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CONSONANT SEQUENCE REDUCTION IN CHILD PHONOLOGY

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Abstract

This article describes consonant sequence reduction in the speech of four children acquiring Yoruba and English concurrently. It is argued that the two children acquiring English primarily and Yoruba secondarily simply delete the most sonorous members of consonant sequences in a manner consistent with the sonority hierarchy, but the children acquiring Yoruba primarily and English secondarily reduce consonant sequences through coalescence. This is apparent in sequences containing sonorants plus voiceless obstruents as inputs, but which consistently have only the voiced counterpart of the input obstruent in the output. We argue that the voicing of the underlyingly voiceless obstruents in this case is from the input sonorant. It is also reported that where the child's primary language is Yoruba, mastery of consonant sequences is slower than where it is English. It is argued that this is because these sequences are limited to only homorganic nasal plus a following consonant in Yoruba, whereas clusters are more frequently encountered in English.

Key words: consonant sequence, homorganic nasal, coalescence, obstruents, sonority hierarchy

0. Introduction

In the acquisition of the sound system of a language, it is established that the articulatory organs of children master different sounds at different stages and ages. Thus, a child acquiring Yoruba will usually master glottal sounds long before velar, as well as stops before fricatives among others (Adeniyi 2015a). The implication of this sequential acquisition of sounds is that a child is prone to employ different phonological processes, some of which may be novel, to cope with those sounds he/she is yet to master. Since many individual sounds present different children with different degrees of difficulty at each stage of acquisition, situating such difficult sounds within the contexts of other sounds may be even more challenging. This is because these developmental difficulties are attributable to different factors including perception, production, and grammar (Rose and Inkelas 2011). In terms of perception, the inability of children to effectively sift speech sounds from the noise around them as well as their inability to process every relevant articulatory cue they hear may result in inadequate perception, which in turn informs how they speak. In terms of the place of production in children's developmental difficulties, it is apparent that their vocal tracts are not yet as developed as those of adults, hence their inability to configure their articulators for proper articulation of certain complex sounds or sound sequences. And regarding the role of grammar, the phonology-grammar interface implies that the phonetic realisation of sounds is sometimes conditioned by the grammatical environment such as word-final devoicing in German, and children are prone to have difficulties with these at early stages of their language acquisition.

In this article, we examine how four children acquiring Yoruba and English concurrently handle these developmental difficulties, particularly those relating to consonant sequences. Regarding the reduction of consonant sequences, detailed input structures such as word-initial consonant clusters are not mastered at early stages of acquisition (Goad and Rose 2001); beyond this, little is known (Demuth 2011:582). We therefore argue in this article that Yoruba-speaking children more often adopt coalescence in their reduction of consonant sequences.

In the remainder of this article, we shall first present brief outlines of the relevant aspects of the phonologies of Standard Yoruba and Nigerian English. Since a published work exists on one of the children, we also supply the sound system of the child as an approximation of child phonology in this context. In section 2, we outline our research method, and present as well as discuss our data in section 3. Section 4 contains a summary of findings while the work is concluded in section 5.

1. Background to the Study

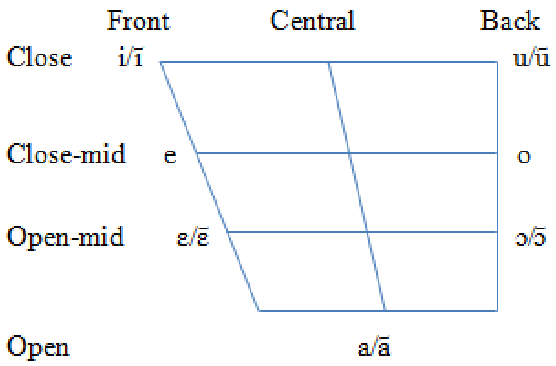
1.1 Yoruba

Yoruba is a West Benue-Congo language spoken predominantly in south-western Nigeria. Yoruba has many dialects, but the standard variety, which is the written form is the form recognised in education and to which speakers approximate when speaking in the public domain. Standard Yoruba (SY) has 18 consonant sounds, seven oral vowels and five underlyingly nasal vowels (Tables 1a-b).

Table 1a: Consonant phonemes of Standard Yoruba

	Labial	Alveolar	Palatal	Velar	Labial-Velar	Glottal
Nasal stops	m	n				
Oral stops	b	t d	dʒ	k g	k͡p g͡b	
		r				
Fricatives	f	s	ʃ			h
Approximants		l	j		w	

Table 1b: Vowel phonemes of Standard Yoruba



Yoruba operates three level tones, High (´), Mid (usually left unmarked), and Low (`), and two contour tones Rising (ˇ), and Falling (ˆ) (Bamgbose 1990, Akinlabi 2004). The rising contour is the allophonic realisation of the high tone when it occurs after a low tone, while the falling contour is the allophonic realisation of the low tone when it occurs after a high tone. In addition, Yoruba has the phenomena of downdrift and downstep, which make its tone system terraced-level in nature (Laniran and Clements 2003, Adeniyi 2009).

Yoruba syllables are generally of three types: V, CV, and the N. The V type is usually one of a vowel standing alone as a morpheme or a vowel occurring in the prefix position of a noun. The CV type comprises an onset consonant plus a nucleus vowel, while the N type is a syllabic nasal consonant. Of the consonants of Yoruba, /n/ is capable of serving as syllable peak, in which case it bears its own tone. When the /n/ is syllabic, its place of articulation conforms to that of the consonant following it (Akinlabi 2004: 459), whether the following consonant is in the same word with it or in another word. Yoruba does not permit closed syllables; neither does it permit consonant clusters within the same syllable. The only instances of consonant sequences in Yoruba involve homorganic syllabic nasals (which serve as peaks of their own syllables) followed by the onset consonants of following syllables. Examples of this in lexical items include *k͡páńdā* "inferior material," *ōǹtɛ̀* "stamp," while phrasal examples include *ń lɔ̄* "is going." As can be seen in these examples, the syllabic nasal has its own tone, which may be different from the tone of adjacent syllables. The fact that the syllabic nasal takes its own tone in a language having the syllable as tone-bearing unit, already implies that it cannot be regarded as part of any other syllable.

1.2 Nigerian English (NE)

Many Nigerians, including Yoruba speakers, are bilingual in English due to the fact that Nigeria was colonised by Britain, and English became her official language as a result. However, English spoken in Nigeria has a lot of inputs from Nigerian languages; hence the term "Nigerian English" (Jowitt 1991). The implication of this is that there are as many varieties of Nigerian English as the number of languages indigenous to Nigeria. Consequently, the Nigerian English discussed in this article is essentially that influenced by Yoruba, hence NEY.

Since NEY is based on the Yoruba language, it is heavily influenced by the tonal patterns of Yoruba. Jibril (1982) emphasised that "Nigerians perceive and internalise English rhythm in terms of their own tonal systems". The segmental phonemes of NEY are outlined in Tables (2-3) below,

Table 2a: Vowels of NEY, adapted from Jowitt (1991)

S/N	NEY Sound	Corresponding RP form	Example words
1	/i/	/ɪ, i:/	pit, sheep
2	/ɛ/	/e, ɜ:/	pet
3	/a/	/a/	cat
4	/ɔ/	/ʌ, ɒ, ɔ:, ə, ɔə/	money, cut, actor
5	/u/	/ʊ, u:/	put
6	/e/	/ei/	say
7	/ai/	/aɪ/	sky
8	/ɔi/	/ɔɪ/	toy
9	/o/	/əʊ/	soul, bowl
10	/ao/	/aʊ/	cow, loud
11	/ia/	/ɪə, ɛə/	chair, ear

12	/ua/	/ʊə/	schwa

Table 2b: Phonemic chart of NEY vowels

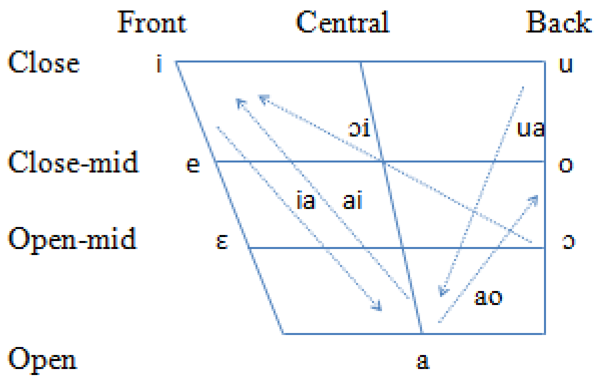


Table 3a: Consonants of NEY, adapted from Jowitt (1991)

S/N	NEY Sound	Corresponding RP form	Example words
1	/p/	/p/	pipe
2	/b/	/b/	blade
3	/t/	/t, θ /	tip, thin
4	/d/	/d, ð /	dip, this
5	/k/	/k/	keep
6	/g/	/g/	give
7	/ʃ/	/ʃ, ʒ, tʃ/	shoe, issue, child
8	/dʒ/	/dʒ/	judge
9	/f/	/f, v/	fan, van
10	/s/	/s, z/	sink, zinc
11	/m/	/m/	man
12	/n/	/n/	man
13	/l/	/l/	lie
14	/r/	/r/	road
15	/j/	/j/	yam
16	/w/	/w/	win

Table 3b: Phonemic chart of NEY consonants

	Labial		Alveolar		Palatal		Velar	
Nasal stops		m		n				
Oral stops	p	b		d		dʒ	k	g
				r				
Fricatives	f		s		ʃ			
Approximants				l		j		w

The point has already been made that NEY is heavily influenced by Yoruba. It then follows that since consonant clusters are prohibited in Yoruba (Akinlabi 2004:460; Taiwo and Adeniyi 2011:114; Owolabi 2011: 139), they are also dispreferred in NEY (Jowitt 1991: 81-82). This however does not accurately reflect the reality since a lot of consonant clusters are generally attested in the English of Yoruba speakers. As a matter of fact, it has been noted that the presence of consonant clusters in NEY has influenced lexical borrowings from English to Yoruba in such a way that many borrowed words are now freely used with their consonant clusters un-nativised (Adeniyi 2015b). A corollary of this is that NEY contains complex syllables with consonant clusters within both the onsets and codas of single syllables. But these complex syllables are still not as basic or as frequent as the CV type. Even in English, it is the universal CV syllable type that appears to be the most basic, and any syllable containing more segments is regarded as "more complex" (McMahon 2002: 106).

1.3 Sound Inventory of Child Iyinoluwa (IY) (2;3-2;5)

The speech of Iyinoluwa, the most longitudinally followed subject in this research, was studied between ages two years, three months (2;3) and two years, five months (2;5), and the inventories of his consonant and vowel sounds are presented in Table (4a-b) (Adeniyi 2015a:12-13)[1].

[1] Adeniyi (2015a) outlines only Iyin's consonant sounds; the vowels have been determined based on the data published in the work. Since this is the only available work on his speech at this stage, the available data is assumed to be representative of his speech at the time.

Table 4a: IY's Vowel sounds

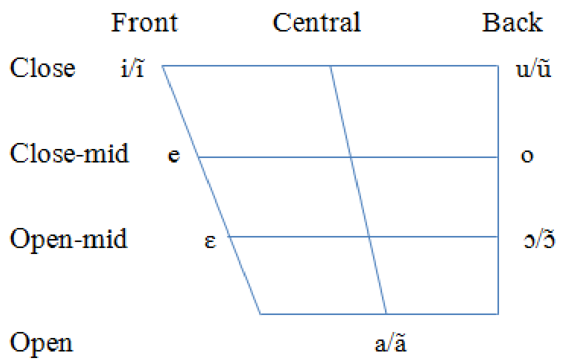


Table 4b: IY's consonant sounds

	Labial	Alveolar	Palatal	Glottal
Nasal stop	m			
Oral stops	p b	t^s d^z	tʃ dʒ	ʔ
Fricatives	f			
Approximants			j	

Notice first that whereas IY used exactly the same set of oral vowels as adult Yoruba speakers at this stage, he used only four nasal vowels compared to five of adult speakers. This leaves [ɛ̃] of adult phonology. Also, his consonant inventory contained only ten sounds, in contrast to 18 used by adult speakers. Of his ten consonants, three [t^s, d^z, ʔ] did not exist in adult phonology; while [ʔ] is a voiceless glottal stop used in place of velar stops /k, g/; [t^s] and [d^z] are affricated alveolar stops used in place of /t, d, s, ʃ/ (Adeniyi 2015a:12-13). This resulted in a lot of disparity between his phonology and that of adults and it captures why his speech was said to be childish.

2. Research Method

2.1. The Subjects

The subjects of this research comprised four children; Iyinoluwa (IY), Araoluwa (AR), Joshua (JS), and Tumininu (TU)[2]. At the time of data collection, all the four children resided in Ile-Ife, south-western Nigeria. The four children were bilingual in Yoruba and English. While TU and JS were three years, eight months (3;8)

[2] We thank the parents of the four children, who granted express approval for their children's participation in this research, were present throughout the elicitation periods, and assisted in encouraging the children to respond to questions.

and two years, four months (2;4) old respectively at the time of data collection, IY and AR were followed longitudinally. For IY, data were collected at ages two years, three months to two years five months (2;3-2;5), two years, ten months to three years (2;10-3;00), and three years, four months (3;4), whereas AR's data were collected in two phases; first for one week when he was aged two years, one month (2;1), and then for another week when he was two years, five months (2;5) (Table 5)[3]. Specifically, IY and AR were acquiring Yoruba primarily, with English being secondary. This is evident in the fact that, at home, Yoruba was the language of communication; interaction between the two children and their parents were done more frequently in Yoruba than English. Also, when IY and AR spoke English they often inserted Yoruba words, which indicated that they had acquired more of Yoruba lexicon than English at the time of data collection. The converse of this, whereby English may be inserted to make up for lexical deficiency in their Yoruba, was never observed. Speakers JS and TU, on the other hand, were acquiring English primarily and at the time of the data collection they spoke English more and habitually augmented their Yoruba with English lexical items. Also, the parents of speakers JS and TU emphasised that they were more comfortable with English than with Yoruba. For ease of referencing in the remainder of this article, the names and ages of the children are abbreviated as in Table (5).

Table 5: Abbreviations for data presentation

s/n	Code	Name/Age
1	IY/1	Iyinoluwa/2;3-2;5
2	IY/2	Iyinoluwa/2;10-3;00
3	IY/3	Iyinoluwa/3;4
4	AR/1	Araoluwa/2;1
5	AR/2	Araoluwa/2;5
6	JS	Joshua/2;4
7	TU	Tumininu/3;8

2.2. Data Items

In this article, "consonant sequence" has two possible interpretations; (i) in Yoruba, it refers to homorganic nasals followed immediately by a voiceless obstruent in the onset position of the following syllable, and (ii) in NEY it refers to clusters of

[3]Note that the sound system of IY presented in section 1.3 is of an earlier study of the speaker that covered only Ages 2;3-2;5. The speaker is followed further for this research and two more stages (2;10-3;00 and 3;4) have been added.

voiceless obstruents plus sonorants within single syllables. Although consonant sequences can also involve voiced obstruents plus sonorants in English, these are excluded because they are outside the focus of our argument. The research focused on voiceless obstruent-plus-sonorant sequences. This is because when the consonants are coalesced to yield a voiced obstruent output, it can be inferred that the [- Sonorant] and [+Voice] features of the output are specifically from the input obstruent and sonorants respectively. By this is meant that while only the input obstruent is realized in the output, the voicing must have come from the sonorant. This is not possible where the input obstruent is itself voiced because it is straightforward to posit a sonorant deletion analysis, which leaves only the obstruent with all its features in the output. This is why sequences of voiced obstruents plus sonorants are excluded from the data. In the light of this, the data used for this research comprised 44 Yoruba words containing syllabic nasals immediately followed by onset consonants of following syllables and 55 English words containing various kinds of consonant clusters. Most of these were words that the children were already exposed to in everyday life. These are complemented by nine Yoruba phrases containing the homorganic aspectual-marking nasal being followed by the onset consonants of following words. These are included in the data because the homorganic nasals are co-articulated with the following consonants in the flow of speech, and this creates the sequence being investigated.

2.3. Method of Data Elicitation

The data items discussed in section 2.2 above were not pre-conceived ahead of the research. Rather, speakers IY and AR were observed over time and words that they used in everyday lives were compiled into a wordlist. This implies that data from speakers IY and AR were collected in free play situations during which each of them was observed and relevant data from their natural conversations were transcribed. The limitation of this elicitation method is that data collected in this manner were limited to household items, words relating to basic activities that the children were exposed to, as well as words they had heard their parents and other adults around them use frequently. Data collection sessions were also subject to a lot of interruptions and noise. But data collected in such situations were of the natural speech of the children in the sense that they were not aware of the study and did not have to try to be more precise than their natural speaking. After this, supplementary data were compiled in a wordlist. The administration of this supplementary list involved saying the items and having the children repeat the words and phrases after the researchers.

For speakers JS and TU, the primary wordlist compiled from free play situations of IY and AR was merged with the supplementary wordlist to form a single wordlist. Data were elicited from them at different sessions. During the elicitation sessions, the researchers said the items in the wordlist one after the other and they were required to repeat after them. Their responses were transcribed phonetically in a notebook. Each session lasted at least two hours and was divided into phases ranging between 10 to 20 minutes. This was because every time the child's attention strayed, he/she was consequently afforded a break.

In instances of uncertainty in the qualities of sounds, the researchers usually pondered on these with attention on perceptual cues expected of different articulatory gestures and further repetitions were required before choices were made. This only means that items from an earlier phase of data collection, for instance, were re-elicited in later phases of the elicitation sessions in order to ensure accuracy. This was done with all the four children involved, and it was partly because recordings were not made due to unstable attention spans of children around the age range being studied[4]. Also, for all the children, the language of interaction depended on the language for which data were collected; for Yoruba data, questions were asked in Yoruba, and for English data, questions were asked in English.

2.4. Method of Analysis

Data analyses were divided into parts, according to languages. Furthermore, grammatical classes were considered in serialising analyses; specifically in Yoruba, consonant-sequences within lexical items were analysed separately from those within phrases. Also, in analysing the data, phonological phenomena not under study were ignored so far as they have no bearing on the result. Such phenomena include fricative stopping, assimilation, tone stability, the simplification of doubly-articulated sounds, and the palatalisation of nasal consonants.

3. Data Presentation and Discussion

3.1 Homorganic Nasals in Yoruba

When a nasal stop is immediately followed by an oral consonant in Yoruba, the place of articulation of the nasal must be adjusted to harmonise with that of the following consonant (Owolabi 2011:61). This is consistent with the conceptualisation of homorganic nasals in the literature (Napoli 1996:8, Matthews 2007:178). It has been reported that, when confronted with such nasal-oral consonant sequences, however, children often simplify them by omitting one of the sounds. This appears to be the strategy employed by speaker JS in examples (1a-i) where he simply deletes the nasal,

[4] Braine (1976: 494) observes quite explicitly that "two-year-olds are subject to well-known vagaries of attention and a certain waywardness in their motivations"

which is the more sonorous in each sequence. He does this to avoid consonant sequences altogether and a consequence of this is that the harmonisation of place of articulation then becomes unnecessary.

(1) Deletion strategy by JS

S/N	JS	Adult target	Gloss
a	àfầɲí́	àɱ̀fầní	benefit
b	fáfó	dáɱ́fó	bus
c	káké	k͡páŋ͜ḿkpɛ́	trap
d	pɛ́pɛ́	sɛ́ŋ͜ḿkpɛ́	calm down
e	sósó	ʃóńʃó	pointed edge
f	osoro	òǹsɔ̀rɔ̀	public speaker
g	kàkà	kàŋ̀kà	magnificent
h	fɛ̀fɛ̀	fɛ̀ɱfɛ̀	wide
i	pàtí	k͡pàǹtí	dirt

More data, especially from IY and AR who were acquiring Yoruba primarily, however, show that omitting one of the adjacent consonants may not be the primary strategy (2a-k). There is ample evidence that these children coalesce the consonants in each cluster, but this is only apparent when the post-nasal oral consonant is voiceless. This is because, as shown in examples (2a-k), both the nasal and the voiceless obstruent are not seen in the output; the sound that takes their place is rather the voiced counterpart of the obstruent. This suggests that the output sound combines the voicing of the nasal plus the minus sonorant feature of the obstruent. This may appear a little obscured by the place of articulation discrepancies in (2a-e,k). Even then, it will be noticed that labial-velars become bilabials in (2a, d-e) and labiodentals become bilabials in (2b-c, k). This is not arbitrary since the feature Labial is constant between the input and output in each case and this only points to the logicality of the handling of complex consonants by the children. This apart, the picture of coalescence in these data set is clear.

(2) Coalescence strategy

S/N	IY/1	IY/2	IY/3	AR/1	AR/2	JS	TU	Adult target	Gloss
a	bébé	bébé		bébé		bébé	bébé	k͡péŋ͜ḿk͡pé	short (e.g. of knickers)
b	àbàní	àbàní		àbàɲí			ãfãɲí	àɱ̀fàní	benefit
c	dᶻábó	dᶻábó	dᶻábó	dᶻábó	dʒábó		dã́fú	dáɱ́fó	bus
d	bábɛ́	bábɛ́	bábɛ́	bábɛ́			páḿpɛ́	k͡páŋ͜ḿkpɛ́	trap
e				bɛ́bɛ́				sɛ́ŋ͜ḿkpɛ́	calm down (slangish)
f	dᶻódᶻó	dᶻódᶻó		dᶻódᶻó			ʃóńʃó	ʃóńʃó	pointed edge
g		dᶻàdᶻò		dᶻàdᶻò			dʒàǹtò	dʒàǹtò	straight away
h		pàdᶻí		bàdᶻí			pàǹtí	kpàǹtí	dirt
i	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀			òǹsɔ̀rɔ̀	òǹsɔ̀rɔ̀	public speaker
j				òdᶻɛ̀		òdɛ̀	ũtɛ̀	oǹtɛ̀	stamp
k		òm̀bà		òbà		òbà	òǹfà	òɱfà	drawer

In some instances where both the homorganic nasal and the post-nasal consonant are voiced, it may appear that the children simply delete one of the clustering consonants (3a-e). But when we consider data that contain a homorganic nasal plus a following voiceless obstruent, as seen in (2a-k) it becomes apparent that although the nasal is dispensed with, its voicing shifts to and surfaces on the surviving obstruent such that the underlyingly voiceless obstruents in each of these utterances appear voiced. For speakers IY/1, IY/2, IY/3, AR/1, and AR/2 where data reflect longitudinal observation and are more natural in the sense that data collections were without their knowledge, coalescence is the primary strategy in (2a-k). It is noteworthy that speaker JS who favoured deletion, as shown in (1a-i), also coalesced in (2a, j-k), while speaker TU who appeared to be the most advanced in consonant sequence/cluster mastery also employed the coalescence strategy in (2a).

(3) Sequences of voiced homorganic nasal plus voiced consonant

S/N	IY/2	AR/2	JS	TU	Adult target	Gloss
a	amábá			anã́bá	aláŋ͜m̀g͡bá	lizard
b	èmúbà				èróŋ͜ḿgbà	thought
c	bádᶻa				k͡páńda	inferior material
d	àjá	àɲã́	àɲã́		àǹlá	personal name
e	paja	paɲa		paɲa	k͡panla	stock fish

3.2 Homorganic nasals in Yoruba phrases

The homorganic nasals in (4a-h) below are different phonetic realisations of the aspectual marker of continuity (ASP-CONT) in Yoruba. This aspectual marker is an independent grammatical unit in Yoruba, separated from both preceding and following words by word boundaries. For instance, the phrase ***ɔmɔ ń lɔ*** "the child is going" is more accurately represented as ***/# ɔmɔ # ń #lɔ # /*** in which case the aspectual marker */n/* is not in the same word with the consonant */l/* following it, hence can ordinarily not be said to be in a cluster with it. Word boundaries however do not interact in any way with the consonant sequence reduction attested in the speech of the children studied in this research. By this is meant that whether the consonants are adjacent within a single lexical item (as in examples 1-3 above) or across word boundaries (as in examples 4a-h below) is immaterial; the coalescence is executed alike since in both cases, the consonants in a sequence are going to be co-articulated in the same way.

In essence therefore, the word boundaries existing in adult language simply do not exist in children phonology at these stages. It is clear that speakers IY/2, AR/1, AR/2, and JS were consistent in coalescing the homorganic nasal with following voiceless obstruents in such a way that the voiceless consonants are then phonetically realised as voiced. The few exemptions here are (4e, g-h) where JS rather deleted the nasal. Notice also that in addition to coalescence, the tone on the final vowels becomes a phonetic falling contour in the output (IY/2 (4a, d-f), AR/1(4a, d, f), JS (4d, f)). Contour tones in Yoruba are results of tone spreading whereby after a low tone, a high tone is realised as a low-high (rising) contour and a low tone following a high tone is realised as a high-low (falling) contour (Bamgbose 1990:41). In (4a, d-f) the homorganic nasals bear high tone, while the tones following in each case is low, which creates the structural condition for the formation of a falling contour tone attested in IY/2 (4a, d-f), AR/1(4a, d, f), JS (4d, f). It is then apparent that while the homorganic nasal is dispensed with and its voicing remains on the following oral consonant, its tone also survives as evident in the falling contour tones.

(4) Homorganic nasals in Yoruba phrases

S/N	IY/2	AR/1	AR/2	JS	TU	Adult target	Gloss
a	obɔ̂/mobɔ̂	ɔ̌bɔ̂		mo: bɔ̀	mompɔ̀	moŋ͜ḿ k͡pɔ̀ 1sg ASP-CONT vomit	I am vomiting
b	mobí		jɔ̀bĩ	mo: bí		moŋ͜ḿ k͡pĩ́ 1sg ASP-CONT share	I am sharing
c	óbaʔuʔú		óbaʔuʔú	óbaʔuʔú	óḿpa kukú	ó ŋ͜ḿ k͡pa kukú 3sg ASP-CONT kill fowl	he/she/it is killing fowl
d	óbɔ̂	óbɔ̂		óbɔ̂	ó mbɔ̀	ó ń bɔ̀ 3sg ASP-CONT come	he/she/it is coming
e	od^{z}â		mód^{z}à	ota	mońt^{s}à	mo ń tà 1sg ASP-CONT sell	I am selling
f	ad^{z}ô	ád^{z}ô	a ńd^{z}ò	ád^{z}ô	á ńtò	a ń tò 1pl ASP-CONT queue	we are queuing
g	ód^{z}ɔji	ód^{z}oɲĩ	óʔɔnĩ	ókɔji	ó ŋ́kɔrĩ	ó ŋ́ kɔorĩ 3sg ASP-CONT sing song	he/she/it is singing
h	ód^{z}á	ód^{z}á	ód^{z}á	ósá	ó ńsá	ó ń sá 3sg ASP-CONT run	he/she/it is running

Whether heterosyllabic sequence or not, it has been proven that obstruents are more prone to voicing in a post-nasal environment than in any other (Hayes 1995:2, Hyman 2001:154). This means that nasals readily spread their voicing feature to following voiceless obstruents. It then follows that when the nasal is lost and the voiceless obstruent surfaces as voiced, we have a sound combining features of the two different input sounds.

It should be pointed out that specifically at age 2;11, IY/2 started to master the clusters of homorganic nasals plus oral consonants, beginning with bilabials. In the sequence of labiodental sounds he retains only the place feature 'Labial' after which he is able to produce the cluster (5a). In (5b-c) involving bilabial nasal plus bilabial stop, he alternates between the coalescence of the sounds and the outright production of both members of the sequences. But in (5d-e) containing clusters of labial-velar nasals plus voiced labial-velar plosives, he dispenses with the velar and sticks with the labial component of the consonants, which enables him to produce the clusters. Also, when speaker TU is considered, it will be observed that she consistently used clusters; except that labiodental nasal becomes alveolar (5a) and labial-velar nasal becomes bilabial

(5d-e). These would seem to indicate the possible age around which significant mastery of consonant clusters emerge in the acquisition of Yoruba.

(5) Progress in cluster mastery in Yoruba

S/N	IY/2	AR/1	AR/2	JS	TU	Adult target	Gloss
a	òm̀bà	òbà		òbà	òǹfà	òɱ̀fà	drawer
b	bɛ̀bɛ̀/dᶻɛ̀m̀bɛ̀		dʒɛ̀m̀bɛ̀	kɛ̀kɛ̀	kɛ̀m̀bɛ̀	kɛ̀m̀bɛ̀	big trousers
c	bɛ̀bɛ́/bɛ̀m̀bɛ́	bɛ̀bɛ́	bɛ̀m̀bɛ́	bɛ̀m̀bɛ́	bɛ̀m̀bɛ̀	bɛ̀m̀bɛ́	a kind of drum
d	baba/bamba	babã	bamba		bamba	g͡baŋ͜mg͡ba	openly
e	bãmbà	bàbà	bàm̀bà	bãbã	bàm̀bà	g͡bàŋ͜m̀g͡bà	big

Another significant indication from examples (5b-e) is the fact that both members of the consonant sequences are voiced. This suggests that voicing similarity between adjacent consonants supports mastery whereas voicing differences between them is consistently associated with the motivation to simplify as seen in examples (1-4).

3.3 Consonant Clusters in NEY

NEY offers a wider range of data on consonant clusters beyond those of homorganic nasals. It has been reported that at age 2;3-2;5, Speaker IY/1 consistently deleted segments when confronted with consonant clusters in a bid to conform all NEY words to the CV syllable structure (Adeniyi 2015a:11). A closer look at the data presented in Adeniyi (2015a:12) however suggests that in many instances, the child did not just delete sounds; he had already begun to retain features from deleted segments. For instance, the words “pray” (/ˈpreː/ in NEY) and “jumping” (/ˈdʒɔmpin/ in NEY) were rendered as [be] and [dʒɔbi] respectively; this shows that although he deleted /r/ and /m/, the voicing feature of these sounds were retained in the surviving consonants. His handling of clusters in NEY appears to have advanced with the expansion of his vocabulary in the sense that he no longer just got rid of one of the clustering consonants as is most often and naturally expected of children acquiring English. The principle that children delete one of the clustering consonants is contained in Radford, Atkinson, Britain, Clahsen, and Spencer (2009:98) and Rose and Inkelas (2011) to mention a few. On the contrary, IY handled this by fusing the consonants concerned. By this is meant that some features of the deleted consonant still show up in the surviving one such that the surviving consonant in place of a consonant cluster is really neither of the input consonants. In examples (6a-b) and (6c), the clustering consonants are [fl] and [fr] respectively; observe that in all of these instances, the resultant consonant in IY/2's speech is [b] which apparently includes the labial feature of [f] and the voicing of [l] and [r] respectively. Also, [pl] and [pr] clusters tend to consistently yield [b] (see also 6d-h). This retention of the labial feature is due to the fact that bilabial sounds were among the few sounds he was able to produce well at this stage. Speaker AR/2 on his part shows consistency in coalescing adjacent consonants. Not only that, he also shows retention of the bilabial feature similar to speaker IY/2's (AR/2:6a-e,g). This coalescence approach falls within what Rose and Inkelas (2011) regard as exotic.

(6) Consonant clusters involving labial sounds in IY/2 and AR/2

S/N	IY/2	AR/2	Adult target (NEY)	Gloss
a	bɔː	bɔː	flɔː	floor
b	bai	bai	flaɪ	fly
c	bai	bai	fraɪ	fry
d	beː	beː	pleː	play
e	bet^s	bet^s	plet	plate
f	beː		preː	pray
g	bet^s	bet^s	preːs	praise
h	bet^s		ples	place

Speaker JS presents a different picture (JS:7a-g), one consistent with the literature on this subject in the sense that he simply deletes the more sonorous member of each cluster. Speaker TU shows the most advanced mastery among the four children (TU:7a-b, d, g). In TU (7f) where she did not have the cluster, coalescence is again attested.

(7) Consonant clusters involving labial sounds in TU and JS

S/N	JS	TU	Adult target (NEY)	Gloss
a	fuɔ	flɔː	flɔː	floor
b	fai	flaɪ	flaɪ	fly
c	fai		fraɪ	fry
d	pe	pleː	pleː	play
e	pe		preː	pray
f	pes	bes	preːs	praise

g	pes	ples	ples	place

In clusters involving sounds that the children have not mastered, speakers IY and AR follow the substitution principle indicated for IY/1 in section 1.3 whereby /t, s, ʃ/ are phonetically realised as affricated [t^s] and /d, dʒ/ are realised as affricated [d^z]. Apart from these, both speakers execute the coalescence just as seen in data sets (2, 4, and 6). Notice that for IY/2, IY/3, AR/1 and AR/2 /sl/ is realised as [d^z] in (8b), IY/2 and AR/2 realised /str/ as [d^z] in (8c), and /ns/ as [d^z] in (8d). In all of these, the voicing in the output is always contributed by the deleted sonorants. Data IY/2 and AR/2 (8e-f) add a deeper view of the coalescence analysis, because rather than delete and leave voicing as its only trace, the sonorant /l/ also contributes its place of articulation to the output. This is because both speakers were yet to master articulation at the velar place and their usual substitution with /?/ was thus overridden by the availability of the alveolar place of the deleted sonorant. In the end, /k/ in these two words contribute only [-Son], and the deleted sonorant contributes everything else to the resultant sound. The fact that the deleted sonorant contributes not only its voicing, but also its place of articulation, lends substantial support to the view that what is happening in these cases can best be viewed as coalescence.

(8) Consonant clusters involving non-labial sounds in IY and AR

S/N	IY/2	IY/3	AR/1	AR/2	Adult target (NEY)	Gloss
a		bad^{z}in	bad^{z}im	bad^{z}in	vaslin	Vaseline
b	d^{z}ip	d^{z}ip	d^{z}ip	d^{z}ip	sli:p	sleep
c	d^{z}ɔd^z			d^{z}ɔnd^z	strɔng	strong
d	id^{z}ait^s			id^{z}and^z	insaɪd	inside
e	d^{z}ɔb			d^{z}ɔb	klɔ:b	club
f	d^{z}ap			d^{z}ap	kla:p	clap
g	d^{z}ajĩ			d^{z}aĩ	kraĩ	crying

As for the other speakers, JS still deletes the more sonorous member of the clusters, while TU shows that at age 3;8, she has learnt to produce consonant clusters in NEY (9a-g). One factor contributing to this mastery of speaker TU's is apparently her acquisition of English primarily. In this case she was more frequently exposed to the clusters of English than the other speakers.

(9) Consonant clusters involving non-labial sounds in JS and TU

S/N	JS	TU	Adult target (NEY)	Gloss
a		bastin	vaslin	Vaseline
b	tˢip	slip	sliːp	sleep
c	tɔt	srɔng	strɔng	strong
d	itˢais	insaɪd	insaɪd	inside
e	kɔf	klɔp	klɔːb	club
f	kap	klap	klaːp	clap
g	kaĩ	krajĩ	kraĩ	crying

4. Summary

How four children acquiring Yoruba and English handled the complexities of consonant sequences and consonant clusters during language acquisition has been discussed in this article. Data showed that two of the children, IY and AR, acquiring Yoruba primarily and English secondarily prefer to coalesce the sequence of homorganic nasal plus following consonants whether across syllable boundaries (within the same lexical items) (2) or across syntactic boundaries (in phrases) (4) in Yoruba. This is because in both instances they still have to co-articulate the adjacent consonants. In instances where they coalesce syllabic nasals plus a following voiceless obstruent in Yoruba, data showed that the output sound is always an obstruent combining the voicing feature of the nasal with [-Son] and [-Nasal] features of the input obstruent (2a-k,4a-h). These two children also employ the coalescence strategy in their acquisition of consonant clusters in English (6a-h, 8a-g). In the consonant clusters of English, the coalescence is such that the voicing quality of the more sonorant member of the cluster is retained along with the [-Son] feature of the obstruent. It has also been argued that this is due to the transference from their Yoruba to English since Yoruba was the more advanced language for them. Consonant coalescence is schematised in Figures (1a-b) below. In Figure (1a) the relevant features are [+Son], [+Nasal], and [+Voice] for the nasal consonant, and [-Son], [-Nasal], and [-Voice] for the voiceless obstruent. Whether the obstruent is a Stop or Non-stop is irrelevant since fricatives are converted to affricated stops by the two children involved. Notice then that it is essentially [-Son] and [+Voice] that characterise the output (since there cannot be [-Son, + Nasal] combination), and these were contributed one apiece by the two input consonants. The main manner in which Figure (1b) differs from Figure (1a) is in the sonorant being broader since it is not limited to only Nasals as in Figure (1a). Thus, the output of Figure (1b) is essentially the same as in Figure (1a), with each input sound contributing a feature apiece.

Figure (1a) Consonant coalescence in Yoruba

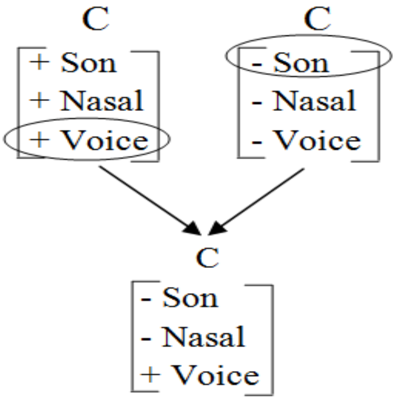
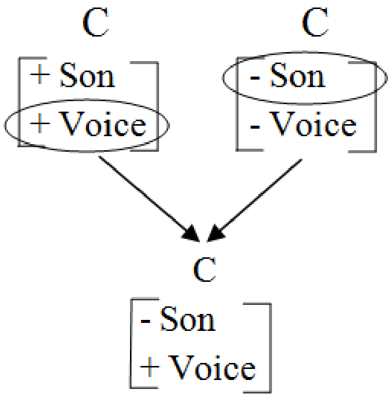


Figure (1b) Consonant coalescence in NEY



Speaker TU, on the other hand, was acquiring English primarily and Yoruba as the secondary language. She had mastered most of the consonant clusters of English and consonant sequences of Yoruba; it was only on a few occasions that she coalesced. At age 3;8, she was also the oldest of the four children. This then points to the role of age in her non-reduction of clusters: she had learnt them. Acquiring English primarily also has a significant implication when comparing with children acquiring Yoruba primarily. English has more consonant clusters than Yoruba, and a child acquiring it will certainly be exposed to more of them than one acquiring Yoruba primarily. Since the frequency of a child's exposure to a particular pattern enhances his or her mastery, it can be inferred that speaker TU's primary language contributed largely to her better mastery of clusters in English and this then carried over to her better handling of consonant sequences in Yoruba. On the other hand, speakers IY and AR's exposure to Yoruba more than English implied less frequent exposure to consonant clusters. Since the nasal-oral consonant sequence is even limited in Yoruba, it means the frequency of their exposure to these complex segments was even lower compared to speaker TU's.

It is worth noting that it is predominantly where the speaker is acquiring Yoruba primarily that consonant coalescence was the primary strategy for consonant sequence reduction. This means that coalescence is essentially a strategy employed by children acquiring Yoruba and it only interferes with their English. But with children acquiring English, simple deletion of the more sonorous member of a cluster is the preferred strategy at earlier stages of acquisition, as revealed by speaker JS's data.

Up to this point, data has essentially been on sequences of a voiced sonorant plus voiceless obstruents. This is the only possible combination in Yoruba since the homorganic nasals involved are inherently voiced. But in English where voiceless-voiceless sequences are also possible, it becomes necessary to make reference to how children IY and AR would handle these. Examples (10a-e) show that in these sequences, both children produce voiceless outputs.

(10) voiceless-voiceless sequences in IY and AR's NEY

S/N	IY/2	AR/1	Adult target (NEY)	Gloss
a	**at^{s}ait^s**		**aotsaid**	outside
b	**bit^{s}it^s**		**biskit**	biscuit
c	**t^{s}u**	**t^{s}u**	**stul**	stool
d		**pet^s**	**spes**	space
e		**pet^s**	**pest**	paste

This is evidence that the voicing in the coalescence data is not from the adjacent vowel, but has to be from the deleted sonorant consonant. If the voicing were results of assimilatory spreading from the adjacent vowels, then we would have expected the resolved sequences in (10a-e) to come out as voiced. The fact that they do not lends more support to the argument that what children IY and AR do at these stages of their phonological acquisition is coalescence.

5. Conclusion

A phonological process termed "consonant coalescence" has been articulated in this article. The description of coalescence for consonants in child phonology, as has been done in this article, cannot be regarded as an anomaly since advancing scholarship in child phonology, especially in non-western languages has been predicted to uncover even yet unattested phenomena (Rose and Inkelas 2011).

Further, our findings show that exposure owing to the primary language being acquired accounted for the different strategies employed by the children in dealing with the complexity of consonant sequences and consonant clusters.

That most of the existing research on child phonology has been on a small number of children and on western languages, especially English-speaking, is an established fact (Radford et al. 2009:96, Rose and Inkelas 2011). It is also important to note that the phenomena encountered in child phonology are almost as diverse as the number of children studied, stages at which they were, as well as the languages being acquired (Buckley 2003). This makes this article a contribution to child language acquisition from a less studied African Language. Although a large portion of our data was drawn from English, it should be emphasised that the English spoken by the children studied is significantly influenced by Yoruba.

It must also be reiterated that the manner in which speakers IY and AR handled consonant sequences at the stages reported in this article was significantly different from what is more widely-known in child phonology literature. Most accounts in the literature simply report the deletion of the most sonorous of the clustering consonants (cf. Smith 1973, Goad and Rose 2001, Radford et al. 2009, to mention only a few). However, an adequate analysis of speakers IY and AR's data requires that one goes some steps further. This is because there is clear evidence that they did not just delete the sonorous member of the cluster; they retained features that they were comfortable with (such as [Labial] and [Voice]) even if they had to then delete the rest. A corollary of this retention of some features of deletion candidates is that their approach is not in total conformity with the sonority hierarchy in the sense that they do not just select the least sonorous member of a cluster in order to achieve maximal difference with following vowels as indicated in Radford et al. (2009:104). Thus, their stray erasure does not apply to whole segments.

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Appendices: Wordlists

(1) Homorganic Nasals in Yoruba Words

S/N	IY/1	IY/2	IY/3	AR/1	AR/2	JS	TU	Adult target	Gloss
i	bébé	bébé		bébé		bébé	pémpé/ bébé	k͡péŋ͜ḿk͡pé	‘short’ (e.g. of knickers)
ii	d^zód^zó	d^zód^zó		d^zód^zó		sósó	ʃóńʃó	ʃóńʃó	‘pointed edge’
iii		àjá			àɲã́	àɲá		àǹlá	‘personal name’
iv		paja			paɲa	pala	paɲa	k͡panla	‘stock fish’
v		bád^za				pã́da	páńda	k͡páńda	‘inferior material’
vi		baʔɛ́jɛ́				nʔɛ́jɛ́	paŋkɛ́rɛ́	k͡paŋkɛ́rɛ́	‘cane’
vii		d^zàʔà				kàkà	kàŋ̀kà	kàŋ̀kà	‘magnificent’
viii		ʔã̀ʔã̀		d^zɔ̀d^zɔ̀/ʔɔ̀/ɔ̀		kɔ̀kɔ̀	kã́kã̀	kɔ̀ŋ̀kɔ̀	‘frog’
ix		ã̀ʔô				kô	àŋ̀kû	àŋ̀kô	‘group clothing’
x		nàʔɔ̂		ʔàʔɔ̂		kàlákɔ̀		làŋ́kɔ̀	‘giant snail’
xi		amábǎ				alábá	anã́bá	aláŋ͜m̀g͡bá	‘lizard’
xii	àbàní	àbàní		àbàɲí		àfàɲí	ã̀fã̀ní	àm̀fàní	‘benefit’
xiii		èmǔbà					erúḿbà	èróŋ͜ḿgbà	‘thought’
xiv		õ̀t^sɛ̀		òd^zɛ̀		òdɛ̀	ũ̀tɛ̀	oǹtɛ̀	‘stamp’

S/N	IY/1	IY/2	IY/3	AR/1	AR/2	JS	TU	Adult target	Gloss
xv	dᶻábó	dᶻábó	dᶻábó	dᶻábó		fáfó	dãfú	dáɱfó	bus
xvi	bábɛ́	bábɛ́	bábɛ́	bábɛ́		kákɛ́	páḿpɛ́	k͡páŋ͡mkpɛ́	trap
xvii			ɲaba	aba			lamba	laŋ͡mgba	youth
xviii			bɛ̀bɛ̀/bɛ̀mbɛ̀	bɛ̀bɛ̀		fɛ̀fɛ̀	fɛ̀ɱ́fɛ̀	fɛ̀ɱfɛ̀	wide
xix		dᶻàdᶻò		dᶻàdᶻò			dʒàǹtò	dʒàǹtò	straight away
xx		pàdᶻí		bàdᶻí		pàtí	pàǹtí	kpàǹtí	dirt
xxi						kútá	kúńtá	kúńtá	short
xxii	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀	òdᶻɔ̀jɔ̀		osoro	òǹsɔ̀rɔ̀	òǹsɔ̀rɔ̀	public speaker
xxiii			téńdé	dᶻédᶻé		tete	téńté	téńté	edge
xxiv				òʔà		ũkà	òŋ̀kà	òŋ̀kà	numeral
xxv			bíńtĩ́	bídᶻí		bitˢim	bĩ́ńtĩ́	bĩ́ńtĩ́	very small
xxvi				bóbó		popo	póḿpó	kpóŋ͡mkpó	club
xxvii				bɛ́bɛ́		pɛ́pɛ́	sɛ́ḿpɛ́	sɛ́ŋ͡mkpɛ́	calm down
xxiii				dᶻédᶻéjé		kékélé	kéŋ́kélé	kéŋ́kélé	small
xxix				óbò		dafo	bóńfò	bóɱ́fò	short dress
xxx		òm̀bà		òbà		òbà	òǹfà	òɱ̀fà	‘drawer’
xxxi		bɛ̀bɛ̀/dᶻɛ̀m̀bɛ̀			dʒɛ̀m̀bɛ̀	kɛ̀kɛ̀	kɛ̀m̀bɛ̀	kɛ̀m̀bɛ̀	‘big trousers’
xxxii		bɛ̀bɛ́/bɛ̀m̀bɛ́		bɛ̀bɛ̌	bɛ̀m̀bɛ̀	bɛ̀m̀bɛ́	bɛ̀m̀bɛ̀	bɛ̀m̀bɛ́	‘a kind of drum’
xxxiii		baba/bamba		babã	bamba		bamba	g͡baŋ͜mg͡ba	‘openly’
xxxiv		bãmbà		bàbà	bàm̀bà	bãbã	bàm̀bà	g͡bàŋ͜m̀g͡bà	‘big’

(2) Homorganic Nasals in Yoruba Phrases

S/N	IY/2	IY/3	AR/1	AR/2	JS	TU	adult target	gloss
i	obɔ̂/mobɔ̂		ǒbɔ̂		mo: bɔ̀	mompɔ̀	moŋ͡m̀ k͡pɔ̀ 1sg ASP-CONT vomit	'I am vomiting'
ii	mobí			jòbĩ	mo: bí		moŋ͡m̀ k͡pĩ́ 1sg ASP-CONT share	'I am sharing'
iii	óba ʔuʔú			óbaʔuʔú	óbaʔuʔú	óm̀pa kukú	ó ŋ͡ḿ k͡pa kukú 3sg ASP-CONT kill fowl	'he/she/it is killing fowl'
iv		óbɔ̂; ó mbɔ̀	óbɔ̂		óbɔ̂	ó mbɔ̀	ó ń bɔ̀ 3sg ASP-CONT come	'he/she/it is coming'
v	odᶻâ			módᶻà	ota	mońtˢà	mo ń tà 1sg ASP-CONT sell	'I am selling'
vi	adᶻô		ádᶻô	ádᶻô	ádᶻô	á ńtò	a ń tò 1pl ASP-CONT queue	'we are queuing'
vii	ódᶻɔji		ódᶻoɲĩ	óʔɔni	ókɔji	ó ŋ́kɔrĩ	ó ŋ́ kɔorĩ 3sg ASP-CONT sing song	'he/she/it is singing'
viii	ódᶻá		ódᶻá	ódᶻá	ósá	ó ńsá	ó ń sá 3sg ASP-CONT run	'he/she/it is running'
vix			ǒdᶻô			mońtò	mo ń tò 1sg ASP-CONT queue	'I'm queing'

(3) Consonant Clusters (in NEY)

S/N	**IY/1**	**IY/2**	**IY/3**	**AR/1**	**AR/2**	**JS**	**TU**	**adult target (NEY)**	**gloss**
i		bɔː			bɔː	fuɔ	flɔː	flɔː	floor
ii		bai			bai	fai	flai	flaɪ	fly
iii		bai			bai	fai		fraɪ	fry
iv		bai				fai	spaɪ	spaɪ	spy
v	be	bet^{s}		beː	bet^{s}	pe	pleː	pleː	play
vi	be	beː		beː		pe		preː	pray
vii		bet^{s}			bet^{s}	pes	bes	preːs	praise
viii		bet^{s}				pes	ples	ples	place
vix	pi	d^{z}ip	d^{z}ip	d^{z}ip	d^{z}ip	t^{s}ip	slip	sliːp	sleep
x		id^{z}aits			id^{z}and^{z}	it^{s}ais	insaɪd	insaɪd	inside
xi		d^{z}ɔd^{z}			d^{z}ɔnd^{z}	tɔt	srɔng	strɔng	strong
xii		d^{z}ajĩ			d^{z}aĩ	kaĩ	krajĩ	kraĩ	crying
xiii		d^{z}ɔb			d^{z}ɔb	kɔf	klɔp	klɔb	club
xiv		at^{s}ait^{s}				at^{s}at^{s}	aosaɪd	aotsaid	outside
xv	dʒoji	t^{s}oji				toji	stori	stori	story
xvi		d^{z}ap			d^{z}ap	kap	klap	klap	clap
xvii		t^{s}uː		t^{s}uː		t^{s}u	stuː	stuːl	stool
xviii		d^{z}ip				t^{s}ip	klep	klip	clip
xix		d^{z}ai				tai		traɪ	try
xx	pipa	bibat^{s}		bibait^{s}		tipas	slipas	slipas	slippers
xxi			bad^{z}in	bad^{z}im			bastĩn	faslin	vaseline
xxii	t^{s}it^{s}i	bit^{s}it^{s}						biskit	biscuit
xxiii		bet^{s}	bet^{s}	bet^{s}				plet	plate