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Phonological Development in Hearing Children of Deaf Parents

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ABSTRACT

The researcher wishes to determine the significance of a unique linguistic environment on the effects of phonological development. The research examines whether 3 hearing children of deaf parents, hereafter referred to as CODAs, have inconsistencies, as compared to children in a typical linguistic environment, in their syllable structure, phonological processes or phonemic inventories. More specifically, the research asks whether their speech is more consistent with children of typical environments or more similar to children with phonological delays or disorders or articulation disorders. After the examination of these three components to a child's phonological development, it can be concluded that the linguistic environment of CODA children does not negatively hinder their phonological language development.

INTRODUCTION

The language development of hearing children of deaf parents (CODAs) has long been a topic of research for investigators. These children develop speech and language in an atypical linguistic environment. It is important for research to determine whether this environment is detrimental to the child's development as they may be lacking important language cues and information.

Some previous researchers have determined that this atypical linguistic environment does affect the language development of CODAs. A Schiff and Ventry (1976) study found that 21% of the 52 children of deaf parents in the study had speech and/or language problems. These problems included articulation problems, language problems, or deviant speech production (Schiff & Ventry, 1976). In addition, Murphy and Slorach (1983) studied 6 pre-preschool age

children and found that all 6 had deviant speech development. The researchers attributed these findings to the children's exposure to two completely different language systems (Murphy & Slorach, 1983). A case study by Sachs, Bard and Johnson (1981) of language deficits in 2 brothers concluded that these deficits in children of deaf parents were due to poor linguistic input, as their only opportunities to acquire spoken language occurred from the television.

In contrast, a Schiff-Myers and Klein (1985) study examined 5 hearing children of deaf parents and noted that these children had no characteristics of deaf voice as well as no atypical speech productions like their mothers'. Similarly, other studies have argued for no detrimental effect on language development for CODAs.

The current study examines detailed aspects of phonological development to provide an in-depth analysis of specific characteristics of 3 children's language acquisition. It also takes into account the changes in a child's development over time by analyzing the children's phonological development over a 12 month period.

LITERATURE REVIEW

i. Children of Deaf Adults

It is estimated that only 4.4% of children born to deaf parents are also deaf, meaning that over 90% percent of the children born to deaf parents are hearing (Mitchell & Karchmer, 2004). Children of deaf adults often times acquire both American Sign Language (ASL) and English simultaneously, also known as bimodal bilingualism. Many CODAs often learn sign language as their first language. In some cases, these children will use in their speech aspects of language that are characteristic of sign language but not English. For example, ASL expresses tense lexically through temporal adverbs while English uses verb inflection (Bishop, 2006). CODA children

might take the same approach to their spoken English for a period of time. Previous research has examined aspects of the language of CODA children, including the grammatical structure of their sign language and their spoken language, their use of both languages together, and the input provided by their parents. Some of these studies are briefly reviewed in the next subsection.

ii. Bimodal Bilingualism

Van den Bogaerde (2005) examined the mixed language input of three deaf mothers and their three deaf and three hearing children up to 3 years of age. All of the children, starting before their first birthday, were filmed at home in sessions lasting 20 to 30 minutes in which the mother and child played together. Van den Bogaerde analyzed the code-blended or simultaneous signed and spoken, utterances. The utterances were analyzed for their use of lexical insertion, alternation and congruent lexicalization. Lexical insertion is defined as using lexical information from one language and inserting it into the structure of another language. Alternation is alternating between the structures of two languages, and congruent lexicalization is defined as lexical material from both languages is mixed in a structure that is shared between the two languages. The process of congruent lexicalization occurred the most frequently with only some lexical insertion. Overall, the researchers concluded that the deaf children produced very few utterances which could be labeled as code-mixing. All 3 hearing children in the study used more code-blended utterances than their mother's or the deaf children in the study. Lexical insertion occurred the most among the hearing children of the deaf mothers. Researchers also found that the hearing children follow the code-mixing in their input from their deaf mothers.

This study focused on the code-blended mixed utterances of deaf mothers and their deaf and hearing children, however, the languages in which these children spoke was Dutch and

NGT (Sign Language of the Netherlands). Although this data is useful in determining the effects of learning two languages in two different modalities, it is necessary to note that there may be some differences when comparing English and ASL versus Dutch and NGT.

Pettito (2001) examined 6 children, 3 acquiring French and LSQ (sign language of Quebec) and 3 children acquiring French and English. The study found that none of these children were delayed in achieving specific language milestones in both of the languages they were acquiring. LSQ-French children used language-mixing, defined as using one element of one language with an element of another language, as well as what the researchers labeled as simultaneous mixing where a child producing a sign and a French word at the same time. The examiners also concluded that the amount of language-mixing that a child used was dependent on the amount of language mixing that their parent used. It was also found that the language preference of the child was determined by the language of the primary sociolinguistic group. This group was defined by the researcher as the language of the group or person with which the child had the strongest bond or most contact with.

Pettito's (2001) study reinforced the hypothesis that children acquiring 2 languages are not at a disadvantage for achieving the proper milestones in language development. Both languages were acquired successfully by all the children in the study.

iii. Typical Phonological Development

Although it is difficult to assess phonology in young children, it is important to get as accurate of an assessment as possible. Stoel-Gammon and Stone (1991) focused on the phonological assessment of children around 24 months of age. They were interested in both the relation between phonological assessment and language level as well as assessment procedures and clinical decision making. It is important to compare the development of phonology to

overall language development as different phonological abilities are expected as children increase their vocabulary and word combination skills. The researchers emphasized the importance of both independent and relational analysis. It is significant to note that an analysis changes when dealing with a 24 month old with a vocabulary of fewer than 50 words. Stoel-Gammon and Stone (1991) stress that with a child with limited production, it is more important to determine their phonetic inventory rather than specific phonological processes. In terms of clinical decision making, it is necessary to establish if a children falls within normal expectations. For children around 24 months of age, the following targets should be met:

- Produce words of form CV, CVC, CVCV, and CVCVC
- Produce a few consonant clusters in word initial and potentially 1 or 2 in word final position
- Produce 9 or 10 different consonantal phones in word initial position, including those from the classes of stops, nasals, fricatives and glides
- Produce between 5 or 6 different consonantal phones in word final position which are mostly stops with some from nasal, fricative, and liquid classes
- Match the consonant phonemes of the adult word at 70% correct

By 36 months of age, the child should have far fewer phonological processes, although some may still be present, including final consonant deletion and velar fronting. Although their speech may not be fully adult-like, it should include the basic distinctions of the adult system. Atypical patterns of children at any age include substitution patterns that are not observed in typically developing children such as initial consonant deletion (Stoel-Gammon & Stone, 1991).

In general, this research article creates a strong foundation as to the typical phonological development of children specifically around the age of 24 months, and up to 36 months. Two of

the three CODA children currently being studied had videotaped sessions by 24 months of age, and the third began only at 36 months of age. Thus, the work by Stoel-Gammon and Stone creates important guidelines to determine whether these 3 children have speech which is considered typical despite their atypical linguistic environment.

In addition, Watson and Scukanec (1997) studied 12 children, 11 girls and 1 boy, longitudinally from 24 to 36 months of age at 3 month intervals to examine the phonological abilities of 2 year olds. It was found that word-initial phonetic inventories increased from 11 consonants at age 2 to 17 at age 3. Their study was consistent with the finding of Stoel-Gammon's 1987 study. In regards to consonant cluster production, as the subjects aged, the production of CVC, CCVC and CVCC increased. The production of phonological processes was found to be dependent on the children's' phonetic inventories which was expected. These results were also consistent with Stoel-Gammon's (1997) findings.

Watson and Scukanec's (1997) study reinforced Stoel-Gammon and Stone's (1991) study which is important for securing the validity of their findings. I feel confident in using these guidelines as they have been confirmed by multiple researchers.

iv. Phonological Delays in Hearing Children

According to the American Speech-Language-Hearing Association ("Speech Sound Disorders, n.d.) speech errors are common in many young children as they begin to acquire language. For example, typically-developing children produce weak syllable deletion, such as saying "nana" instead of banana; or cluster reduction, saying "poon" for spoon (Bowen, 1998; see Appendix A). The phonological processes that are typically present at 24 months of age include final consonant deletion, cluster reduction, fronting of velars, stopping, gliding, and

context sensitive voicing. Reduplication and consonant harmony are processes that should be declining. At 36 months of age, cluster reduction and gliding are the most present phonological processes. Declining processes should include final consonant deletion, prevocalic voicing, and vowel changes. The warning signs of impairment include frequent vowel errors, deletion of initial consonants, and final consonant deletion that is still present as the child nears the age of 3 (Mcleod & Bleile, 2003). By 36 months, most phonological processing errors should have disappeared. If these errors occur past the expected age of development then the child may have an articulation or phonological disorder. Difficulty making sounds, such as substituting, leaving off, adding or distorting sounds, is classified as an articulation disorder. A phonological disorder is described as making patterns of sound errors ("Speech Sound Disorders," n.d.).

The definitions of both articulation and phonological disorders and delays are important for identifying the speech of the 3 children in the study. In addition, Bowen's description of phonological processes is important for the analyses of these processes in determining how closely these children relate to children in typical linguistic environments.

v. Language delays evident in CODA children

Some literature has found delays in CODAs acquisition of spoken language due to the unique linguistic environment of these children. In a case study by Sachs, Bard, and Johnson (1981) which examined the speech and language of 2 CODA children, they found that both children had delayed spoken development. In particular, Jim, at 3 years; 9 months was found to have a severe articulation problem (Sachs et al., 1981).

Schiff and Ventry (1976) found that 21% of the 52 children studied were considered to be developing speech and language atypically. Their results showed that compared to the general

population, speech and language problems, which included defective articulation, deviant stress and intonation patterns, and fluency problems, were more prevalent in these children. As a result, it was concluded that there seems to be a higher percentage of communication problems in the population of children of Deaf parents. It is important to note that with this study there seemed to be no correlation between the amount of time spent with hearing adults and the speech and language problems found with these children. The study failed to pinpoint why these children of deaf parents have communication problems. Also the study did not observe the children in their natural environment, but instead with both a formal portion and an informal play portion with the examiner. This variable could have affected the results of Schiff and Ventry's study as the child may not have been as comfortable with the examiner (Schiff & Ventry, 1976).

vi. Language delays not evident in CODA children

A study by Schiff (1979) which focused on the language development of five 2 year old children of deaf parents found that oral language was similar to that of children who came from homes of hearing parents. Although the study did not focus specifically on the phonological development of these children, Schiff found that one of the children had developed the stress patterns and articulation of deaf speech. As a result of this finding, Schiff hypothesized that imitation of deaf speech had a negative effect on the child's phonological acquisition (Schiff, 1979).

Motivated by her findings in the previous research, Schiff-Myers and Klein (1985) examined the phonological characteristics of 5 CODAs to see if they were similar to those of normal-hearing children. Their research found that although the children did imitate their mothers' speech, they rarely imitated the atypical productions of that speech. Although

phonological processes were present in all 5 children's speech, these simplifications were not atypical of any child at this age (Schiff-Myers & Klein, 1985). Although Schiff-Myers & Klein (1985) analyzed the phonological processes of CODA children, the researchers only examined one taping session for each child. In addition, there was one child (Ron) whose results were somewhat atypical of the other 4 children in the study. Schiff-Myers and Klein were unable to pinpoint the exact reason as to why this was.

Brejle (1971) studied 56 children of deaf adults and found that their receptive vocabulary was the same as the general population while their articulation was above average (Brejle, 1971 as cited in Schiff-Myers, 1988). Similarly, a study by Mayberry (1976) of 8 first born hearing children of deaf parents found that exposure to oral language outside the home along with their parents structured communication system at home was adequate enough for the child to acquire oral language (Mayberry, 1976 as cited in Schiff-Myers, 1988).

METHODS

This study examined the phonological development of three CODA children between the ages of 2 years to 3-1/2. The videotapes used were part of a larger study being conducted at Gallaudet University and the University of Connecticut (Chen Pichler et al, in press). Their study is examining the bimodal bilingual development of children of deaf adults. Children involved in the study were videotaped in naturalistic settings in two different environments; in communication with deaf adults, or ASL target, and in communication with hearing adults, or English target. Videotaped sessions were filmed weekly from 18 months to 4;06 (years, months) of age.

For this study, the videotapes with the children in communication with hearing adults were utilized as English communication was the main focus. Three children were selected from the larger study: Lex, Ben, and Tom. These children were selected based on the availability of finished transcripts. Videotapes were previously transcribed using trained transcribers of English language. Videotaped sessions at approximately 24, 30, 36, and 42 months of age were analyzed (see Table 1).

Table 1. Ages of the participants in this study (years; months)

BEN	1;11		2;06	3;00		
TOM	2;00-2;02	2;03-2;04	2;06-2;07	3;01		
LEX				3;00	3;03	3;05

All 3 children had normal hearing, and had not been diagnosed with any other disabilities that would have affected their language development. In addition, all 3 children were enrolled in daycare and also had opportunities to interact with hearing relatives.

It is important to note that Tom had a greater amount of videotaped sessions analyzed for this study due to the environment that he was videotaped in as well as the observation that he produced fewer utterances per session than the other children did. For Tom, unlike the videotaped sessions for Ben and Lex, videotaping was sometimes conducted in a daycare setting making it difficult to understand some of his utterances due to the background noise of other children. Also, Tom's linguistic utterances were sometimes minimal due to the nature of the activities he was partaking in. Often times, he was videotaped while involved in solo play where he wasn't very communicative with the researcher.

Elan software (Hellwig, 2008), a language archiving system, was used to view the videos and accompanying transcripts. To convert the data into a form that would be recognized by Microsoft Excel, the data was extracted using the Export to Tab Delimited feature of Elan. The 50 most frequently used words of each session for each child were then further analyzed in

Excel. For some of the videotaped sessions the child produced fewer than 50 different words; in this case all the words of that session were analyzed. For each word, both the researcher's target pronunciation was transcribed as well as up to five of the child's utterances or tokens.

Each of the child's tokens was further analyzed for the phonological processes present. The phonological processes were taken from Table 2 of Bowen (Bowen, 1998). Specifically, the phonological processes studied included context sensitive voicing, word final devoicing, final consonant deletion, velar fronting, palatal fronting, consonant harmony, weak syllable deletion, cluster reduction, gliding of liquids, and stopping. Further analysis of each token also examined any vowel changes as well as any additional changes that did not fit into one of the phonological processes. All phonological processes displayed by each token were counted. The target syllable structure for each word as well as the syllable structure for each token were also recorded. (See Appendix B for a sample spreadsheet.)

For each child, the phonological processes identified for all utterances were summed and analyzed against the total number of instances of all processes to derive percentages. This information was organized in a table format created in Microsoft Excel. Each child's data was compared against the other two children's in the study, and against the standards established by Bowen (1998) and Stoel-Gammon and Stone (1991).

Phonetic inventories for each child at each videotaped session were also derived. The phonetic inventory examined the presence of stop, nasal, fricative, affricate, liquid and glide phonemes at three positions, word initial, intervocalic and word final. In addition, the phonetic inventories for all sessions for each child were summarized in a block grid format like that used by Sander's (1972) (see Appendix A). This format made it easier to determine how consistent each child was at producing the various phonemes in the varying positions.

Syllable structure was also analyzed. The child's syllable structure for each token was compared against the target syllable structure. A percentage was derived by counting the number of times the child used the target syllable structure over the number of times the target syllable structure should have been used. These percentages for each videotaped session were then summarized with the other videotaped sessions for each child and placed in a table format to see if each child met the syllable structures defined as normal in previous research.

RESULTS

Phonological Processes

Table 2. Use of each phonological process at each age range (raw number (proportion))

BEN	Total Types	Total Tokens	Adult-Like	Final Cons Deletion	Stopping	Weak Syll Deletion	Context Sens Voicing	Gliding of Liquids	Velar Fronting	Devoicing	Cluster Reductior	Consonant Harmony
1;11	47	176	110 (.63)	35 (.2)	8 (.05)	0 (0)	0 (0)	12 (.07)	0 (0)	0 (0)	14 (.08)	0 (0)
2;06	52	249	160 (.64)	24 (.1)	28 (.11)	5 (.02)	8 (.03)	7 (.03)	15 (.06)	3 (.01)	4 (.02)	0 (0)
3;0	48	227	180 (.79)	15 (.07)	4 (.02)	0 (0)	10 (.04)	2 (.01)	0 (0)	4 (.02)	11 (.02)	0 (0)
TOM	**Total Types**	**Total Tokens**	**Adult-Like**	**Final Cons Deletion**	**Stopping**	**Weak Syll Deletion**	**Context Sens Voicing**	**Gliding of Liquids**	**Velar Fronting**	**Devoicing**	**Cluster Reductior**	**Consonant Harmony**
2;00-2;02	82	142	47 (.33)	54 (.38)	19 (.13)	4 (.03)	5 (.04)	9 (.06)	5 (.04)	4 (.03)	0 (0)	0 (0)
2;03-2;04	132	219	74 (.34)	69 (.32)	33 (.15)	6 (.03)	9 (.04)	21 (.1)	15 (.07)	9 (.04)	2 (.01)	0 (0)
2;06-2;07	92	309	176 (.57)	61 (.2)	35 (.11)	0 (0)	4 (.01)	8 (.03)	7 (.02)	8 (.03)	21 (.07)	0 (0)
3;01	97	378	176 (.47)	52 (.14)	52 (.14)	1 (0)	3 (.01)	27 (.07)	3 (.01)	6 (.02)	23 (.06)	5 (.01)
LEX	**Total Types**	**Total Tokens**	**Adult-Like**	**Final Cons Deletion**	**Stopping**	**Weak Syll Deletion**	**Context Sens Voicing**	**Gliding of Liquids**	**Velar Fronting**	**Devoicing**	**Cluster Reductior**	**Consonant Harmony**
3;00	52	231	178 (.77)	5 (.02)	14 (.06)	2 (.01)	8 (.03)	5 (.02)	2 (.01)	9 (.04)	11 (.05)	0 (0)
3;03	51	230	178 (.77)	22 (.1)	15 (.07)	0 (0)	2 (.01)	1 (0)	5 (.02)	1 (0)	6 (.03)	0 (0)
3;05	45	185	142 (.77)	7 (.04)	13 (.07)	5 (.03)	3 (.02)	2 (.01)	7 (.04)	4 (.02)	0 (0)	0 (0)

Ben had low occurrences of all phonological processes which is consistent with the typical findings of children who are 2 to 3 years of age. By age 3 years 0 months Ben's adult-like utterances reached 79%. Lex also had low occurrences of all phonological processes. By age 3 years 5 months, Lex had adult like utterances of 77%. Tom did not have as low a number of occurrences of phonological processes in comparison with the other two children. His final consonant deletion and stopping percentages were much higher than the other two children. In regards to final consonant deletion, Tom, by 3 years, 1 month, was producing this process 14% of the time. Tom was also producing stopping 14% of the time by age 3 years, 1 month. Tom by

age 3 years 1 month had adult like utterances of 47%. Tom did reach a high of 57% for adult-like utterances at age 2 years 6 months. His amount of adult-like utterances was far less than those of the other two children in the study.

Syllable Structure

Table 3. Proportion target syllable structure at each age range

	CV	CVC	CVCC	CCV	CCVC	CCVCC	V	VC		CVCV
Ben 1;11	0.88	0.81	0.88	0.75	0.25	1	1	0.9		1
Ben 2;06	0.94	0.87	0.94	–	1	–	1	0.6		–
Ben 3;0	1	0.92	1	1	0.93	–	1	0.9		–
Tom 2;00-2;02	0.67	0.48	0.33	0*	1	0*	0.86	0.6		1
Tom 2;03-2;04	0.79	0.5	0.46	0.56	0.38	–	1	0.67		0.69
Tom 2;06-2;07	0.98	0.74	0.55	0.2	0.63	0.4	1	0.76		1
Tom 3;01	0.95	0.84	0.48	0.7	0.92	0	0.95	0.66		0.75
Lex 3;00	0.98	0.96	0.83	0.8	1	–	1	0.84		1
Lex 3;03	0.98	0.89	0.4	1	1	–	1	0.88		–
Lex 3;05	0.95	0.96	0.79	–	1	1	–	1		–
*** if ≤ 2 observations**										

In regards to syllable structure, Lex and Ben both had a higher percentage of correct syllable structure than Tom had. Lex at 3 years, 5 months of age had high percentages of correct syllable structure as compared to target syllable structure for the consonant structures CV, CVC, CVCC, and CCVC. In regards to vowel structure, he had a high percentage for VC but did not produce words that were of the V vowel structure. Ben had very high percentages of correct syllable structure as compared to the target syllable structure for the words analyzed in the videotaped sessions. At 3 years, 0 months of age, he hit the targets for CV, CVCC, and CCV perfectly, with values of 100%. For CCVC, he also had a high value of 93%. For videotaped sessions in general, Tom showed decreased variation of syllable structure compared to Lex and Ben. Tom did have a high percentage of correct syllable structure versus the target syllable

structure for CV, CVC and CCVC. When examining vowel structure, Tom has a higher percentage of correct syllable structure for V but a much lower percentage for VC, at 66% for his session at 3 years, 1 month of age.

Phonemic Inventory

Table 4. Use of each phoneme in word-initial position at each age range

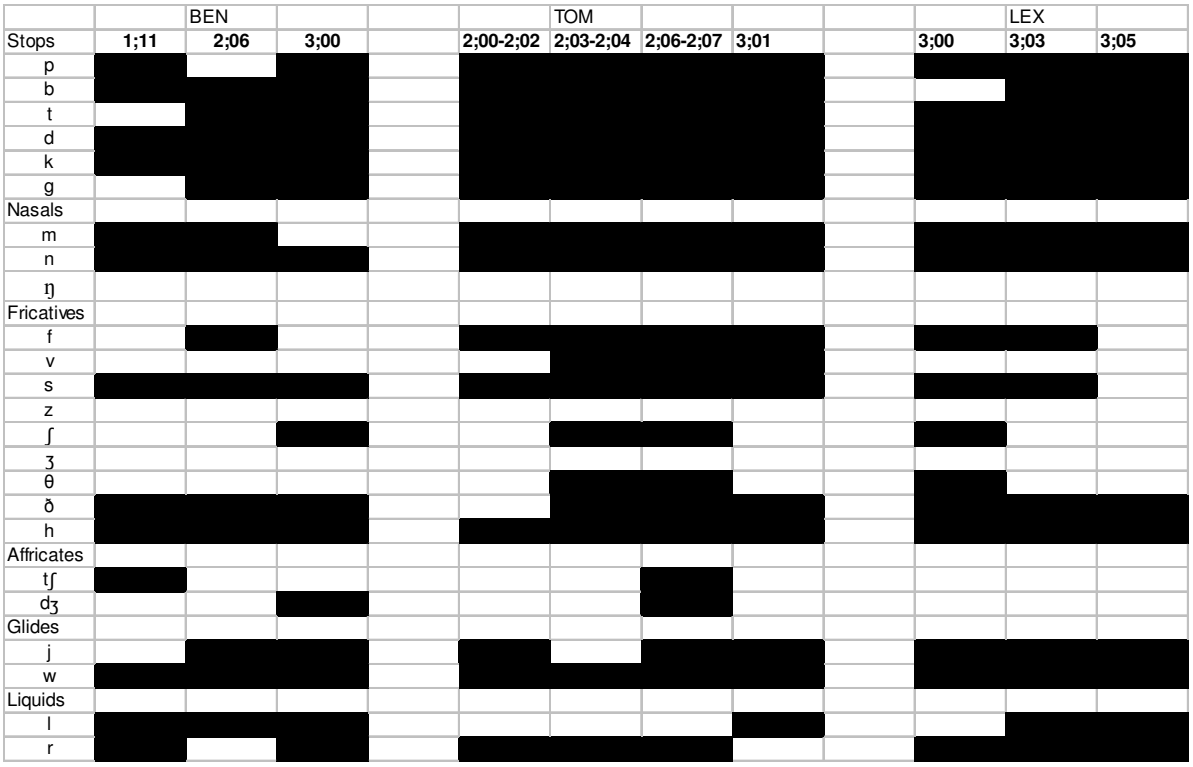

Table 5. Use of each phoneme in word-medial position at each age range

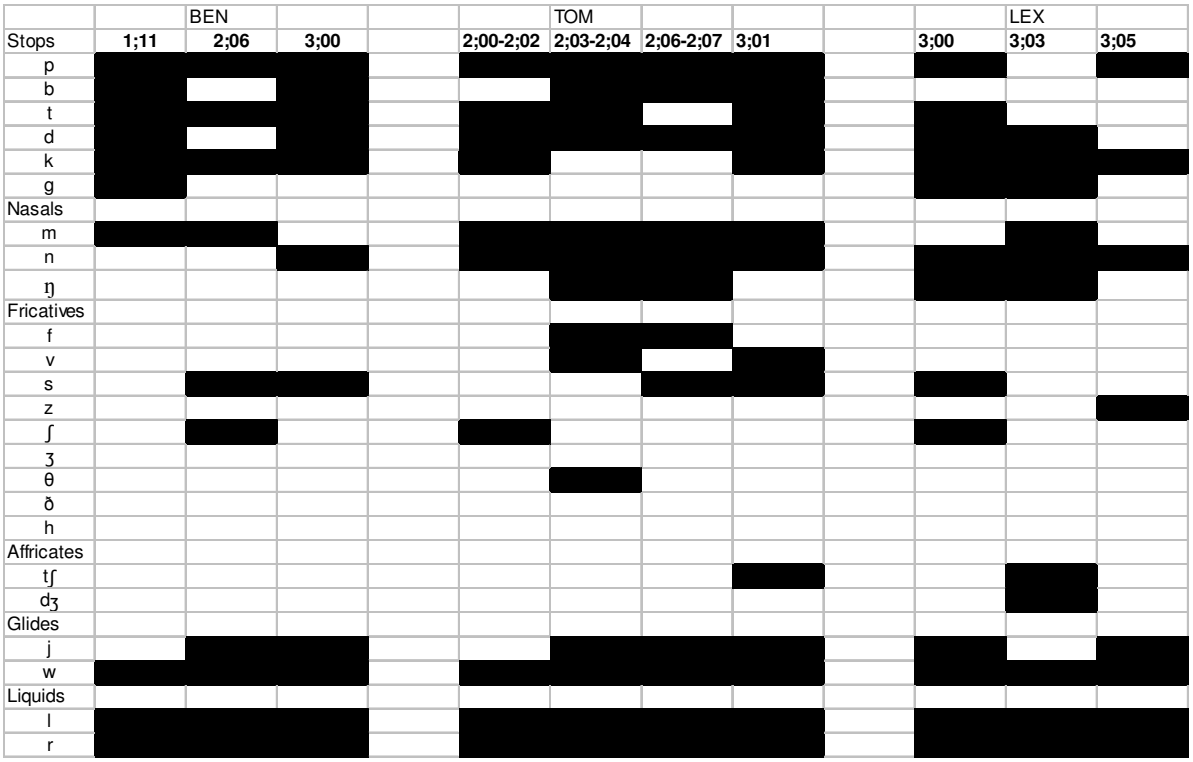

Table 6. Use of each phoneme in word-final position at each age range

Ben has appeared to have mastered all of the stops and nasals in word initial position by 3 years of age. These phonemes include /p/, /b/, /t/, /d/, /k/, /g/, /m/, and /n/. In the intervocalic and word final position, Ben has the all of the stops present minus /g/ and /b/. The phoneme /b/ was not present at all in the word final position and the phoneme /g/ was present only in the session at 1 year, 11 months of age. In regards to nasals, Ben has not appeared to master the phoneme /m/ in word final position, as it is not present in any of the videotaped sessions analyzed. There is evidence of use for both the phonemes /n/ and /ŋ/ in word final position. For fricatives, the phonemes /v/ and /ʒ/ are not present in any of the videotaped sessions in either word initial, intervocalic, or word final position. The phoneme /s/ is the only one evident in most sessions and across all word positions. The affricates /tʃ/ and /dʒ/ are only present in one videotaped session in word initial position. For glides, /j/ and /w/ are both present in word initial and intervocalic positions but neither is present in word final position. In regards to liquids, both /l/ and /r/ are present in all three word positions.

Tom has appeared to have mastered all of the stop phonemes in all 3 word positions except for /b/ in word final position. For stops, the phonemes /m/ and /n/ are present across all 3 word positions and /ŋ/ is present in some videotaped sessions in intervocalic and word final position as expected. In regards to fricatives, the phoneme /z/ is not present in any sessions in word initial and intervocalic position but does appear in word final position in some sessions. The phoneme /ʒ/ is not present in any of the videotaped sessions for any of the 3 word positions. Multiple phonemes including /f/, /v/, /s/, /ʃ/, and /θ/ are present in all 3 word positions. For affricates, the phoneme /dʒ/ is present in word initial position and is absent from both intervocalic and word final position. In regards to glides, /j/ is present in all 3 word positions and

/w/ is present only in word initial and intervocalic position. The liquids /l/ and /r/ are present in all 3 word positions and across most videotaped sessions.

Lex has all of the stops besides /b/ and /g/ present in all 3 word positions. The phoneme /b/ is not present in intervocalic or word final position and /g/ is not present in word final position. The stops /m/ and /n/ are present in most videotaped sessions across all 3 word positions and /ŋ/ is present in both intervocalic and word final position. In regards to fricatives, /f/ is present in word initial and final position but not in the intervocalic position. The phonemes /v/ and /ʒ/ do not appear in any of the 3 word positions. For affricates, /tʃ/ appears in at least 1 videotaped session in intervocalic and word final position. The phoneme /dʒ/ only appears in the intervocalic position. The glide /j/ is present in all 3 word positions and /w/ is present in word initial and intervocalic position. The liquids /l/ and /r/ are present in all 3 word positions across almost all videotaped sessions.

DISCUSSION

Although previous studies have examined the language development of children of deaf adults, those studies have not targeted the longitudinal language development of these children. Therefore, the current study is important in providing language information about children of deaf adults from 24 to 36 months of age.

Using Stoel-Gammon and Stone's (1991) article as a reference, it is evident that all three children in the study fall within the normal range for language development specifically regarding phonological processes, syllable structure and phonemic inventory.

Phonemic Inventory

In regards to phonemic inventory, all three children fell within the normal range of development in accordance with Sander's (1972) chart for acquiring consonant phonemes. As is evident from the chart, acquisition isn't a sudden phenomenon and it takes years for children to fully acquire a phoneme for every day use. Although each child lacked production of some phonemes, these gaps can be partially attributed not only to the play situations of the videotaped sessions but more generally to the child's vocabulary. Using Stoel-Gammon and Stone's (1991) study as a benchmark, it can be determined that all 3 children in the study meet the targets specified. For example, the researchers suggest that by age 24 months, children should have 9 to 10 phonemes in word initial position which all 3 children in the study have. In addition, the benchmarks created in their study recommend that by age 24 months, children should have 5 to 6 phonemes in word-final position. Ben, Lex and Tom also meet this target. As evidenced by a comparison between Sanders' (1972) consonant acquisition chart as well as Stoel-Gammon and Stone's (1991) research findings, all three children in the study are acquiring phonemes as well as children in a typical linguistic environment.

Syllable Structure

All three children in the study also have similar syllable and vowel structure presentations. In accordance with Stoel-Gammon and Stone's (1991) findings, Lex, Tom and Ben are all within the normal range for syllable structure. As suggested by their research, by the age of 24 months, children should have the following syllable structures; CV, CVC, CVCV, and CVCVC. All 3 children in the study had high percentages of accurate use of CV and CVC. More inconsistent but still present in some of the videotaped sessions was CVCV. In addition,

Stoel-Gammon and Stone (1991) add that by 24 months of age, children should have a few consonant clusters in word-initial position. Evidenced by CCV and CCVC syllable structures, the children in our study are acquiring these structures. It is important to note that some structures were not evident in all three children's transcriptions as they all did not produce each variation. In addition, multi-syllabic structures were not recorded besides CVCV as all 3 children produced dissimilar and inconsistent forms.

Phonological Processes

It can be concluded that all three children have language that is becoming more adult-like much like Bowen illustrates in her Table 3.1. Ben and Lex both have very high percentages of adult-like utterances, which is typical of children by age 3. In addition, both these children have low occurrences of the other phonological processes. Illustrated in Bowen's table, the processes context sensitive voicing and word final de-voicing should be gone by 3 years of age. Ben and Lex have very low percentages of these processes, at less than 2% each.

Tom, however, has the lowest percentage of adult-like utterances as well as the highest percentages of phonological processes including stopping and final consonant deletion. Final consonant deletion should be gone by age 3 years, 3 months, and stopping should be gone by 3 years, 6 months depending on the phoneme. Tom falls within this normal range, but it is interesting to note the processes that are present as compared to the other two children in the study. It is also interesting to note that Tom's percentage of adult-like utterances were higher in sessions 2 years 6 months to 2 years 7 months than at 3 years, 0 months. This discrepancy could be attributed to the difficulty of his words in his 3 year transcript. Words such as "another,"

"ladybugs," and "rainbow" may allow for more instances of mistakes than words that are more common for 3 year olds.

Specific Child Differences

It is important to note the differences between Tom and the other two children in the study. Tom's videotaped sessions were somewhat difficult to extract words from given the environment he was filmed in. Many of Tom's sessions were taken at childcare centers during group activities with other children including outdoor play. These sessions with a lot of background noise made it harder to not only hear Tom's pronunciation but involve Tom in one-on-one conversation. Therefore Tom had more videotaped sessions analyzed in order to create a more even comparison of the data with the other two children. In addition, Tom's sessions were less structured therefore yielding less linguistic information than both Lex and Ben.

Schiff and Ventry Article Comparison

In Schiff and Ventry's (1976) study it was determined that of the 52 children evaluated, 23 were considered to be developing speech and language normally. Of the 29 remaining children, 23 appeared to have speech and language problems in addition to 5 suspected to have difficulties with speech and language. 1 child was not classified due to him being too young to get a reliable evaluation. Of the 23 children identified to have problems in their speech and language, 6 children had problems related to an undiagnosed hearing loss, and 6 had other factors contributing to their language difficulties, including brain damage, psychomotor retardation or emotional disturbance. The remaining 11 children, or 21% of the total participants, had either an articulation problem, a language problem, or both a speech and

language problem. The examiners defined speech problems as those including defective articulation, deviant stress and intonation patterns and fluency problems. Examiners used a variety of tests to determine the children's speech and language including, but not limited to, the PPVT, the Templin-Darley Diagnostic and Screening Tests of Articulation, communication evaluation charts, and developmental scales.

It is important to understand that the norms for each of the above tests vary and could therefore influence the researcher's findings of deviant speech and language problems. Although it is helpful that the study used a variety of developmental scales and evaluations, it is still interesting to note the potential comparisons between a formal evaluation and naturalistic play in deriving data.

In addition, considering that Schiff and Ventry's (1976) study is somewhat dated, their findings may not be the same today. Now in 2010, children have many more opportunities for English language input including television, daycare, and interaction with hearing relatives. The examiners note that they had many difficulties convincing the deaf parents that their children had problem speech. Although a notable occurrence in the 1970s, so much awareness and attention has been paid to early intervention of speech and language problems as well as positive English language input that it does not appear that this same problem would have occurred if the study had been done today.

Further Research

To further investigate Tom's language differences, it would be important to analyze some videotaped sessions of Tom at 4 years of age. By comparing the current videotaped sessions to the ones at an older age, it would help determine whether the language differences evident in the

current study have become more adult-like. These comparisons would benefit the statement that being a child of a deaf parent does not negatively affect a child's language development.

In addition, comparing the children in this study to children in a typical linguistic environment using the same methodology would be beneficial in determining the specific language affects of their environment. By analyzing children of hearing parents' phonological processes, syllable structure and phonemic inventory, a stronger comparison could be made with the three children in the current study.

The current study only analyzed 3 male children as initially only male children had gotten consent from their parents to participate in the study. Recently, 2 female children have been added to the larger study examining bimodal bilingualism at Gallaudet University and the University of Connecticut. It would be interesting to compare the phonological processes, syllable structure, and phonemic inventory of the 2 female children to the 3 male children in the study. This would provide gender-specific information on these children's phonological language development.

CONCLUSION

As noted above, the current research has determined that CODAs, although acquiring language in an atypical linguistic environment, do not show any obvious language deficits. Specifically, in regards to phonological processes, syllable structure, and phonemic inventories, the three CODAs in the current study are within the normal range for all three of these aspects of phonological development.

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APPENDIX A

Bowen's (1998) tables showing phonological processes and the elimination of phonological processes, and Sander's (1972) diagram of typical consonant development are provided in this appendix.

TABLE 2: Phonological Processes in Normal Speech Development		
PHONOLOGICAL PROCESS (Phonological Deviation)	**EXAMPLE**	**DESCRIPTION**
Context sensitive voicing	"Pig" is pronounced and "big" "Car" is pronounced as "gar"	A voiceless sound is replaced by a voiced sound. In the examples given, /p/ is replaced by /b/, and /k/ is replaced by /g/. Other examples might include /t/ being replaced by /d/, or /f/ being replaced by /v/.
Word-final devoicing	"Red" is pronounced as "ret" "Bag" is pronounced as "bak"	A final voiced consonant in a word is replaced by a voiceless consonant. Here, /d/ has been replaced by /t/ and /g/ has been replaced by /k/.
Final consonant deletion	"Home" is pronounced a "hoe" "Calf" is pronounced as "cah"	The final consonant in the word is omitted. In these examples, /m/ is omitted (or deleted) from "home" and /f/ is omitted from "calf".
Velar fronting	"Kiss" is pronounced as "tiss" "Give" is pronounced as "div" "Wing" is pronounced as "win"	A velar consonant, that is a sound that is normally made with the middle of the tongue in contact with the palate towards the back of the mouth, is replaced with consonant produced at the front of the mouth. Hence /k/ is replaced by /t/, /g/ is replaced by /d/, and 'ng' is replaced by /n/.
Palatal fronting	"Ship" is pronounced as "sip" "Measure" is pronounced as "mezza"	The fricative consonants 'sh' and 'zh' are replaced by fricatives that are made further forward on the palate, towards the front teeth. 'sh' is replaced by

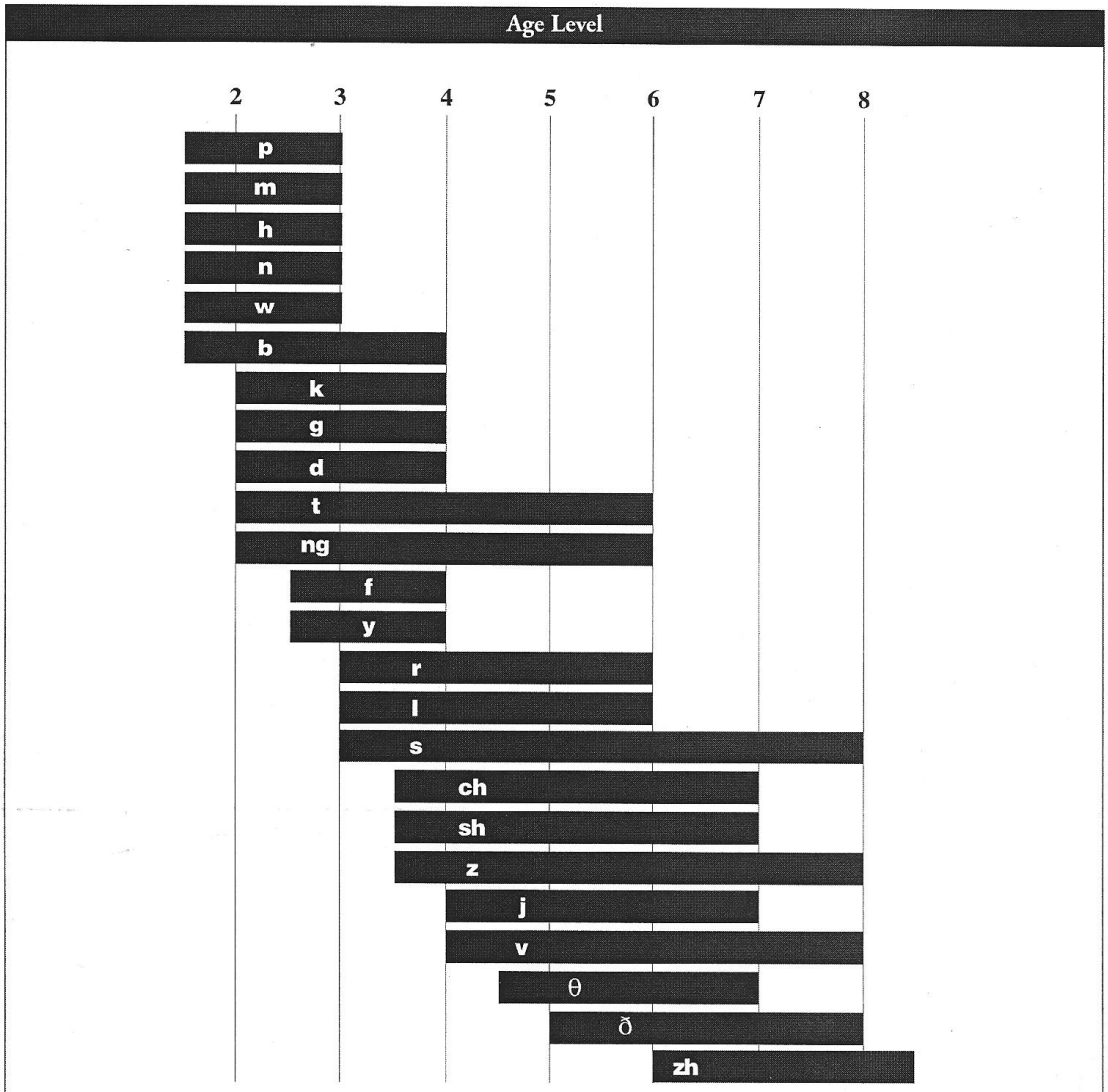
		/s/, and 'zh' is replaced by /z/.
Consonant harmony	"Cupboard" is pronounced as "pubbed" "dog" is pronounced as "gog"	The pronunciation of the whole word is influenced by the presence of a particular sound in the word. In these examples: (1) the /b/ in "cupboard" causes the /k/ to be replaced /p/, which is the voiceless cognate of /b/, and (2) the /g/ in "dog" causes /d/ to be replaced by /g/.
Weak syllable deletion	Telephone is pronounced as "teffone" "Tidying" is pronounced as "tying"	Syllables are either stressed or unstressed. In "telephone" and "tidying" the second syllable is "weak" or unstressed. In this phonological process, weak syllables are omitted when the child says the word.
Cluster reduction	"Spider" is pronounced as "pider" "Ant" is pronounced as "at"	Consonant clusters occur when two or three consonants occur in a sequence in a word. In cluster reduction part of the cluster is omitted. In these examples /s/ has been deleted form "spider" and /n/ from "ant".
Gliding of liquids	"Real" is pronounced as "weal" "Leg" is pronounced as "yeg"	The liquid consonants /l/ and /r/ are replaced by /w/ or 'y'. In these examples, /r/ in "real" is replaced by /w/, and /l/ in "leg" is replaced by 'y'.
Stopping	"Funny" is pronounced as "punny" "Jump" is pronounced as "dump"	A fricative consonant (/f/ /v/ /s/ /z/, 'sh', 'zh', 'th' or /h/), or an affricate consonant ('ch' or /j/) is replaced by a stop consonant (/p/ /b/ /t/ /d/ /k/ or /g/). In these examples, /f/ in "funny" is replaced by /p/, and 'j' in "jump" is replaced by /d/.

TABLE 3: Elimination of Phonological Processes

Phonological processes are typically gone by these ages (in years ; months)

PHONOLOGICAL PROCESS	EXAMPLE	GONE BY APPROXIMATELY
Context sensitive voicing	pig = big	3;0
Word-final de-voicing	pig = pick	3;0
Final consonant deletion	comb = coe	3;3
Fronting	car = tar ship = sip	3;6
Consonant harmony	mine = mime kittycat = tittytat	3;9
Weak syllable deletion	elephant = efant potato = tato television =tevision banana = nana	4;0
Cluster reduction	spoon = poon train = chain clean = keen	4;0
Gliding of liquids	run = one leg = weg leg = yeg	5;0
Stopping /f/	fish = tish	3;0
Stopping /s/	soap = dope	3;0
Stopping /v/	very = berry	3;6
Stopping /z/	zoo = doo	3;6
Stopping 'sh'	shop = dop	4;6
Stopping 'j'	jump = dump	4;6
Stopping 'ch'	chair = tare	4;6
Stopping voiceless 'th'	thing = ting	5;0
Stopping voiced 'th'	them = dem	5;0

Sander's (1972) Consonant Acquisition



Average age estimates and upper age limits of customary consonant production. The solid bar corresponding to each sound starts at the median age of customary articulation; it stops at an age level at which 90% of all children are customarily producing the sound.

From "When Are Speech Sounds Learned?" by E. Sander, 1972, *Journal of Speech and Hearing Disorders, 37,* p. 62.

APPENDIX B

Following is an example of the Excel spreadsheets used in this study, showing the analyses for each token. The table gives the time on the video at which the word appears; the word in regular orthography; the total number of tokens of that word in that session; the child's pronunciation of the word in IPA transcription; an IPA transcription of the word target (using the researcher's pronunciation); the phonological processes displayed by the word (if non, this is coded as 'adult-like'); any additional changes observed; vowel changes (which are not included in the list of phonological processes); the syllable structure of the form produced by the child; and the target syllable structure.

BEN_048 (2;06)

Time	Word	Tot.	BEN	Target Trans.	Phonolog. Processes	Add'l Changes	Vowel Changes	Syllable Structure	Target Syll Str
00:00.8	a	65	/•/	/•/	adult-like			V	VC
00:03.0	a		/•/		adult-like			V	
01:05.3	a		/•/		adult-like			V	
02:02.3	a		/•/		adult-like			V	
02:06.0	a		/•/		adult-like			V	
00:12.0	at	10	/æ/	/æt/	final consonant deletion			V	VC
07:12.2	At		/æt/		adult-like			VC	
08:05.7	at		/æd/		context sensitive voicing			VC	
09:52.5	at		/æt/		adult-like			VC	
09:55.2	at		/æt/		adult-like			VC	
28:54.9	bite	10	/bɑɪt/	/bɑɪt/	adult-like			CVC	CVC
28:58.8	bite		/bɑɪt/		adult-like			CVC	
29:04.5	bite		/bɑɪt/		adult-like			CVC	
31:18.5	bite		/bɑɪt/		adult-like			CVC	
31:20.1	bite		/bɑɪt/		adult-like			CVC	
40:10.9	bologna.	10	/bloʊni/	/b•loʊni/	weak syllable deletion			CCVCV	CVCV CV
49:20.2	bologna.		/bloʊni/		weak syllable deletion			CCVCV	
49:23.0	bologna.		/bloʊni/		weak syllable deletion			CCVCV	
49:26.9	bologna.		/bloʊni/		weak syllable deletion			CCVCV	
49:29.7	bologna.		/bloʊni/		weak syllable deletion			CCVCV	
40:04.1	bread	10	/bwɛd/	/brɛd/	gliding of liquids			CCVC	CCVC
40:59.8	bread		/bwɛd/		gliding of liquids			CCVC	
49:51.9	Bread		/brɛd/		adult-like			CCVC	
46:28.0	bread.		/brɛd/		adult-like			CCVC	
47:37.6	bread.		/brɛd/		adult-like			CCVC	

15:47.7	close	11	/kloʊz/	/kloʊz/	adult-like			CCVC	CCVC
15:50.4	close		/kloʊz/		adult-like			CCVC	
30:04.1	close		/kloʊd/		stopping			CCVC	
30:07.6	Close		/kloʊz/		adult-like			CCVC	
30:13.8	Close		/kloʊd/		stopping			CCVC	
18:16.0	coming	14	/kʌmɪn/	/kʌmɪ•/	velar fronting			CVCVC	CVCVC
23:36.3	coming		/kʌmɪn/		velar fronting			CVCVC	
23:40.9	Coming		/kʌmɪn/		velar fronting			CVCVC	
28:18.4	coming		/kʌmɪn/		velar fronting			CVCVC	
31:00.2	coming		/kʌmɪn/		velar fronting			CVCVC	
01:51.1	Cow	10	/kɑʊ/	/kɑʊ/	adult-like			CV	CV
02:11.7	Cow		/kɑʊ/		adult-like			CV	
02:14.6	Cow		/kɑʊ/		adult-like			CV	
01:40.4	cow.		/kɑʊ/		adult-like			CV	
01:42.4	cow.		/kɑʊ/		adult-like			CV	
37:37.4	cut	25	/kʌt/	/kʌt/	adult-like			CVC	CVC
42:21.8	cut		/kʌt/		adult-like			CVC	
42:27.3	cut		/kʌd/		context sensitive voicing			CVC	
42:33.1	cut		/kʌt/		adult-like			CVC	
48:39.0	cut		/kʌt/		adult-like			CVC	
36:40.7	diaper,	10	/dɑɪpɜrd/	/dɑɪpɜr/		adding /d/		CVCVCC	CVCVC
33:57.4	diaper.		/dɑɪpɜr/		adult-like			CVCVC	
34:06.1	diaper.		/dɑɪpɜr/		adult-like			CVCVC	
34:13.3	diaper.		/dɑɪpɜr/		adult-like			CVCVC	
34:25.5	diaper.		/dɑɪfɜr/			/p/ to /f/		CVCVC	
08:21.1	Don't	24	/doʊn/	/doʊnt/	final consonant deletion			CVC	CVCC
08:23.2	Don't		/doʊn/		final consonant deletion			CVC	
12:19.0	don't		/doʊn/		final consonant deletion			CVC	
12:23.4	don't		/doʊn/		final consonant deletion			CVC	
12:27.0	don't		/doʊn/		final consonant deletion			CVC	
24:49.9	door.	10	/doʊr/	/doʊr/	adult-like			CVC	CVC
25:13.9	door.		/doʊr/		adult-like			CVC	
28:19.5	door.		/doʊr/		adult-like			CVC	

28:20.7	door.		/doʊr/		adult-like			CVC	
30:08.9	door.		/doʊr/		adult-like			CVC	
04:17.1	fell	10	/fɛl/	/fɛl/	adult-like			CVC	CVC
07:32.9	fell		/fɛl/		adult-like			CVC	
20:23.4	fell		/fɛl/		adult-like			CVC	
24:22.4	fell		/fɛl/		adult-like			CVC	
33:20.5	fell		/fɛl/		adult-like			CVC	
12:08.8	Go	37	/goʊ/	/goʊ/	adult-like			CV	CV
21:20.2	go		/goʊ/		adult-like			CV	
21:37.7	Go		/goʊ/		adult-like			CV	
26:04.9	go		/goʊ/		adult-like			CV	
27:06.0	go		/goʊ/		adult-like			CV	
04:08.4	going	28	/goʊɪn/	/goʊɪ•/	velar fronting			CVVC	CVVC
06:53.6	going		/goʊɪn/		velar fronting			CVVC	
21:08.1	going		/goʊɪn/		velar fronting			CVVC	
21:55.1	going		/goʊɪn/		velar fronting			CVVC	
22:27.3	going		/goʊɪn/		velar fronting			CVVC	
03:24.6	got	32	/gɔd/	/gɔt/	context sensitive voicing			CVC	CVC
09:01.6	got		/gɔd/		context sensitive voicing			CVC	
13:52.7	got		/gɔd/		context sensitive voicing			CVC	
13:58.4	got		/gɔd/		context sensitive voicing			CVC	
16:58.2	got		/gɔd/		context sensitive voicing			CVC	
01:29.8	He	62	/hi/	/hi/	adult-like			CV	CV
01:32.4	He		/hi/		adult-like			CV	
02:09.8	He		/hi/		adult-like			CV	
02:17.6	He		/hi/		adult-like			CV	
02:20.3	He		/hi/		adult-like			CV	
13:12.6	help	24	/hɛlp/	/hɛlp/	adult-like			CVCC	CVCC
13:15.5	help		/hɛlp/		adult-like			CVCC	
13:17.7	help		/hɛlp/		adult-like			CVCC	
14:00.3	Help		/hɛlp/		adult-like			CVCC	
14:39.4	Help		/hɛl/		final consonant deletion			CVC	
29:33.2	Here	10	/hjir/	/hjir/	adult-like			CCVC	
39:53.4	Here		/hjir/		adult-like				
43:10.0	Here		/hjir/		adult-like				
43:19.7	Here		/hjir/		adult-like				
43:24.0	Here		/hjir/		adult-like				
01:06.9	He's	65	/hiz/	/hiz/	adult-like			CVC	CVC
01:25.6	He's		/his/		word final			CVC	

					devoicing				
01:28.3	He's		/hiz/		adult-like			CVC	
05:15.4	He's		/his/		word final devoicing			CVC	
06:25.2	He's		/hɪz/		adult-like			CVC	
00:00.2	I	177	/ɑɪ/	/ɑɪ/	adult-like			V	V
00:02.5	I		/ɑɪ/		adult-like			V	
00:08.0	I		/ɑɪ/		adult-like			V	
00:33.0	I		/ɑɪ/		adult-like			V	
00:35.1	I		/ɑɪ/		adult-like			V	
02:18.9	in	27	/ɪn/	/ɪn/	adult-like			VC	VC
05:06.2	in		/ɪn/		adult-like			VC	
05:13.1	in		/ɪn/		adult-like			VC	
07:23.6	in		/ɪn/		adult-like			VC	
08:10.2	in		/ɪn/		adult-like			VC	
02:56.1	It	50	/ɪ/	/ɪt/	final consonant deletion			V	VC
03:37.3	it		/ɪ/		final consonant deletion			V	
03:48.1	it		/ɪt/		adult-like			VC	
05:05.4	it		/ɪt/		adult-like			VC	
05:10.5	it		/ɪ/		final consonant deletion			V	
16:30.9	It's	19	/ɪts/	/ɪts/	adult-like			VCC	VCC
17:23.4	It's		/ɪs/		cluster reduction			VC	
18:45.1	It's		/ɪs/		cluster reduction			VC	
21:07.3	It's		/ɪts/		adult-like			VCC	
32:16.3	it's		/ɪts/		adult-like			VCC	
00:11.5	Look	12	/lʊk/	/lʊk/	adult-like			CVC	CVC
07:59.3	look		/lʊk/		adult-like			CVC	
08:05.3	Look		/lʊk/		adult-like			CVC	
09:52.0	Look		/lʊk/		adult-like			CVC	
09:54.6	Look		/lʊk/		adult-like			CVC	
50:34.3	me	12	/mi/	/mi/	adult-like			CV	CV
14:00.8	me.		/mi/		adult-like			CV	
14:39.9	me.		/mi/		adult-like			CV	
50:36.2	me.		/mi/		adult-like			CV	
50:39.5	me.		/mi/		adult-like			CV	
07:54.1	My	14	/m•/	/mɑɪ/		change in vowel		CV	CV
07:54.7	my		/mɑɪ/		adult-like			CV	
08:41.9	my		/mɑɪ/		adult-like			CV	
19:00.7	my		/mɑɪ/		adult-like			CV	
32:53.4	my		/mɑɪ/		adult-like			CV	

08:41.4	no	10	/noʊ/	/noʊ/	adult-like			CV	CV
49:33.8	NO!		/noʊ/		adult-like			CV	
04:59.9	No,		/noʊ/		adult-like			CV	
32:09.7	No,		/noʊ/		adult-like			CV	
32:12.1	No,		/noʊ/		adult-like			CV	
05:01.0	not	21	/nɑt/	/nɑt/	adult-like			CVC	CVC
07:22.8	not		/nɑ/		final consonant deletion			CV	
09:34.3	not		/nɑt/		adult-like			CVC	
17:24.1	not		/nɑ/		final consonant deletion			CV	
21:54.7	not		/nɑt/		adult-like			CVC	
03:12.4	Okay!	38	/oʊkeɪ/	/oʊkeɪ/	adult-like			VCV	VCV
21:18.7	okay,		/oʊkeɪ/		adult-like			VCV	
34:06.9	Okay,		/oʊkeɪ/		adult-like			VCV	
36:47.4	Okay,		/oʊkeɪ/		adult-like			VCV	
38:03.3	Okay,		/oʊkeɪ/		adult-like			VCV	
03:50.1	on	20	/ɔn/	/ɔn/	adult-like			CVC	CVC
03:50.8	on		/ɔn/		adult-like			VC	
04:05.2	on		/ɔn/		adult-like			VC	
04:09.0	on		/ɔn/		adult-like			VC	
04:12.0	on		/ɔn/		adult-like			VC	
13:26.3	one	19	/wʌn/	/wʌn/	adult-like			CVC	CVC
16:26.5	One		/wʌn/		adult-like			CVC	
16:31.5	one		/wʌn/		adult-like			CVC	
34:30.6	one		/wʌn/		adult-like			CVC	
00:01.4	one.		/wʌn/		adult-like			CVC	
05:31.1	out	17	/ɑʊt/	/ɑʊt/	adult-like			VC	VC
07:18.4	out		/ɑʊ/		final consonant deletion			V	
07:21.2	out		/ɑʊ/		final consonant deletion			V	
10:11.4	out		/ɑʊ/		final consonant deletion			V	
26:40.6	Out		/ɑʊt/		adult-like			VC	
02:37.6	right	22	/wɑɪ/	/rɑɪt/	gliding of liquids, final consonant deletion			CV	CVC
03:37.7	right		/wɑɪt/		gliding of liquids			CVC	
03:48.5	right		/wɑɪt/		gliding of liquids			CVC	
05:05.8	right		/wɑɪt/		gliding of liquids			CVC	
05:10.9	right		/wɑɪt/		gliding of liquids			CVC	
00:08.3	see	15	/si/	/si/	adult-like			CV	CV

00:21.0	See		/si/		adult-like			CV	
00:33.6	see		/si/		adult-like			CV	
00:37.0	see		/si/		adult-like			CV	
00:44.5	see		/si/		adult-like			CV	
32:51.0	sleep,	20	/slip/	/slip/	adult-like			CCVC	CCVC
21:48.5	sleep.		/slip/		adult-like			CCVC	
21:55.7	sleep.		/slip/		adult-like			CCVC	
27:07.2	sleep.		/slip/		adult-like			CCVC	
27:11.6	sleep.		/slip/		adult-like			CCVC	
01:08.3	take	13	/teɪk/	/teɪk/	adult-like			CVC	CVC
01:10.7	take		/teɪk/		adult-like			CVC	
01:59.6	take		/teɪk/		adult-like			CVC	
02:12.3	take		/teɪk/		adult-like			CVC	
02:15.1	take		/teɪk/		adult-like			CVC	
15:41.3	that	23	/dæ/	/ðæt/	stopping, final consonant deletion			CV	CVC
23:52.3	That		/dæ/		stopping, final consonant deletion			CV	
27:02.1	that		/ðæ/		final consonant deletion			CV	
28:16.9	That		/dæt/		stopping			CVC	
37:15.8	That		/dæt/		stopping			CVC	
36:59.6	Thats	59	/dæts/	/ðæts/	stopping			CVCC	CVCC
02:25.5	That's		/dæts/		stopping			CVCC	
02:29.7	That's		/dæs/		stopping, cluster reduction	deletion of t		CVC	
03:26.2	That's		/dæs/		stopping, cluster reduction			CVC	
05:00.5	that's		/doʊs/		stopping	deletion of t	wrong vowel	CVC	
00:08.7	the	85	/d•/	/ð•/	stopping			CV	CV
00:37.3	the		/ð•/		adult-like			CV	
00:42.2	the		/ð•/		adult-like			CV	
00:44.8	the		/ð•/		adult-like			CV	
01:30.9	the		/d•/		stopping			CV	
05:40.3	There	31	/dɛ•ɪ/	/ðɛ•ɪ/	stopping			CVC	CVC
05:45.6	There		/dɛ•ɪ/		stopping			CVC	
06:21.0	There		/dɛ•ɪ/		stopping			CVC	
09:11.4	There		/dɛ•ɪ/		stopping			CVC	
18:26.9	There		/dɛ•ɪ/		stopping			CVC	
05:54.9	these	11	/diz/	/ðiz/	stopping			CVC	CVC
08:00.3	these		/diz/		stopping			CVC	
08:06.5	these		/diz/		stopping			CVC	
09:55.8	these		/diz/		stopping			CVC	
37:52.4	These		/dis/		devoicing			CVC	

01:41.9	this	105	/dɪs/	/ðɪs/	stopping			CVC	CVC
01:44.0	this		/dɪs/		stopping			CVC	
02:51.6	This		/dɪs/		stopping			CVC	
02:53.9	This		/dɪs/		stopping			CVC	
03:07.5	this		/dɪs/		stopping			CVC	
02:21.2	to	52	/t•/	/tu/			centralized and shortened	CV	CV
07:20.4	to		/t•/				centralized and shortened	CV	
12:46.1	to		/t•/				centralized and shortened	CV	
21:38.1	to		/t•/				centralized and shortened	CV	
21:48.0	to		/t•/				centralized and shortened	CV	
00:09.1	train	32	/treɪn/	/treɪn/	adult-like			CCVC	CCVC
09:44.2	train		/treɪn/		adult-like			CCVC	
14:08.3	train		/treɪn/		adult-like			CCVC	
24:21.8	train		/treɪn/		adult-like			CCVC	
26:20.2	train		/treɪn/		adult-like			CCVC	
05:07.1	trashcan	11	/træʃkæn/	/træʃkæn/	adult-like			CCVCCVC	CCVC CVC
05:32.3	trashcan		/træʃkæn/		adult-like			CCVCCVC	
00:59.1	trashcan.		/træʃkæn/		adult-like			CCVCCVC	
02:00.7	trashcan.		/træʃæn/		adult-like			CCVCCVC	
02:11.2	trashcan.		/træʃkæn/		adult-like			CCVCCVC	
27:08.9	trying	16	/trɑɪɪn/	/trɑɪɪ•/	velar fronting			CCVVC	CCVVC
27:13.2	trying		/trɑɪɪn/		velar fronting			CCVVC	
27:16.3	trying		/trɑɪɪn/		velar fronting			CCVVC	
27:36.9	trying		/trɑɪn/		velar fronting		just the dipthong	CCVC	
28:53.9	trying		/trɑɪɪn/		velar fronting			CCVVC	
07:08.8	up	11	/ʌp/	/ʌp/	adult-like			VC	VC

07:10.7	up		/ʌp/		adult-like			VC	
09:59.3	up		/ʌp/		adult-like			VC	
18:16.4	up		/ʌp/		adult-like			VC	
21:08.9	up		/ʌp/		adult-like			VC	
00:00.5	want	52	/wɔn/	/wɔnt/	final consonant deletion			CVC	CVC
00:02.7	want		/wɔn/		final consonant deletion			CVC	
00:52.0	want		/wɔn/		final consonant deletion			CVC	
00:55.0	want		/wɔn/		final consonant deletion			CVC	
00:58.5	want		/wɔn/		final consonant deletion			CVC	
23:12.6	What.	44	/wʌd/	/wʌt/	context sensitive voicing			CVC	CVC
04:32.5	What?		/wʌt/		adult-like			CVC	
04:57.1	What?		/wʌt/		adult-like			CVC	
08:51.4	What?		/wʌt/		adult-like			CVC	
11:17.2	What?		/wʌt/		adult-like			CVC	