation used in Mexico City Spanish.

Thus, the distribution: /e/ : [e] - [ɛ]

3.2.3 /i/

[nəɹˢʔís]	[narís]	*nariz*	'nose'
[qobíˢɑ]	[koβíxa]	*cobija*	'blanket'
[sīqo]	[sīŋko]	*cinco*	'five'
[aˢí]	[akí]	*aquí*	'here'
[d̪oɹˢmˢʔíɹ]	[d̪ormíɾ]	*dormir*	'to sleep'

This high front unrounded vowel is always represented by an [i] (just as in Mexico City Spanish).

Thus, the distribution is simply: /i/ : [i]

3.2.4 /o/

[óʕo]	[óxo]	*ojo*	'eye'
[péɬo]	[pélo]	*pelo*	'hair'
[mə̃ɬo]	[máno]	*mano*	'hand'
[t̪eɬéfõno]	[teléɸono]	*teléfono*	'telephone'
[qwat̪ɹo]	[kwád̪ro]	*cuadro*	'square'

Most of the examples of this phoneme occur in word-final position in E.'s spoken vocabulary (the only exceptions occur in *ojo* and *teléfono*). However, this tense mid back rounded vowel phoneme does appear to occur consistently with only one phone in his speech.

Thus, the distribution is simply: /o/ : [o]

3.2.5 /u/

[tsiqoɬo]	[sírkulo]	*circulo*	'circle'
[t̪ɹiðguɬo]	[t̪riãŋgulo]	*triangulo*	'triangle'

This phoneme, representing a high back rounded vowel occurs in only two lexical items in E.'s vocabulary; thus, it is very difficult to make generalizations about its distribution. A particularly troublesome example is *circulo* [tsiqoɬo]; here he replaces the first instance of the vowel with the mid back rounded vowel phone (also found as an allophone of the phoneme discussed in the previous section). Perhaps its rarity in his vocabulary makes it difficult for him to gain accuracy through usage.

Thus, the distribution must be: /u/ : [u] ~ [o]

3.3 Diphthongs

E.'s spoken vocabulary does comprise some words which contain diphthongs. One of the semivowels that makes up the diphthongs has already been mentioned in the consonant section: the voiced palatal approximant. The other semivowel used is the voiced labio-velar approximant. He uses these the same way his hearing counterparts do, in Mexico City Spanish (except for the word *yo*). Here are all the examples in his repertoire.

3.3.1 Inventory

/wa/	[ɑ̈ɢwa]	[áɣwa]	*agua*	'water'
	[qwaɻɪo]	[kwáɖro]	*cuadro*	'square'
/we/	[pwéɬɻta]-[pwéɻta]	[pwéɾɻta]	*puerta*	'door'
	[ɛsqwéɬa]	[eskwéla]	*escuela*	'school'
	[nwéβeθ]	[nwéβes]	*nueves*	'nine'
/je/	[pjeɪʔə]	[pjérna]	*pierna*	'leg'
	[pjé]	[pjé]	*pie*	'foot'
[jo]	[jõ]	[ʄ͡ʝó]	*yo*	'I'

3.3.2 /jo/

E. only has increasing diphthongs in his vocabulary but, for the most part, they are used correctly. However, in a few instances, he fully vocalizes the semivowel, thus, producing a vowel:

/jo/	[ɬəβioʃ]	[láβjos]	*labios*	'lips'
	[ɻteɬeβizióɖ]-			
	[ɻteɬeβizióʔ]	[ɻteleβizjón]	*televisión*	'television'

These fully vocalized pronunciations normally occur in slower, careful speech with unfamiliar words which he is reading.

No other diphthongs (normally found in Mexico City Spanish) occur in E.'s speech.

Chapter Four

4.0 Deaf Speakers' Phonology

This chapter reports on certain misarticulations found in the pronunciation of English by many deaf individuals, and compares them to E's misarticulations of Mexico City Spanish. The purpose of this chapter is only to continue to narrow down E.'s phonological features to a set which are unique to a specialized group of individuals. This chapter does not make any statements about language acquisition nor does it review these phonological processes in terms of language acquisition.

I have chosen to base this chapter on a considerably dated article: Hudgins and Numbers (1942). The reason for choosing this particular article is that it was the most comprehensive and most-used study (Jones (1967), Nickerson (1975), etc.), I was able to find; as well, it makes use of the largest data base corpus.[20] It clearly details phonological misarticulation processes and their frequency in deaf students' speech. As the following quote indicates, the age group used is relevant for work with E.'s speech, as is the type of data given; i.e. their elicitation and recording technique is similar to

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20 As mentioned earlier, no articles on the pronunciation of Spanish by deaf children could be found.

the one I used.

"This paper presents a detailed analysis of speech samples obtained from 192 deaf pupils between the ages of 8 and 20 years, with hearing losses ranging from a slight impairment to profound deafness" (Hudgins and Numbers, 1942:295). Hudgins and Numbers (1942) did not use IPA symbols for their transcriptions, so I have converted them. They do not include aspiration in their transcriptions, so I have also omitted it.[21] Hudgins and Numbers do not mark stress on their example words; however, at one point in the article, they do discuss the complexities of stress pronunciation in deaf speech and call it "rhythm" misarticulation (1942:347).

Hudgins and Numbers presented deaf children with a list of simple sentences (of approximately six words in length) to be read. Then each researchers transcribed what they had heard; in addition, they wrote down what they believed the intended sentence to have been, using only the information provided by the deaf individual's pronunciation. The phonological errors Hudgins and Numbers found in the speech of these deaf students often changed the meanings of words, so that entire sentence semantics were altered. This can be seen in the difference between the intended form and the transcription of the form pronounced by the deaf

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21 As there is no aspiration of voiceless stops in Spanish, aspiration is not an issue.

individual (as illustrated in the following sections). Occasionally the misarticulation produced a completely different word. I have changed some of the section headings from those used by Hudgins and Numbers in order to employ present-day terminology, and to avoid ambiguity.

This chapter is not intended to be a complete inventory of deaf speech misarticulations, as I have only included the deaf speech error categories which are also demonstrated by E. This is simply an attempt to keep the focus on the search for unique features of speech. I chose to keep all rules which even remotely coincided with E.'s misarticulations, but omitted the few which could in no way be found, or which were very English-specific. Note also, that the examples provided of E's speech are not a comprehensive list of the particular misarticulation(s) being discussed; instead I have only included a representative form for comparison. In each section, the first group of examples are those of deaf youngsters attempting English words, while the second collection illustrates E.'s attempts at spoken Spanish. The rules proposed for E.'s speech are basically optional rules, since E. does occasionally produce correct Mexico City Spanish pronunciations.

4.1 Consonant Errors

4.1.1 Final Deletion

[æpéjl̩]	-›	[æpej]	'a pail'
[bɑ́t̩]	-›	[bɑ:]	'bought'
[ówrɪs̩]	-›	[owrɪ]	'Otis'
[bɪgdɑ́g̩]	-›	[bi:do:]	'big dog'

"Any one of several things may happen to the [word-final] consonant in the speech of the deaf; it may be dropped completely, it may become a[n] [initial] consonant in a following syllable, or it may lose all of its dynamic properties and become merely a passive oral gesture dangling at the end of the syllable. In rare cases a glottal stop was substituted for the final consonant" (Hudgins and Numbers, 1942:319).[22]

[l] and [t] were most frequently lost in this category. Few of E.'s words end in a consonant (a less common feature of Spanish than English). He does delete syllable finally quite frequently, so this fits into the pattern of the English speakers. Note the following examples of deletion in the initial-syllable:

[pan̪talónes]	-›	[pɑ̃t̪ɑɬõɬeʃ]	*pantalones*	'trousers'
[pwérṯa]	-›	[pwéṯa]	*puerta*	'door'
[sírkulo]	-›	[tsiqoɬo]	*circulo*	'circle'

22 Hudgins and Numbers' only mention of the glottal stop is in this statement. In chapter 5 I will discuss this in greater detail.

[marléna] -› [mɑ:ɬēra] *Marlena* 'Marlena'

[sīŋko] -› [sīqo] *cinco* 'five'

Due to the phonotactic constraints of Spanish, the deleted consonant was typically a non-lateral sonorant (i.e. a nasal or an r). However, since this is predictable from the general sequential constraints of Spanish, the substitution rule for E. can simply be:

(Opt.) C -› Ø / ___ σ

However, he does periodically (i.e., when fatigued or learning new vocabulary word) delete entire word-final syllables:

[sīŋko] -> [sī] *cinco* 'five'

[kanadá] -> [qánɑ́] *Canadá* 'Canada'

[kanadá] -> [qãn] *Canadá* 'Canada'

This rule cannot be stated using a categorical (i.e., feature) rule, so it is stated showing syllable loss.

Thus, we may propose a rule of the form:

Since the rule can apply twice in the word *Canadá*, I propose that this is an iterative rule, applying from right to left (however, due to the lack of data from E., it is difficult to assert, and could simply be a performance-type error).

4.1.2 Consonant Denasalization

[ætðəkóɹn̲ɜɹ]	-›	[ænðəkoɹt̲ɜɹ]	'at the corner'
[sán̲ɜɹ]	-›	[samb̲ɜɹ]	'summer'
[θín̲]	-›	[θɪk̲]	'thing'

> "Any consonants may become nasalized by the failure of the speaker to close the nasal pharynx by raising the velum. .... Deaf children often fail to close off the nasal pharynx in articulating consonants with the result that nasality predominates in both consonants and vowels. Lack of velum control is evidenced in both directions, namely, non-nasal consonants are often nasalized and nasal consonants often become complete stops" (Hudgins and Numbers, 1942:315).

There was no agreement in this study on the most common consonants affected. The word 'summer' listed above has a portion of the nasal denasalized and occluded, so the category is still appropriate.

E. denasalized /n/ word internally, but never word initially. However, since his vocabulary contained only one n-initial word (*naris*), this could be an accident of the data. There are no examples of denasalization of /m/; the velar [ŋ] is typically deleted.

[máno]	-›	[mə̃ɬo]	*mano*	'hand'
[kanaḍá]	-›	[qɑ́ɖɑ́ɖa]	*Canadá*	'Canada'
[pan̈talónes]-	-›	[pə̃ɬɑɬõɬeʃ]	*pantalones*	'trousers'
[ɬeleβizjón]	-›	[ɬeɬeβizióɖ]	*televisión*	'television'

These examples show that, when /n/ was denasalized, it produced a non-continuant with the same voicing and primary place of articulation as /n/.

Thus, the rule for E. is:

$$(\text{Opt.})\quad C \qquad C \quad / \quad V \quad \_\_\_ \quad V$$

$$\begin{bmatrix} +\text{ nasal} \\ +\text{ cor} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ nasal} \\ \beta\text{ son} \\ \beta\text{ lat} \end{bmatrix}$$

4.1.3 Voice Onset Time (V.O.T.) of Stops

[blækdɑ́g]	-›	[pæktɑk]	'black dog'
[bɔ́jzbɑt]	-›	[pojspɑt]	'boys bought'
[fúwd]	-›	[fʊt]	'food'
[gám]	-›	[kam]	'gum'
[bǽg]	-›	[bæk]	'bag'
[dʒɔ́wk]	-›	[tʃowk]	'joke'
[ɹídʒ]	-›	[ɹɪtʃ]	'ridge'

"Deaf children find it difficult to control the thoracic and buccal pressures in the manner required for the proper articulation of [voiced] stops" (Hudgins and Numbers, 1942:313).[23] This error involves pronunciation of a voiceless stop for a voiced one, or less commonly, a voiced stop for a voiceless one. This most often occurs with [b,d,g,dʒ] becoming [p,t,k,tʃ].

This type of error was found in E.'s speech, not only with stops but also for fricatives. Furthermore, in E.'s speech, it is more common for a nasal stop ([n]) to switch V.O.T, than for an oral one (such as [k]). The following examples illustrate this type of error, in both directions:

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23 Discussed in greater detail in Mahshie and Conture (1983) where laryngeal behavior was analyzed using a fiberoptic nasolaryngoscope.

[sí ʝõn̲]	-›	[sijõʔ̲]	*sillon*	'(arm)chair'
[pjérn̲a]	-›	[pjeɹʔ̲ə]	*pierna*	'leg'
[paréð̲]	-›	[paɬɛʔ̲]	*pared*	'wall'
[ʇeleβizjón̲]	-›	[ʇeɬeβizióʔ̲]	*televisión*	'television'

[óx̲o]	-›	[óʕ̲o]	*ojo*	'eye'
[káx̲a]	-›	[qáʕ̲ɑ]	*caja*	'box'
[koβíx̲a]	-›	[qobíʕ̲ɑ]	*cobija*	'blanket'
[ak̲í]	-›	[aʕ̲í]	*aquí*	'here'

Althought the English-speaking deaf children switched V.O.T. without making any other modifications, note that, for E., the voicing changes always result in some type of [+low] consonant: either a glottal [ʔ] or a pharyngeal [ʕ]. So, this process is in fact quite different from the one used by these deaf students.

Consonant sounds produced by the vocal cords are described as [+low], as they are produced at the very lowest edge of the vocal tract. The correlation in E.'s speech between [+low] consonants (i.e. glottals and pharyngeals) and

V.O.T. change, thus, appears to result from the fact that V.O.T. is also controlled at the vocal cords.

Therefore, the V.O.T. rule for E. can be described as:

(Opt.) C → C

[ß voice] → [-ß voice, + low]

4.1.4 Consonant Substitution

[ɹ̲éjd]	-›	[w̲ejt]	'raid'
[wijɹ̲ówd]	-›	[wijw̲owt]	'we rode'
[ɹ̲éjs]	-›	[w̲ejs]	'race'
[s̲léjt]	-›	[ʃ̲ej]	'slate'
[s̲íjl]	-›	[ʃ̲ijl]	'seal'

> "The problem in consonant substitution appears to be one in which the deaf child substitutes a similar though perhaps easier sound for another .... The deaf child learns his consonants and vowels visually and tactually. Sounds which are produced using similar lip and tongue articulations (i.e., features that are visible to the listener) are often substituted for one another. In this study the [phones] [ɹ] and [s] ranked highest in frequency of being replaced by other sounds" (Hudgins and Numbers, 1942:314).

They explain that the phones most often replaced are: [ɹ] -› [w]; [s] -› [ʃ], or [s] -› [t].

As mentioned in the previous chapter, there are numerous consonant substitutions in E.'s speech. I have not listed each word with this type of error, but simply shown some examples of each type of substitution. The substitutions made by E. are often not the same ones as those made by deaf English speakers, but nonetheless they are generally quite predictable.

First note the following data:

[láβjos̲]	-›	[ɬəβio[]	*labios*	'lips'
[pan̪̪talónes̲]-›		[pãn̪̪ɑɬõɬe[]	*pantalones*	'trousers'
[mésa]	-›	[me[ə]-[me[ɑ]	*mesa*	'table'
[bólsa]	-›	[boɬ[ã]	*bolsa*	'purse'
[mános̲]	-›	[mánoθ̲]	*manos*	'hands'

It is evident that E. shows the same misarticulation of [s] as [ʃ] which has been seen in this study of English-speaking deaf children. In addition, E. has a single occurrence of [θ]. Since single occurrences are not amenable to generalization, I will propose that, in E.'s speech, there is a general optional rule which can be described as:

$$\text{(Opt.)} \quad \begin{bmatrix} +\text{strid} \\ +\text{cor} \\ -\text{vcd} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{ant} \\ +\text{high} \end{bmatrix}$$

The deaf children's substitution for 'r' is evident in E.'s speech in another set of data which illustrates what may happen to r sounds:

[paɾéð]	->	[paɬé?]	*pared*	'wall'
[pwéɾta]	->	[pwéɬta]	*puerta*	'door'

We see that (dark) l's may be subsituted for r's. Since [ɬ] is the only other liquid in E.'s sound system, this substitution is unsurprising.[24] Thus, we can state:

(Opt.) $\begin{bmatrix} +\text{cons} \\ +\text{son} \\ -\text{nas} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{lat} \\ +\text{back} \\ -\text{cont} \end{bmatrix}$

These English-speaking deaf children also plosivize fricatives.

[sælij] -> [tælij] 'Sally'

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24 English [ɹ] is characterized by extremely strong (but non-distinctive) lip rounding, which is very visible. Thus, [w], which is also very strongly lip-rounded is an obvious substitution. However, one would not expect the same substitution in Spanish, as both Spanish r sound are completely without lip rounding.

[wijsɑ]] -> [wijtʌ] 'we saw'

In E.'s speech we also find a strong tendency for fricatives to become stops.

[d̪éð̲o]	->	[d̪ed̲o]	*dedo*	'finger'
[t̪óð̲o]	->	[t̪ód̲o]	*todo*	'all'
[aβ̲lár]	->	[ab̲ɬɑ́ɹ]	*hablar*	'to speak'
[áɣ̲wa]	->	[ɑ́g̲wa]	*agua*	'water'
[réɣ̲lo]	->	[ɹégɬo]	*reglo*	'ruler'

Note that in E.'s speech the plosivized fricatives are always voiced. This can be described as:

(Opt.) $\begin{bmatrix} \text{- son} \\ \text{+ vcd} \end{bmatrix}$ -> [+ cont]

As discussed in Chapter 3, E. extensively substitutes uvulars and pharyngeals for velars:

[oɾéx̲a]	->	[oɹéqə]	*oreja*	'ear'
[bóx̲a]	->	[βóqə]	*boca*	'mouth'

[k̲áro]	->	[qaɹo]	*carro*	'car'
[esk̲wéla]	->	[ɛsqwéɬa]	*escuela*	'school'
[qáṯo]	->	[qaṯo]	*gato*	'cat'
[áɣ̲wa]	->	[áɢ̲wa]	*agua*	'water'
[sīŋk̲o]	->	[sīʕ̲o]~[sīqo]	*cinco*	'five'
[óx̲o]	->	[óʕ̲o]	*ojo*	'eye'
[ak̲í]	->	[aʕ̲í]	*aquí*	'here'

This sort of substitution was not evident in the study of English-speaking deaf individuals. However, it is widespread in E.'s speech. Since velars are not visible to the eye, it may be conjectured that E. attempted some sort of consonant which is produced at the back of the mouth and succeeded all too well. While uvulars are produced with the back of the tongue, and pharyngeals with the tongue root, both types of sounds occur about as far back in the vocal tract as is physiologically possible.

Unlike any previous rules, this articulation was not optional, but obligatory. Thus, E.'s rule is:

$$\begin{bmatrix} \text{- son} \\ \text{+ back} \end{bmatrix} \quad \rightarrow \quad [\text{ - high }]$$

The final set of data illustrates several occurrences of glottal stop:

[pjérn̪a]	->	[pjeɹʔə]	*pierna*	'leg'
[teléɸono]	->	[t̪eɬéfõʔo]	*teléfono*	'telephone'
[sí ʝõn̪]	->	[sijõʔ]	*sillon*	'(arm)chair'
[paɾéð̪]	->	[paɬéʔ]	*pared*	'wall'
[t̪eleβizjón̪]->		[t̪eɬeβizióʔ]	*televisión*	'television'
[sēn̪t̪ɾál̪]	->	[sēt̪ɹɑʔ]	*central*	'central'

Note that the occurrence of glottal stop in English-speaking deaf individuals is relatively rare. I quote (again) from Hudgins and Numbers:

> "Any one of several things may happen to the [word-final] consonant in the speech of the deaf; it may be dropped completely, it may become a[n] [initial] consonant in a following syllable, or it may lose all of its dynamic properties and become merely a passive oral gesture dangling at the end of the syllable. *In rare cases a glottal stop was substituted for the final consonant* [italics mine]" (Hudgins and Numbers, 1942:319).

Note that the sounds which become glottal stops in E.'s speech are typically

coronal consonants, and occur, not just in word-final position, but medially as well. Thus, the rule proposed is:

$$(\text{Opt.})\quad \underset{[+\text{cor}]}{\text{C}} \rightarrow \begin{bmatrix} -\text{cor} \\ -\text{son} \\ +\text{low} \\ -\text{vcd} \\ -\text{nas} \\ -\text{cont} \\ -\text{lat} \end{bmatrix}$$

This is a very common process in E.'s speech. However, the rule describing it is quite complex. In the following chapter I propose a simpler way of accounting for this process.

4.2 Vowel Errors

> "The experimenters were less critical in determining the degree of vowel accuracy than that of consonants. The justification for this lies in the nature of the vowel itself and in degree of tolerance of the normal ear for a wide degree of vowel distortion. Classifications of vowels into rigid categories in which each vowel is assigned a definite oral conformation and definite bands of frequencies representing a distinctive quality can be done only by having subjects intone the vowels singly and without context. Vowels in normal speech become mere approximations of rigid forms. Speech is intelligible and may be

> even considered normal in which the vowels only remotely approach the degree of accuracy set up by the phoneticians and phonologists. The acoustic structure or quality of vowels varies widely within a group of individuals. Furthermore, the immediate phonetic context, the degree of stress and rate of syllable utterance all are factors modifying the vowel.
>
> "Vowels in the speech of the deaf rarely reach the degree of accuracy attained by those in the speech of normal hearing persons. Vowel errors were listed only when the assigned vowel was totally unrecognizable" (Hudgins and Numbers, 1942:321).

Hudgins and Numbers (1942) included diphthongs in this section, as have I. I have altered their section headings slightly so as to conform with present-day terminology.

4.2.1 Substitution

[píjpəl]	-›	[pæpəl]	'people'
[dʒán]	-›	[dʒejn]	'John'
[bóɹn]	-›	[pæn]	'barn'
[méjd]	-›	[mijt]	'made'
[báj]	-›	[pej]	'buy'
[majtíjm]	-›	[matam]	'my team'

"Deaf children not only substitute vowels whose formations are similar, for instance [ɪ] for [ij] but they also substitute one vowel for another

in which the formations are dissimilar" (Hudgins and Numbers, 1942:321). This type of vowel error had the greatest frequency. There was no one consistent vowel error.

Just as with the deaf children, there was little consistency in E.'s substitutions, except that E. did not replace a vowel with a dramatically qualitatively different one:

[pan̪t̪alónes]	-›	[pãn̪t̪ɑɬõɬeʃ]	*pantalones*	'trousers'
[k̪áma]	-›	[qɑ́mɑ]	*cama*	'bed'
[k̪áx̪a]	-›	[qɑ́ʕɑ]	*caja*	'box'
[koβíx̪a]	-›	[qobíʕɑ]	*cobija*	'blanket'

We see that E. often replaced the low front vowel with a back vowel, as described by this rule:

$$\text{(Opt.)} \quad V \rightarrow [+\text{back}] \quad / \quad [+\text{low}]$$

Another substitution involved the mid front vowel:

[paréð]	-›	[paɬɛ̲ʔ]	*pared*	'wall'
[ké]	-›	[kɛ̲]	*que*	'that'
[eskwéla]	-›	[ɛ̲sqwéɬa]	*escuela*	'school'

This can be described as follows:

$$\text{(Opt.)} \quad V \quad \rightarrow \quad [\text{-ATR}] \qquad \begin{bmatrix} \text{- high} \\ \text{- low} \\ \text{- back} \end{bmatrix}$$

4.2.2 Diphthong Production Errors

[bój]	-›	[bɑi]	'boy'
[dej]	-›	[dæi]	'day'
[ajhæv]	-›	[aihæf]	'I have'

"A diphthong, properly articulated, is a fusion of two movements, it is similar in this respect to compound consonants." Just as with that error, with diphthongs "two components were separated or prolonged until two distinct vowels were heard ..." (Hudgins and Numbers, 1942:322).

There was only one diphthong which was prolonged in E.'s speech: /jo/.

This occurred in two words:

[t̪eleβizj̪ón]	-›	[t̪et̪eβizió?]	*televisión*	'television'
[láβj̪os]	-›	[t̪áβio∫]	*labios*	'lips'

Thus, the rule is:

$$(\text{Opt.}) \quad \begin{bmatrix} -\text{syll} \\ -\text{cons} \\ -\text{rnd} \end{bmatrix} \quad \rightarrow \quad [+\text{syll}] \quad / \quad \underline{\quad} \quad V$$

4.2.3 Neutralization

[wíl̪]	-›	[wə̪l]	'will'
[tɹéj̪n]	-›	[tɹə̪n]	'train'
[míj̪]	-›	[mə̪]	'me'
[bɜ́ɹd]	-›	[bə̪d]	'bird'

"Neutralization of vowels is a form of vowel substitution; it is listed as a separate category because it represents a very definite type of error rather than [simple] substitution.

"A vowel is neutralized when a minimum modification occurs

> in the vocal canal during its production. The quality and often the duration of such vowels are similar to those of short unaccented vowels. There is a tendency ... for vowels in unaccented syllables to become neutral vowel. ... When syllables usually accented lose their accent and vowels become neutralized the speech becomes more or less unintelligible. Vowels in the speech of deaf children, both in accented and unaccented syllables, are often neutralized" (Hudgins and Numbers, 1942:324).

This was the second most frequent error category for the deaf English speakers. This was also quite common in E.'s speech, as can be seen in these words:

[máno]	-›	[mə̱ɬo]	*mano*	'hand'
[naɾís]	-›	[nə̱ɹˤʔís]	*nariz*	'nose'
[láβjos]	-›	[ɬə̱βioʃ]	*labios*	'lips'
[bóka]	-›	[βóqə̱]	*boca*	'mouth'
[kamísa]	-›	[qə̱misə̱]	*camisa*	'shirt'

Note that, unlike neutralization for hearing speakers, which normally occurs in unstressed environments, schwa is substituted in stressed and unstressed syllables (although it does occur more often in unstressed syllables than stressed syllables). Thus, the common rule for E. and the English-speaking deaf children is:

(Opt.) V → [- high, - low, + back, - rnd, - ATR]

4.2.4 Nasalization[25]

> "The speech of many of the deaf pupils studied was affected by nasality in varying degrees. When this reached what the experimenters considered an excessive degree the sounds were listed in the nasality category. Vowels occuring in syllables with nasalized consonants were more commonly nasalized. Those pupils, therefore, who were inclined to nasalize consonants also were the chief offenders in nasalizing vowels. It is difficult to determine whether the audition-errors caused by nasality are to be attributed to the defective vowel or consonant since both result from the lack of control or malfunctioning of the velum" (Hudgins and Numbers, 1942:324-5).
>
> "The problem of nasality, therefore, unlike the other types of errors studied in this paper, is common to both consonants and vowels" (325).

In some environments (i.e., where a /n/ has been deleted), E. produced compensatory nasalization. However, on occasion he also produced nasalized vowels without any nasal consonant in the environment. It should be noted, however, that just as Hudgins and Numbers had to

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25 "The term nasality as used in this paper means the effects produced by failure of the velum to close the nasal pharynx" (Hudgins et al. 1942:324).

determine a cut-off point for marking nasality, so did I. This is not to say that there was no nasality in other words which have not been marked for it, but that these may have had less extreme examples of nasalization.

[pa̤n̤talo̤nes]-›		[pã̤t̤ɑɬõ̤ɬeʃ]	*pantalones*	'trousers'
[sí ɟõn]	-›	[sijõʔ]	*sillon*	'(arm)chair'
[má̤no]	-›	[mã̤ɬo]	*mano*	'hand'
[bólsa̤]	-›	[boɬʃã̤]	*bolsa*	'purse, bag'
[lá̤lo]	-›	[ɬã̤ɬo]	*Lalo*	'Lalo'

Thus, the rule for deaf speakers, including E. is:

(Opt.) V -› [+ nas]

Note that, in this chapter, we have presented certain similarities between E.'s production of spoken Mexico City Spanish and the production of spoken English by a number of deaf individuals. Although a number of similarities were found, there are also a few interesting differences. These differences will be discussed further in the following chapter.

Chapter Five

5.0 Discussion

Three areas are discussed in this chapter: pre-speech vocalizations in terms of laryngeal features, Genie's laryngeal behaviour (with Susan Curtiss' comments), and finally the feature geometry of E.'s laryngealizations.

5.1 Pre-Speech Vocalizations

Many researchers have investigated the phonetic realization of pre-speech sounds. This is a difficult task as pre-speech infant vocal tracts are not yet formed for production of all speech sounds. Ingram (1989:98) states that there is a "physiological limitation on the [infant's] early vocal tract." He also states that the glottal stop predominated for the first 8 weeks of life in infants he studied.

Several researchers have done considerable work comparing the vocalizations of pre-speech hearing with those of pre-speech deaf infants. It was not an easy task to collect the subjects, as infants this young are often not yet diagnosed with hearing impairments. Oller, Eilers, Bull and Carney (1985) are one of the groups that look at this phenomenon:

> "To the extent that a deaf infant vocalizes like a hearing infant, the sounds of both can be assumed to be independent of auditory input. To the extent that the infants systematically differ, the vocalizations of the hearing infant can be assumed to involve imitation or some other forms of adaptation to environmental sounds" (Oller *et al.* 1985:47).

This study also notes that through personal communications with various researchers they have learned that "deaf babies may, in general, produce relatively large proportions of this particular feature [i.e., the glottal stop]. The reason is unclear at this time, but the matter is being explored further" (Oller *et al.*, 1985:57).

Another researcher looking at this problem (Stoel-Gammon, 1988) details the glottal feature's use in both deaf and hearing infants. "In terms of sound classes, glottals predominated [in the untrained speech of hearing-impaired (HI) subjects] ... unlike [the vocalizations] of NH [normal-hearing] subjects in the same age range" (Stoel-Gammon, 1988:303). ... In a study of three HI subjects "... the only phones that appeared in the repertoires of all three subjects were the glottals [h , ʔ] and syllabic [m]" (303).

In terms of place of articulation, Stoel-Gammon (1988) shows that both HI and NH subjects have the glottal phones [h] and [ʔ] in their inventories, but:

> "the two glottal phones tend to represent a larger proportion of consonantal types in the HI samples. ... Studies focusing on proportional occurrence of consonantal *tokens* (rather than types), have [also] shown that glottal phones typically account for a larger proportion of phones in HI babbling samples than in samples of NH subjects" (Stoel-Gammon 1988:306).

The key to Stoel-Gammon's studies (see also Stoel-Gammon & Otomo, 1986) is that the glottal characteristics are visible only in pre-speech-training session infants. Linguistic input with intense speech training seems to give the infant enough information to language-specialize speech.

Another study (Lach *et al.* 1970) followed the phonological development of deaf infants through their first year of a program which emphasized use of residual hearing; this study revealed the same pattern. In the consonant analysis section Lach *et al.* (1970) state that, before training, "glottal stops and breathy /h/-like sounds which occur in early infancy, but not at a linguistic level in English ..." occurred almost 50% of the time (Lach *et al.* 1970:524). "The marked decrease of glottal consonants during the first three months of training appeared to be due both to propioception rapidly giving way to auditory feedback and to the effectiveness of reinforcement procedures" (Lach *et al.* 1970:526).

Because I have mentioned not only cross-linguistic issues in the study, but also data on deaf infant pre-speech vocalization, I must make reference to at least one study done on "normal" hearing children. One study I found

which clearly describes their speech happens to discuss Swedish infants. Holmgren, Lindblom, Aurelius, Jalling, and Zetterstöm (1984) studied eight hearing infants of Swedish parents. Their results show similar findings to those mentioned previously, i.e., "there is an abrupt change around 30 weeks [of age] when glottal attributes decrease dramatically" (Holmgren *et al.* 1984:55). Their study reveals that "the development of motor performance begins with an initial period of glottal ... modulations ..." (Holmgren *et al.* 1984:61).

All of the studies presented above show a predisposition by infants to use glottals in their first attempts at sound production. The glottals are then slowly lost as language-specific sounds begin to appear in their vocalizations as the infants develop. Since language-specific sounds are learned, and if laryngeal features are innate (or predisposed), then perhaps children who have nothing with which to replace them will continue to use them. I present examples of such children in the next section.

5.2 Genie

The best-documented case of a hearing child subjected to extreme social isolation is that of "Genie" (a pseudonym), a child found after years of extreme neglect and isolation. Her case has been documented by linguist

Susan Curtiss (see Curtiss *et al.* 1974; Curtiss 1977; Fromkin *et al.* 1974).

I will not give a detailed description of Genie's life up to her discovery, as this can be found in the previously-mentioned works by Susan Curtiss. The relevant information about her life before being found is that she was isolated from human contact and speech for some 13 years. Her linguistic abilities were negligible when she was first found, but over time and with great assistance from researchers she gained huge strides in her language skills. As her imitative skills improved, her spontaneous speech still lagged behind.

> "Genie can pronounce many sound sequences in imitation which she does not use in spontaneous speech. It is clear that her output is more constrained by her own phonological 'realization' rules than by her inability to articulate the sounds and sound sequences of English. This shows that, even in an abnormal case of language acquisition, one must differentiate between a child's phonological system and phonetic ability" (Curtiss *et al.* 1974:534).

Although this phenomenon is common in hearing children, it is also evident in E.'s speech. Curtiss mentions it to illustrate that the ability to reproduce a sound is not the same as the spontaneous use of a sound; it is important to keep this in mind. Note that this occurs in the speech of E. and Genie, who were both adolescents, just as it does in that of "normal" hearing children learning their first language.

The above quote clearly differentiates between phonologically-induced

"errors" and accurate phonetic vocalizations; both E.'s and Genie's (as discussed in Curtiss, 1977) limitations (due to their phonological systems) are not commensurate with their phonetic abilities. For example, some of the phonological rules discussed for these individuals reveal several variants per phoneme; these reveal phonetic ability, but may not be part of the speaker's phonological system. In E.'s laryngealizations, just as in Genie's glottalizations, there were no consistent rules. Thus, this inconsistency is evidently due to the fact that the data collected for both E. and Genie reflects (the more accurate) imitations as well as the (less accurate) spontaneous utterances.

In her article on deaf children of hearing parents, Susan Goldin-Meadow (1985) gives a detailed report on the children's language. Her emphasis is on the gesture system many deaf children create, apparently as a result of relative language isolation: they are unable to communicate using only vocalizations, and have (as yet) no exposure to a signed language. This created gesture system is commonly referred to as "home-sign". Goldin-Meadow also notes the vocalizations used by these children but qualifies them by saying: "All four deaf children in this study were found to use both vocalizations and gestures to communicate. However, in every instance ... gestures appeared to be the child's primary means for communicating information" (Goldin-Meadow 1985:213). " ... [T]heir few meaningful

vocalizations ... were used only as single, unconnected words ..." (Goldin-Meadow 1985:214). This was also the case in some of E.'s utterances, i.e., he seemed to add them as a courtesy to the hearing receiver. At other times, however, the vocalizations were all the output given.

Goldin-Meadow calculated the distributions of the children's various gestures and vocalizations. "The children varied tremendously on their production of meaningless vocalizations alone (recall that meaningless vocalizations were either unrecognizable sounds spontaneously produced by the child or imitated sounds elicited by the child's caregiver)" (Goldin-Meadow 1985:228). She explains the distribution pattern: "The more meaningless vocalizations alone a child produced, the fewer gestures alone that child produced" (Goldin-Meadow 1985:228).

> "In addition, all of each child's meaningful vocalizations were single words (either nouns, verbs, adjective, or modulators such as *no, yes, uh-oh*). Almost half (43%, 36/82) of all of the meaningful words produced by the four children were accompanied by a gesture, and in 69% (25/36) of those gesture-plus-vocalization sequences, the word conveyed the same meaning as the gesture" (Goldin-Meadow 1985:228).

This evidence suggests that vocalizations had little value in the communication systems of these children. I am not going to make a judgement call on the semantic value of E.'s vocalizations, except to note that he made few gestures alone (ie. gestures were mostly accompanied by a

vocalization), had a fair number of "meaningless vocalizations" (fitting into Goldin-Meadow's category of elicited words), and had mostly one-word utterances. Thus, E.'s overall language production fits into the distribution pattern she found in some of her children. The interesting thing is that her children were 1-5 years old, the older ones often having already begun going to oral schools (schools that teach vocalizing, not sign language). E. was 16 years old at the time of this study, yet, from a phonological stand-point, there are definite similarities with his speech and Goldin-Meadow's children.

> "The ten deaf children we have observed over the course of our two studies share the same two characteristics necessary for inclusion in the studies: (1) each child was congenitally deaf and unable to acquire spoken language naturally even with a hearing aid; (2) each child had not yet been exposed to a conventional sign language" (Goldin-Meadow 1985:239).

And, of course, they are all deaf children of hearing parents.

With regard to Genie, Goldin-Meadow (1985) mentions her lack of a communication system of her own at the time of her discovery at the age of 13.5 years (Goldin-Meadow 1985:241). Her speech did, however, improve during her exposure to spoken English.

> "However, Genie did not succeed in acquiring all of the properties of spoken English even after she was exposed to linguistic input. Rather, she acquired many of the same

> language properties we have found in the deaf child's spontaneous gesture systems (e.g., ordering rules, recursion); that is, she acquired some of the properties of language which we have called resilient. ... Further, even after intervention, Genie failed to develop certain properties of English (e.g., the auxiliary, movement rules). These properties of language were also found to be absent from the deaf child's gesture system. Thus, these properties do indeed appear to be fragile - properties of language whose development appears to require the conditions under which language is typically learned" (Goldin-Meadow 1985:241-2).

As mentioned earlier, my study does not look at the semantic and syntactic values of E.'s utterances, but I feel this point should at least be mentioned in order to understand the similarities between Genie and the language of deaf children of hearing parents (including E.).

Susan Goldin-Meadow also mentions a hearing child named Jim (discussed in Sachs, Bard, & Johnson, 1981; Sachs & Johnson, 1976) "whose deaf parents exposed him neither to conventional oral nor to conventional manual linguistic input ..." (Goldin-Meadow 1985:242). This child was found to have developed "many of the resilient properties of language ..., but was not observed to develop the fragile properties" (Goldin-Meadow 1985:242). In summation Goldin-Meadow looks at the possible impact of findings from research with children who were subjected to these various forms of linguistic isolation:

> "An entire spectrum of severity of language learning

> deprivations might eventually be established in this manner, environments which would empirically define a spectrum of language properties running from the most resilient (developed virtually everywhere) to the most fragile (needing the most finely tuned support to find expression)" (Goldin-Meadow 1985:242).

First, the terms "resilient" and "fragile" need to be elaborated. Susan Goldin-Meadow uses these terms to describe different types of language properties: those which are found in an individual's language without further reinforcement, and those which need to be supported in order to be learned or maintained.[26] This terminology overlaps somewhat with the use of the term 'language universals'. Of those aspects of language which are innate, some will not be maintained without reinforcement while others will. Learned features are also discussed within this paradigm, but I am concentrating only on the innate aspects, in particular the phonological aspects. The "resilience" of [+low] features is proved to be minimal once they are dropped for language-specific phonological forms, even though they are apparently innately universal. They are not resilient, and so disappear once individuals replace them with the particular phones of their language's

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26 Although these terms are sometimes confused with 'universal' terms such as *innate* and *learned*, they cannot be assessed as parallel to these terms. Innate features, to my mind, are either resilient or fragile. Learned features appear later in the language acquisition paradigm and can also be either resilient or fragile.

phonology.[27]

I contend that, if there are universal syntactic features of language, then there could also be universal phonological features. Of these, some are therefore "resilient", others "fragile". The results I found look phonetic, i.e., not rule-based, but perhaps conventional phonological rules do not reveal a pattern that is, nonetheless, present. Perhaps these features are remnants which have slowly been trained out of the language systems of these groups (i.e., fragile features being replaced), but have remained in certain individual words, rather than in predictable phonological environments.[28]

In several works written about Genie, the use of laryngeal/glottal sounds is documented. For instance, Fromkin *et al.* (1974:89) mentions Genie's "laryngeal mechanisms". As well, Curtiss discusses the general qualities of Genie's speech in her book (Curtiss 1977). Curtiss explains the qualities in the following paragraph:

> "A few comments about Genie's spontaneous speech are in order. Genie's voice quality is abnormal. Although her vocal control is improving and normalizing, untrained people often

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27 This lack of resiliency follows from the feature geometry which plays an active role in phonological acquisition. This belief is further substantiated by Brown & Matthews (1993).

28 Just as in morphology of English analogical regularization processes have gradually regularized the past tense of most English verbs, except in certain individual words (i.e. some of the most common verbs) like *sleep - slept*.

> remark that she sounds like a deaf or cerebral-palsied individual. Comments from trained speech pathologists suggest that she sounds like a child with cerebral palsy and not like a person who is deaf. Regardless, there are abnormal aspects to her speech that color almost all of her spontaneous output, segmental and nonsegmental, and make the use of traditional IPA symbols inexact. Her vowels are generally laxed and centralized; her off-glides, too, are laxed and centralized. *During the first year (1971) her speech was highly glottalized - probably due to her inability to control laryngeal mechanisms.* [italics mine] Her average fundamental frequency is still abnormally high, her output very breathy, so breathy that she often speaks in something like a whisper. In contrast, every once in a while she utters a word "creaky-voiced". All of these distortions make transcriptions only approximations to her speech" (Curtiss 1977:62).

In a personal communication with Susan Curtiss I questioned her about Genie's use of glottals; she responded that glottal stops occurred phonetically, not phonologically (ie., were not systematic) in Genie's speech. Curtiss had, at first, thought that there was consistency, but by the time Genie's phonological rules were recorded with accuracy, the consistency was not evident. I explained my intuitive sense about the glottal's existence in isolated individuals' speech, and Curtiss replied that "there is something to having the body know there is a speech state, and that it is there, at the glottis. Breath meets the vocal tract there first, so if language is innate, humans would produce glottals as an initial expression of speech" (p.c. Tues, June 13, 1995).

Note that glottals consistently appear in E.'s speech, the speech of Genie, and the pre-speech vocalization of infants. All of this evidence

combines to implicate glottals as either anatomically primary and/or pre-programmed for human speech.

5.3 Feature Geometry

The two laryngealization processes used by E. are crucially different in an interesting way (see section 4.1.4): the rule which changes velars to uvulars or pharyngeals is an obligatory rule; velars never surface. Thus it seems that E. has made an incorrect interpretation about how velars are represented; he has chosen to give them a representation which involves [+RTR] instead of one which contains a supralaryngeal dorsal node. The second rule is an optional rule which changes coronals to glottal stops. In most feature geometries coronal is the underspecified place of articulation, and it may be that E. optionally interprets a supralaryngeal node with no associated place features as a segment which lacks a supralaryngeal node. Thus, the velar/pharyngeal rule is obligatory and the glottal stop rule is optional; and the former involves deletion of other parts of the feature geometry, while the latter involves E.'s unique representation for a segment. However, these rules are also both similar in that they show that for E. laryngeal segments are more accessible or simpler.

Stemberger's 1993 article 'Glottal Transparency' uses "the speech of three children learning English" (Stemberger 1993:107) to assess the occurrence of glottals during first language acquisition. He eventually concludes that the children's lavish "glottal participation turns out to be natural for phonetic reasons" (Stemberger 1993:109).

Stemberger (1993:111) also notes that:

> "Goldsmith (1990:286) talks about glottals as having a 'default place of articulation', suggesting a possible analysis where [Glottal] is substituted for all other articulator nodes, possibly because glottals are relatively unmarked or easy to articulate".

Consequently, Stemberger (1993:107) proposes that glottals are "underspecified for both consonant and vowel place of articulation features". Accordingly, underlying glottals would completely lack any place of articulation features. Subsequently a late default rule would fill in a feature such as [Glottal] or [Laryngeal] for any segments which were without place of articulation features. Thus, when E. uses his default consonants ([ʔ], [ʕ]) in place of other phonemes,[29] he is producing consonants which have lost all their supralaryngeal features, leaving only laryngeal features.

As for a child's use of glottals in environments where an adult does

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29 For example, when glottal stop occurs in place of the final dental stop in the word *pared* 'wall'.

not, Stemberger postulates: "The child's process can be used to assess basic phonological properties of glottals, with less contamination from learning and perceptual factors than in adult grammars" (Stemberger 1993:112). Stemberger also makes the same connection with this feature and Universal Grammar; he discusses the child's syntactic output as a combination of Universal Grammar and language-particular input, and continues: the "child's early phonology can be viewed in a similar fashion" (Stemberger 1993:132). Although the work of Goldsmith (as quoted above by Stemberger) and others (based on analyses of many of the world's languages) has previously proposed that [Glottal] could be used to represent a default place of articulation, the data and conclusions in this article provide additional evidence from child language acquisition.

As seen in the previous chapters, there are certain phonological alterations that E. makes which are not features of deaf speech or Mexico City Spanish. These are glottalization of coronals and pharyngealization of velars. How can we explain this?

The glottal stop and the pharyngeal voiced fricative ([ʔ], [ʕ]) are two unique features of E.'s speech (see discussion in sections 3.1.4, 3.1.5, 3.1.10, 3.1.13, 3.1.15, 3.1.17, 4.1.3, 4.1.4). They share the feature [+ low]; in articulatory terms, both sounds occur at the lower periphery/boundary of the vocal tract. It is well known that the sounds at the other periphery of the vocal tract (i.e.

at the lips) are universally common and are also sounds that are commonly produced by children during pre-speech stages. One of the obvious reasons for labial use (which does not apply to low consonants) is the visibility of the lips; in other words, their use is evident to babies, and, thus, easily duplicated. However, I hypothesize that low consonants (ie. those produced at the lowest points of the vocal tract) may also be universal and innate, and preprogrammed on the basis of anatomy. An egressive airstream would hit these areas of the vocal tract first; if speech sound production is built-in, it follows that this might be one of the first places of articulation to be tried out. Once visual feedback begins to be processed, labial sounds would become more common.

The use of [+ low] sounds as an instinctive attempt at speech can be very easily described by a feature geometry tree. Halle and other generative phonologists have developed a feature tree model which makes a strong case for an anatomical justification of my hypothesis. Kenstowicz (1994:452) and others refer to this as the "Halle-Sagey Articulator Model of feature geometry". This model "recognizes six articulators" (Kenstowicz 199:139) which are distributed on a tree showing hierarchical relationships among features.

The analysis of processes in this section is based on the most recent version of the Halle-Sagey feature tree.

> This model "simultaneously reflects two distinct aspects of features: the anatomical mechanism by which they are phonetically implemented, and the fact that they function as units in rules. This convergence ... suggests that all functional feature groupings have an anatomical basis" (Halle 1995:2).

Although independently created to describe universally common processes in many languages, the feature tree also makes it possible to simply and elegantly describe two extremely common processes in E.'s speech. The fact that this independently-created phonological system of description operates as it does strengthens our argument for a universal, anatomical predisposition to produce laryngeal sounds.

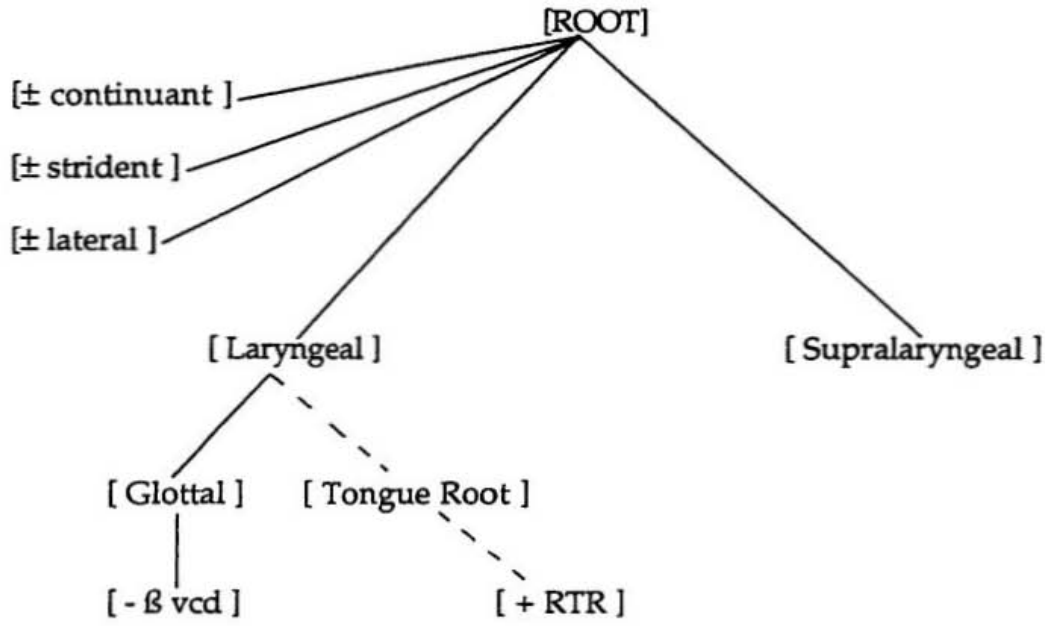
The issue of accurately labelling features often creates varying models; Halle based his most recent version of the laryngeal branch on studies of results from X-rays of articulators, acoustic analyses, and various other tests. Halle (1995:17) concludes from the results of these researches that:

> "... both the uvulars and the pharyngeals are produced with a major constriction in the lower pharynx; they differ in this respect from [h /], which lack this constriction. I shall use the feature [retracted tongue root] ([RTR]) to distinguish laryngeal [h ʔ] from pharyngeal [h ʕ]. This is reflected formally in ... :
>
> Pharyngeals and uvulars are [+ RTR]; [glottals] are [- RTR]."

Thus, [RTR] is the feature which is used to distinguish between these

laryngeal pairs, as is evident in my feature tree analysis of E.'s glottalization and pharyngealization.

5.3.1 V.O.T. and Lowering Process

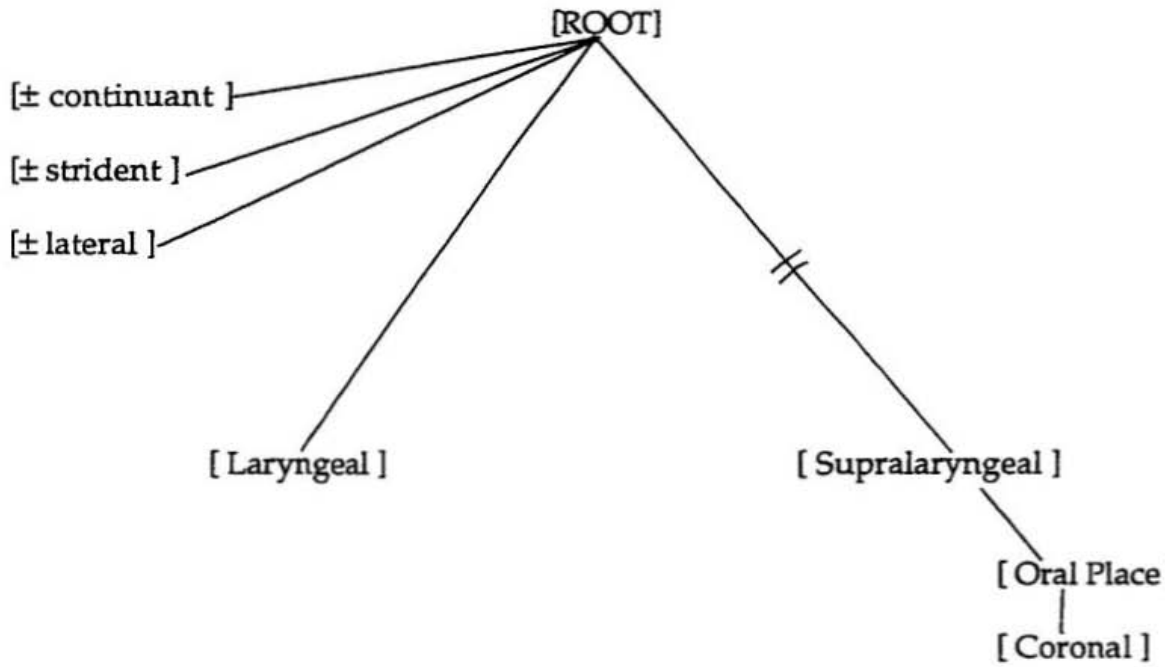


This process deletes all supralaryngeal features (including, of course, all place of articulation features)[30] and simultaneously switches voicing. At the same time the [Laryngeal] node may optionally acquire the feature [+RTR], which is

30 If no other changes occur, this results in a glottal stop by a late default rule.

characteristic of pharyngeals.[31] Hence this process describes the simultaneous alteration of V.O.T. and place of articulation in E.'s speech. (See Section 4.1.4 for the traditional SPE formulation of this rule.)

5.3.2 Glottalization



This process is both simpler and more general than the previous one, in that E. is choosing a representation which involves less structure and, in this sense, it is a 'simpler' sound. While it applies only to coronals, the process is

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[31] This will yield the voiced pharyngeal fricative which E. produces.

far-reaching in that it completely delinks all supralaryngeal features. As in the previous process, a subsequent late default rule results in a glottal stop. This feature tree diagram can quite simply produce the same result as the more complex traditional rule shown in chapter 4, section 4.1.5.

Along with providing a better analysis of E.'s system than a standard generative account, these data also provide a good argument for feature geometries. By using them in this analysis, feature geometries allow us 1) to show how these two rules are related (i.e., they both require the presence of the [laryngeal] feature; and 2) to show that [laryngeal] is less embedded in the geometry, and therefore earlier acquired (and more pervasive in E.'s case) than specific supralaryngeal features. This analysis of E.'s use of laryngeals also makes a strong case for their 'resiliency'.

Chapter Six

6.0 Conclusion

The [Laryngeal] features of glottalization and pharyngealization consistently displayed in E.'s speech are not normally features of Mexico City Spanish, nor are they misarticulations found in deaf speech. Yet laryngeal alterations can be found in the vocalizations of pre-speech infants, who lose this feature unless deaf, in which case it is retained until a language model is taught. Genie also had abnormal laryngealizations when first discovered, but once presented with a language model she lost this feature over a short period of time. Also, on an interesting note, my most recent communication with E., which was almost a year after he had received hearing aid devices revealed a significant reduction in laryngeal abnormalities in his speech. I was unable to do any formal analysis, so this result has not been mentioned in the body of this work.

E.'s lack of language training has allowed for retention of certain features in his speech which can not be accounted for simply by factoring in his deafness. His isolation, involving only a lack of linguistic contact (rather than the additional psychological trauma and neglect documented for Genie) could explain the unique variables in his speech.

All these discoveries point to the innate quality of laryngeal sounds in humans. This feature does not appear to be "resilient" so that it is quickly replaced or masked by supralaryngeal features once a language model is introduced. But in those who have little or no linguistic input, the feature[Laryngeal] remains dominant.

6.1 Final Summary

This thesis has been a discussion of some of the universal and innate features of phonology. In particular, it has looked at the speech of E., a deaf teenage Mexican immigrant who had no formal education and no access to a language which he could use as his first language. His speech, though difficult to analyze or understand contained strong laryngeal features which could not be explained through language-specific rules.

In Chapter Two I reviewed the model of Mexico City Spanish (see Canfield, 1981; Cressey, 1978; Perissinotto, 1975) provided by *la familia*; and to which E. would have been exposed. In Chapter Three, I described the phonological system of E.'s speech, and compared it to the Mexican Spanish system presented in the preceding chapter. I then compared his speech to that of deaf speakers (Chapter Four), in particular to children enrolled in a school that teaches speech to children with varying degrees of hearing loss

(see Hudgins & Numbers, 1942).

In Chapter Five any remaining anomalies were compared to the vocalizations of pre-speech infants and to the phonology of Genie (provided by Curtiss (1977) and Curtiss (p.c.)).

The feature [Laryngeal] did show up in the literature on pre-speech infant speech sounds (see Ingram, 1989; Oller *et al.*, 1985; Stoel-Gammon, 1988; Lach *et al.*, 1970). Thus, the laryngeal features in E.'s speech also occurred as the first sounds produced by children before they develop language-specific phonological systems.

The unique case of Genie, the isolated, traumatized child who was eventually taught to speak, revealed that her initial vocalizations were also very laryngeal, but that this feature was quickly lost as her speech improved (see Curtiss *et al.*, 1974; Curtiss, 1977; Curtiss (p.c.)). Use of this information has revealed that both she and E. shared the common experience of isolation from society through an inability to communicate, which manifested itself in a language form devoid of learned rules and structures, thus revealing a base of universal features.

The opportunity to learn any language i.e., signed or spoken, was not available to E., and so he grew up in a form of social isolation which only removed him from any communication with most of the individuals in his life. Unlike Genie, E. did not, according to his own accounts, suffer any great

hardships or abuse.

The feature [Laryngeal] was revealed as a common one in the speech of isolated individuals. Its simple physiological production, i.e., at the source of breath and voice, logically displayed a universal, innate aspect of human language.

The thesis presents the hypothesis that laryngealization is an innate, universal quality of human speech, which is justified, in part, by human physiology. The independently-created phonological descriptions of feature geometry also support this view.

The thesis proposes that the use of laryngeals is universal and constant until a language model is available to replace them with language-specific phonological features. If this does not occur during "normal" language acquisition stages, then the features remain until such a time as they are finally supplanted. This is a universal feature of language acquisition at the phonological level.

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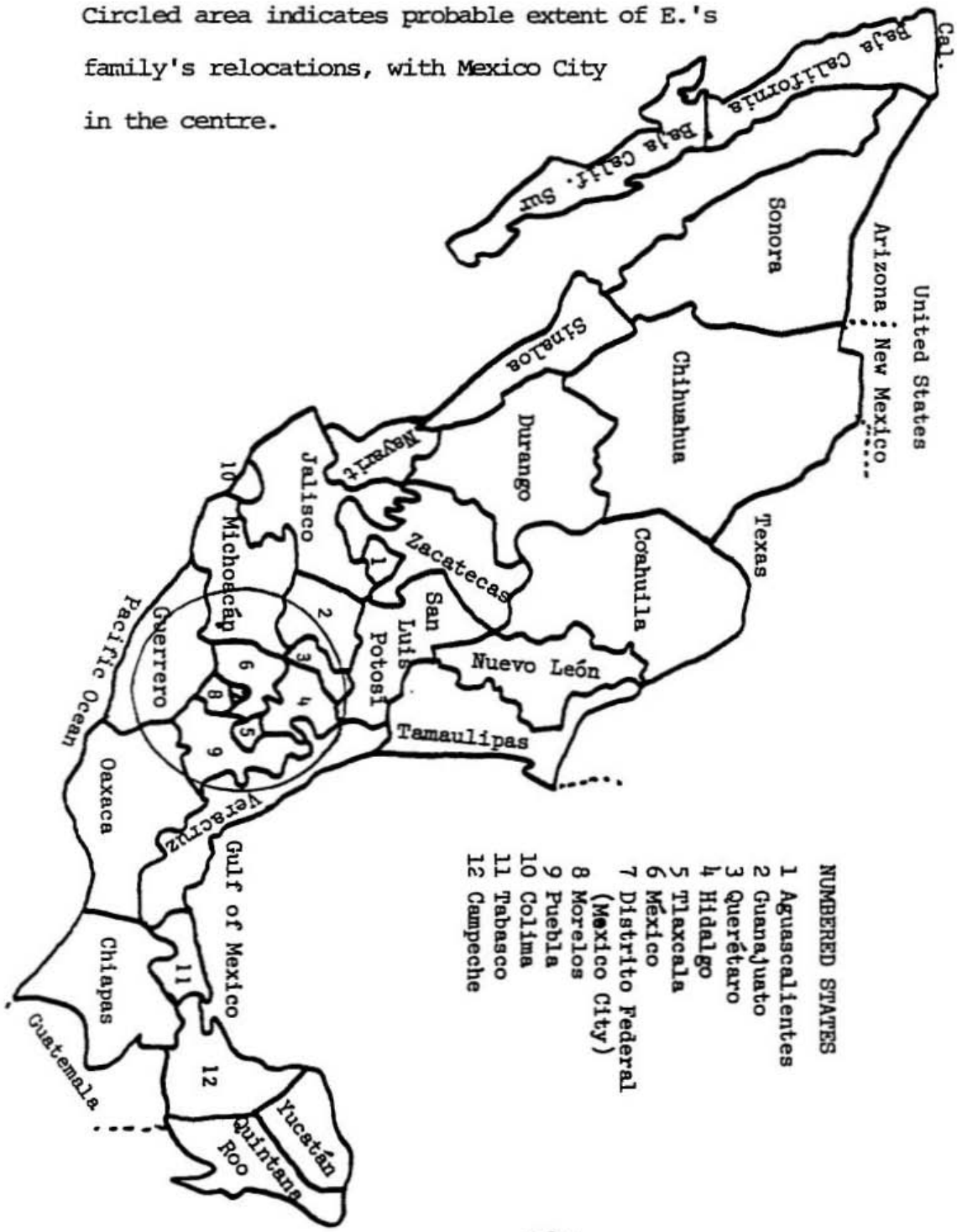
APPENDIX A

Circled area indicates probable extent of E.'s family's relocations, with Mexico City in the centre.



NUMBERED STATES

Appendix B: Conversation of April, 1992

(E. and *La Familia* and Researchers)

Speakers: Grandmother, Rafael, and E.

Setting: Living room in Grandmother's apartment

Two researchers operating camera and listening

Conversation: Grandmother and Rafael ask E. questions and correct his speech

E. makes no spontaneous utterances

All words spoken by E. have previously been used by either Grandmother or Rafael (except for the number '5')

This list includes words which E. attempted more than once. This was due to prompting from his Grandmother to correct his articulation. She would repeat the word, loudly, and he would try again. Only with one word ('Canada') did he correct himself during his second attempt at it. I have noted this by not repeating the gloss.

I have chosen not to string E.'s utterances together in some attempt at demarkating clauses as I have with his family members where I used their

pauses as natural ends. The reason I have given virtually every word its own line is that E. pauses after almost every word, making phonological decisions about environments beyond the word haphazard. The pauses are long enough that it would appear that only the segments combined on each line affect one another.

His third usage of *cinco* 'five' was spoken while simultaneously signing it (holding up five fingers), so the meaning of this word was clear, despite the loss of the second syllable /síŋko/ › [sĩ] , and I have kept it in the list of intelligible words.

E.'s Speech	Dialect	Spanish	Gloss
[mɑ:ẽɾa]- [mɑ:ɬẽɾa]	[marléna]	*Marlena*	'Marlena'
[ɬɑ̃ɬo]	[lálo]	*Lalo*	'Lalo'
[t̪óra]- [t̪óð̪a]	[t̪óða]	*toda*	'all'
[papa]	[papá]	*papá*	'Dad'
[māma]	[mamá]	*mamá*	'Mom'
[sĩʔo]-[sĩqo]-[sĩ]	[sĩŋko]	*cinco*	'five'
[aʔí]	[akí]	*aquí*	'here'
[qɑ́ɒ́ɑ̀ɒa]	[kanad̪á]	*Canadá*	'Canada'
[qɑ̃n]			
[qɑ́ná]			
[qɑ̃nɑ̃ð̪a]			
[ké]	[ké]	*que*	'that'
[mánoθ]	[mános]	*manos*	'hands'
[ɛsqwéɬa]	[eskwéla]	*escuela*	'school'
[jõ]	[j̪͡j̪ó]	*yo*	'I'

[abɬɑ́ɹ]	[aβlár]	*hablar*	'to speak'
[aɬa]	[ala]	*a la*	'to the'
[d̪oɹˢmˢʔíɹ]	[d̪ormír]	*dormir*	'to sleep'
[ɑ́ɢwa]	[áɣwa]	*agua*	'water'
[t̪ó𝼈o]	[t̪óðo]	*todo*	'all'
[pɬɑ́t̪o]	[plát̪o]	*plato*	'plate'
[ɹégɬo]	[réɣlo]	*reglo*	'ruler'

Appendix C: Word List Reading Session of June, 1992
(E. and Researcher)

These words were taken from the workbook E. used in his studies with his aunt. (She had started working with him on spelling.) I chose to use these words for a word list as I knew that he would recognize them. I wrote them out and asked him to read them each three times. The variants are results of phonetic alternates within the repetitions. I have added a column containing the pronunciation of each word based on the Mexico City phonology work in Chapter Two so that those unfamiliar with a hearing speaker's pronunciation may find it easier to follow the variations in E.'s speech.

E.'s Speech	Dialect	Spanish	Gloss
[óʕo]	[óxo]	*ojo*	'eye'
[nəɹˤʔís]	[narís]	*nariz*	'nose'
[βóqə]	[bóka]	*boca*	'mouth'
[ɬəβioʃ]	[láβjos]	*labios*	'lips'
[oɹéqə]	[oréxa]	*oreja*	'ear'
[péɬo]	[pélo]	*pelo*	'hair'
[məɬo]	[máno]	*mano*	'hand'
[d̪ed̪o]	[d̪éðo]	*dedo*	'finger'
[pjeɹʔə]	[pjérna]	*pierna*	'leg'
[pjé]	[pjé]	*pie*	'foot'
[sapáṯo]	[sapáṯo]	*zapato*	'shoe'
[qəmisə]	[kamísa]	*camisa*	'shirt'
[pãṯɑɬõɬeʃ]	[pan̪talónes]	*pantalones*	'trousers'
[meʃə]~[meʃɑ]	[mésa]	*mesa*	'table'

[sijõʔ]	[síʝõn]	*sillon*	'(arm)chair'
[paɬéʔ]	[paréð]	*pared*	'wall'
[t̪eɬeβiziód̪]~ [t̪eɬeβizióʔ]	[t̪eleβizjón]	*televisión*	'television'
[boɬʃɑ̃]	[bólsa]	*bolsa*	'purse, bag'
[t̪eɬéfõno]~ [t̪eɬéfõʔo]	[teléɸono]	*teléfono*	'telephone'
[qɑ́mɑ]	[káma]	*cama*	'bed'
[pwéɬt̪a]~[pwét̪a]	[pwért̪a]	*puerta*	'door'
[qɑ́ʃɑ]	[káxa]	*caja*	'box'
[qobíʃɑ]	[koβíxa]	*cobija*	'blanket'
[sẽ̪ɹɑɬ]~[sẽ̪ɹɑʔ]~ [ʰẽ̪ɹɑʔ]	[sẽn̪t̪rál]	*central*	'central'
[páɬo]	[pálo]	*palo*	'stick, wood'
[qaɹo]	[káro]	*carro*	'car'
[qat̪o]	[gát̪o]	*gato*	'cat'
[tsiqoɬo]	[sírkulo]	*circulo*	'circle'
[t̪ɹiɑ̃gulo]	[t̪riãŋgulo]	*triangulo*	'triangle'
[qwat̪ɹo]	[kwád̪ro]	*cuadro*	'square'

IMAGE EVALUATION
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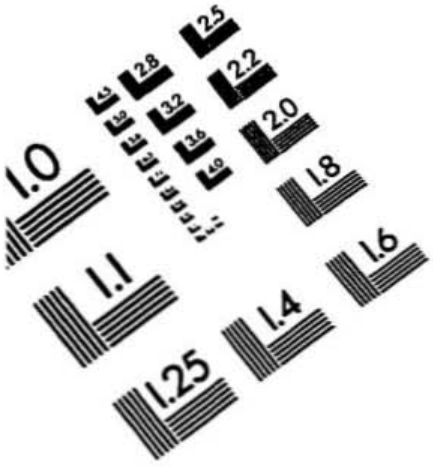

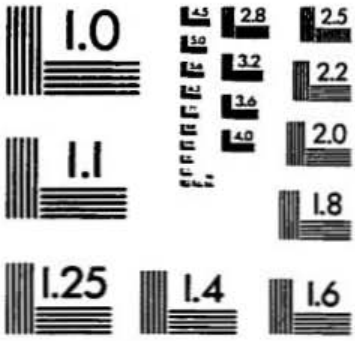

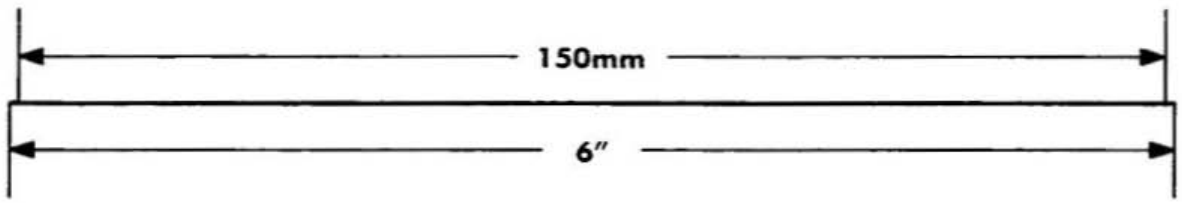

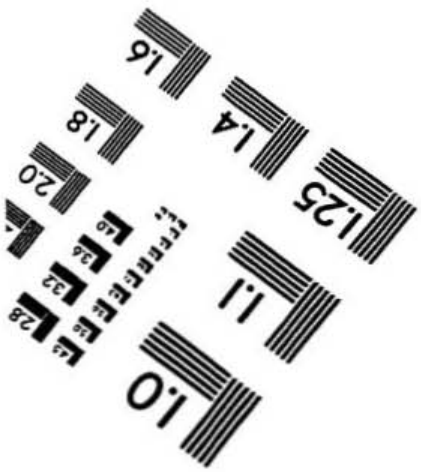

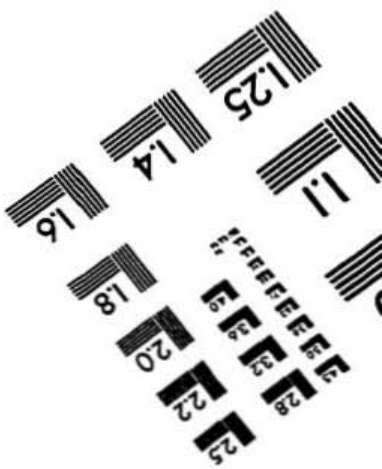

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