Phonological processes in child language phonology

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Abstract: The current study presents some data of child phonology. The data is collected from a 2 year 10 months old child acquiring Saraiki. From the data different phonological processes like deletion, denazalization, harmony, lenition and fortition are observed. These phonological processes occur as direction of acquisition is from unmarked to marked phonemes and structures. The data is analyzed through optimality theory (Prince and Smolensky,1993). In the process of deletion, the child deletes a single sound as well as a complete syllable in disyllabic words. Substitution is another common process in the child phonology. At initial position, the child substitutes fricatives and other sounds with stops. It is also observed that sometimes fricatives change into aspirated stops as /su:rət/ is pronounced as /t^hu:rət/ . It means the child can perceive frication but she is unable to produce it. That is why she adds aspiration to stops in order to compensate the loss of frication. The process of denazalization occurs as the child can pronounce only oral stops at this stage of acquisition. The child follows the learning scale of stops >fricatives> nasals> liquids >glides. Therefore, substitution of all nasal sounds with oral stops is observed. In the above processes, it is clear that child follows a specific pattern in L1 acquisition.

Key words: *substitution, deletion, L1 acquisition, denazalization, Optimality Theory*

1. Introduction and background

Learning language is a natural process or it is a product of society (nature or nurture debate) is a debatable phenomenon (Johnson &Reimers, 2010). However, literature on language acquisition shows that the process of language learning, is the same as second language learning. In both cases, learning starts from unmarked to marked structure. The process of L1 phonology is a much, discussed phenomenon in the field of language acquisition. Different paradigms are under discussion by many researchers, some believe that learning process starts from perception which leads to production (Brown, 1998) but many researchers suggest that every child develops its own grammar (Vihman& Croft, 2007) which helps to learn the language in a definite order.

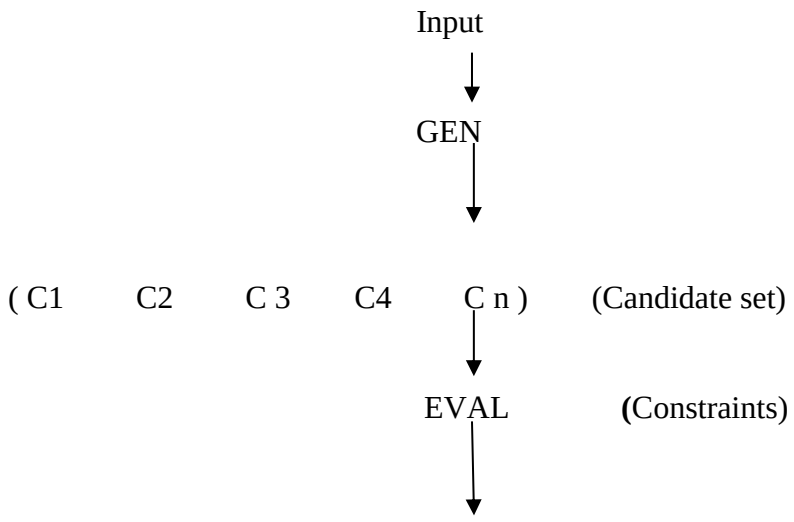
From the day first child's perception starts and after passing from different pre-linguistic stages (crying, babbling) a child speaks first complete word at the age of one year (Radford et. al, 2006). This first word more or less resembles to the input. According to Moffit (1971), a child can percieve the difference between /b/ and/g/ at onset position at the age of 5 months. But the ability of discriminating non-native sounds decreases with the passage of time (Best & McRoberts 2003, Best et al. 1995, Mattock & Burnham, 2006). It is because native language resists the perception of non- native sounds. It means perception leads to production (Best, 1994,1995) .

UG claims that coronals are the least marked sounds. According to Avery and Rice (1989), first, place contrast is acquired by a child. Jakobson (1968) was the first who introduced the universal

path of language acquisition and further explained that CV is the first syllable, which a child acquires. The current study will investigate the direction of language acquisition and OT is used to analyze the data.

Optimality theory was first presented by Prince and Smolensky (1993). Later on OT was presented in different versions, classical OT (Prince &Smolensky, 2004) and standard OT (McCarthy, 2008), etc. There are differences in constraint hierarchy of both versions. For example, the constraint FILL and PARSE of classical OT are substituted with DEP and MAX constraints in standard optimality theory. Optimality theory explains the input output relations (Tesar & Smolensky, 2004) in language acquisition. OT deals with two types of constraints, Markedness and Faithfulness constraints. Markedness constraints (*COMPLEX,*CODA, etc) demand the wellformedness of a structure and prohibit complex structure. Markrdness constraints demand to make the structure easier or more unmarked. Faitfulness constraints (DEP. MAX, IDENT-IO, etc) demand that input and output should be identical.

Optimality theory revolves around three fuctions; GENrator, EVAluator and CONstraints. The GENrator generates different candidates and EVAluator evaluates those candidates. The optimal candidate wins through certain constraint rankings. It is said that all constraints are part of universal grammar and are observed in every language. But these constraints have different ranking in different languages. In other words rankings of constraints are language specific. The input output relation is better explained in the OT model below;



Optimal output

In this study, OT is selected for analysis because it not only explains the reasons of selecting the winner candidate but also gives the justification for defeated candidates. Moreover, OT can better illustrate input-output relation, which is the main characteristic of child language acquisition. The current data is analyzed, in the light of standard OT (McCarthy, 2008). Optimality is the new and widely attested model in the field of first language acquisition as it explains the constraint rankings of input and output. It also explains that how child re-ranks constraints hierarchy in language acquisition. According to OT the place hierarchy of language acquisition is:

*DORSAL >> *LABIAL >> *CORONAL

The hierarchy shows that the first sounds, which a child acquired, are coronals then labials and at the end, the baby learns dorsal sounds. However, there is a controversy among researchers about the learning order. Jakobson (1968) says that front sounds are learned earlier and suggests the learning direction; **labial > coronal > dorsal**. At initial stages, child only violates the FAITH-IO because at the initial stages, child does not give any response to the input. Later on, s/he starts satisfying FAITH-IO and starts producing phonemes. Optimality theory explains the learning scale in terms of manner of articulation like that:

*GLIDES >> *LIQUIDS >> *FRICATIVES >> *STOPS >> FAITH -IO

It means, in the beginning, a child violates the constraint *STOP when s/he speaks only STOPS because FAITH-IO demands that the child remains faithful with the input. Slowly and gradually child re-ranks the constraint ranking, can produce every sound, and finally develops the constraint hierarchy of:

FAITH -IO >> *GLIDES >> *LIQUIDS >> *FRICATIVES >> *STOPS.

The current study will analyze the data which is taken from a baby who was learning her first language, Saraiki. Saraiki is one of the Pakistani languages and it belongs to Indo-Aryan family (Shackle, 1976). Saraiki is spoken in all four provinces of Pakistan but it is the first language of the people of Southern Punjab. It has rich phonemic contrast along with plosives and implosives. The consonant phonemic inventory of Saraiki is given in appendix.

For current study, the data is taken from a child at the age of 28 to 34 months. The baby was acquiring Saraiki as the first language. The first author is the mother of the baby and always

remains with the subject. The author listens to her very carefully and quickly notes the words she speaks. She was 28 months old when the authors started recording her speech and it continued until the age of 34 months. This is a very sensitive period of language acquisition as many developmental changes in the grammar of a child occur during this period. Development of different features in child grammar is also observed in this period. The data is recorded with proper dates and it will be very helpful to understand the direction of acquisition. In child phonology, different phonological processes are observed. In order to analyze the input-output relations optimality theory (Prince &Smolensky, 2004) is used. The data is also analyzed in the light of feature geometry (Clements & Hume, 1995).

2. Presentation and analysis of data

Different phonological processes namely Stopping, Substitution, Deletion, Denazalization and Lateralization are observed in the child grammar. These processes are presented in the following sub-sections.

2.1 Stopping

In child language phonology, stopping is very common and an attested phenomenon. In the initial stage of acquisition, a baby changes all other sounds into stops at word initial position. It is also very important to note that among stops, she prefers only coronals. She changes /f/, /z/, /l/, /n/ into coronal stop. This also shows the direction of learning which starts from coronals. It is important to note that apart from /f/ other sounds in the above list are also coronals but she changes them. The difference between /l/, /z/ and /d/ is the only feature [+cont]; it means the feature [cont] is still inactive in her grammar. However, /n/ which is also a coronal and [-cont] is also changed into /d/. Here the difference between these sounds is of the feature [nasal], /n/ is a nasal stop and /d/ is an oral stop. It also indicates that at this stage the baby can only produce oral stops. The following words illustrate the phenomenon.

(1)

In put	**out put**	**meanings**
i. /fərdos/	[dadoʃ]	firdos (name)
ii. /ludo/	[dudo]	name of a game
iii. /no.dəlz/	[do.dəʃ]	noodles
iv. /zəbʌrdəst/	[dəbadʌs]	excellent

The above data is recorded when she was 29 months old. It is also observed that at the age of 29 months, sometimes, she changes /f/ with /c^h/ sound, which is also a stop in Saraiki language (Shackle, 1976). This indicates that *FRICATIVE>>*STOP. This is further explained in the following tableau.

Tableau1: Stopping

/zəbʌrdəst/	*FRICATIVE-ONSET	*STOP-ONSET	IDENT-IO[cont]
(a) / zəbʌrdəst/	*!		
☞(b) / dəbadʌs/		*	***

***FRICATIVE-ONSET:** means no fricative onset.

***STOP-ONSET:** means no stop onset

IDENT-IO[cont]: explains input and output should be identical.

The tableau shows that the first candidate is defeated because it violates the higher ranked constraint *FRICATIVE but satisfies two lower ranks constraints *STOP-ONSET which is a markedness constraint and IDENT-IO which is a faithfulness constraint. Here IDENT-IO[cont] constraint demands that output should be identical with the input (Kager, 2010). The winner candidate violates this constraint three times but it satisfies the higher ranked constraint.

In the example (iv), the syllable structure of the input is CV.CVC.CVCC but the structure of output candidate is CV.CV.CVC. In the output of second syllable the child deletes the coda and it is worth mentioning that she retains the weight of the syllable in order to compensate the loss of coda. She deletes /r/ sound at coda position because it is marked and coda position itself is a marked position. In the third syllable she deletes stop /t/ and retains fricative /s/ in the final 'st' cluster. At this stage of language learning she is not able to produce 'st' cluster, therefore, she deletes /t/. It is because fricatives are perceptually salient than stops. It indicates that direction of learning is not only from unmarked to marked. But sometimes output is based on perceptual prominence.

In the process of stopping, all other sounds are substituted by stops at initial stage of learning but at the age of 2;8:15[1] the substitution of fricatives with aspirated stops at different places of

[1] 2 years; 8; months 15;days

articulation are observed. As the data in (2) show, the child substitutes all fricatives with aspirated stops. It is observed that the child produced /f/ as /p^h /, and /ʃ/ and /s/ as /t^h/. At initial stages, it is also noted that she replaces /f/ with /c^h/, which is also a stop in Saraiki language (Shackle, 1976, p.18). As it is a developing stage of language acquisition so she is able to perceive frication but cannot produce it properly. By adding aspiration to stops, means, she tries to compensate the loss of frication. At initial stages she substitutes fricatives and other sounds only with coronal but now it seems that she has developed other places of articulation. The following data confirms the substitution of place and sounds.

(2)A

Input	**output**	**meaning**
i. /fi:dər/	[c^hi:dər]	feeder
ii. /fon/	[c^h u:n]	phon
iii. /fo.tu/	[c^ho.tu]	picture
1v./fərdos/	[dadoʃ]	firdos (name)

(2)-B

iii. /ʃəmã/	[t^həmã]	candle
iv. /xətʌm/	[k^hətʌm]	finish
V. /xuʃ/	[k^h us]	happy
vi. /fələk/	[p^hlək]	falak
vii./fo.tu/	/p^ho.tu/	picture
viii./su.ra ʈ /	[t^hu.laʈ]	face
x. /zaənəb/	[daənəb]	name
xi. /sə.ci/	[t^hə.ti]	true
xii. /sə.mo/	[t^hə.mo]	sleep
xiii. /ʃæm.po/	[t^həm.po]	shampoo

In the example (i) /f/ is substituted with /c^h/, which makes it clear that at this stage labial place is still inactive. It is also obvious from the above examples that she is able to perceive the difference between fricatives and stops.

In the above data, it is clear that at this stage she substitutes all fricatives except /ʃ/ with the aspirated stops of the same place of articulation. In case of /ʃ/ sound which is substituted with

retroflex /t^h/ , it indicates that the child is unable to produce palatal sounds so she substitutes it with the sound of near place of articulation. The change of fricatives into aspirated stops with different place of articulation at initial stage and with the same place of articulation in the next stage clearly indicates development in child language acquisition. The constraint ranking of child at this stage is explained in the tableau below;

Tableau2: Substitution of /f/ with /c^h/

/f/	*FRIC	*LAB	DEP-IO Aspiration	*COR	IDENT-IO PLACE
/s/	*!		*	*	
☞ (b) /c^h/			*	*	*
(c) /f/	*!	*!			

***FRIC**; no fricative

***LAB**: demands consonant should not be labial

DEP-IO $_{\text{Aspiration}}$:do not epenthesis aspiration

***COR**: no coronal

IDENT-IO PLACE: input and output have same place.

The tableau shows that the candidate 'a' and 'c' are defeated because they violate the higher rank constraints in child grammar. The candidate 'b' is a winner candidate as it only violates the constraint, which is lower ranked in child phonology at this specific period of her life. This indicates the direction of place of articulation *LAB>>*COR. However, later on the baby re-ranked the constraint hierarchy, which is explained in the next tableau.

Tableau 3: Substitution of /f/ with /p^h/

/f/	*FRIC	IDENT-IO (place)	DEP $_{\text{Aspiration}}$	IDENT-[cont]
/ f/	*!			
(b) /c^h/		*!	*	*
☞ (c) /p^h/			*	*

In this tableau, the candidate ‘c’ is the winner because it only violates the lower ranked constraint and other two candidates are defeated as they violate those constraints, which are higher ranked in the child's grammar. This analysis also indicates that at this stage she can speak labial sounds as well as coronals. The data shows the direction of learning in child language phonology is * FRICATIVE>>*STOP. It means the first stage of learning is acquisition of stops and later on, the child acquires fricatives and other phonemes. Apart from substitution, it is also observed that sometimes the child only replaces the place of articulation and retains all other features. How a segment changes into another sound only by replacing the place of articulation is discussed in the next section.

2.2. Denazalization

Denazalization is a process in which a nasal sound changes and becomes an oral sound. Nasal sounds are those sounds in production of which air passes through nasal cavity. At early stages of language acquisition, it is noted that the child produced nasal sounds as oral. At the age of 33 months, it is observed that she changes all nasal sounds into oral. For example, in the given data, which is recorded in the age of 33 months, all nasal sounds are produced as non-nasal,

In put	**out put**	**meanings**
i./məkora/	[bəkola]	ant
ii. /na: t̪ /	[da: t̪]	Naat
iii./mo.ti/	[bo.ti]	fat
iv./mək^{h}ən/	[bək^{h}ən]	butter
vi./muk^{h}/	[buk$^{h]}$	fist

The most interesting thing from the above data is that the places of articulation of these nasal sounds are already active in child grammar. She is in a position to produce coronals and labials and these nasals are labial and coronals. Here the difference between the input and output is the only feature [+nasal] which is absent in the output. It means in her grammar still *NASAL-ONSET is higher ranked. The grammar hierarchy of denazalization for the subject is further explained through a tableau below.

Tableau 4: Denazalization

/na: t̪ /	*NASAL	MAX-C	*IDENT-[nasal]

(a) /a: t̪/		*!	
☞ (b) /da: t̪/			*
(c) /na: t̪/	*!		

***NASAL** means consonant should not be nasal

MAX-C demands output should contains maximum consonants

The constraint hierarchy of the subject shows that *NASAL, MAX-C>>IDENT-IO [nasal]. It means in the child grammar still [+nasal] feature is not active and the interesting thing is that she does not want to lose any phoneme. The candidate 'a' is defeated because it violates the higher ranked constraint MAX-C which is a faithfulness constraint and demands that output should contain the maximum consonants of the input. The candidate 'c' is also defeated as it violates the higher ranked constraint. The winner candidate is 'b' which only violates the lower ranked constraint IDENT-IO[nasal] but satisfies both higher ranked constraints. It indicates that the child's grammar has the constraint MAX-C higher ranked and the direction of learning is from oral to nasal stops, which are also according to the universal generalization.

In the above phonological processes observed in child phonology it is clear that she follows the ranking*DOR>>*LABIAL>>*COR and also follows the markedness scale of learning acquisition: Oral>Nasal. However, this is not the only way, which she prefers to follow in order to develop her language grammar. Some data, which is recorded from her speech, is not according to any universal generalization. For example,

In put	**output**	**meaning**
i./bəx.to/	[əx.to]	name
ii./mo.bail/	[a.ba il]	mobile
iii./ni.kəl/	[i.kəl]	out
iv./gal.la/	[al.la]	throat
v./ni.maz/	[i.ma ʒ]	prayer

The above data is taken when she was in between 33 to 34 months. This is the stage where she is able to produce nasal and oral stops but here in disyllabic words she deleted every stop at word initial position. Now the question is why she deletes stops if she has already acquired these sounds? It is also obvious from the literature of L1 acquisition that the acquisition process varies from child to child so it may be the only exception that is adapted by the baby.

2.3. Lateralization

Another thing, which is very common in child phonology, is lateralization (Smith, 2010). In this process, the child substitutes the /r/ sound with /l/. The following words from the subject also illustrate the phenomenon;

Input	**output**	**meanings**
i./kə.ri:m/	[kə.li:m]	cream
ii./es. ʈri/	[es.li]	iron
iii./kʌp.ɽa/	[kʌp.la]	cloth
iv./ k^hi:ra/	[k^hi:la]	cucumber
v./kursi/	[kul.si]	chair

In the given data, /r/ is changed into /l/ at onset and coda positions. The sound /r/ is a retroflex flap in Saraiki language. The main difference between these two sounds is the feature [anterior]. Phoneme /l/ is [+anterior] and /r/ is [-anterior] which is more marked. The child constraint hierarchy is further explained in the following tableau.

Tableau.5 Substitution of /r/ with /l/

/kur.si/	*Rhotic	*Laterals	IDENT-IO[anterior, lateral]
a. kur.si	*!		
☞b. kul.si		*	*

***Rhotic** demands consonant should not be rhotic.

***Laterals** means no lateral consonant

From the above tableau, it is clear that the candidate ‘a’ is defeated because it violates the higher ranked constraint, which demands that there is no /r/ sound in the output. In other words [anterior] feature may not be active in child phonology. The candidate ‘b’ is the winner candidate

because it satisfies the higher ranked constraint at the cost of the violation of two lower ranked constraints. If the acquisition of sound is the acquisition of features (Brown, 1998) then the question arises, when there is only a feature difference between /l/ and /r/, then the child should acquire [r]? The reason is, at this stage, the subject can produce /ʒ/ sound in different words, which is also [-anterior][2].But from the recorded data it is observed that /r/ is not acquired, indicating that apart from this active feature geometry, there may be other differences, one of which is, the position of the active articulator in the production of sounds. It is considered that /r/ is more marked because of the trilling. In Saraiki language /r/ is trill in which the tongue strikes the alveolar ridge continuously with force.Phonetically trill sounds are more marked, as the articulatory features involved require more effort. This could be the reason that she cannot produce /r/ sound at this stage of language acquisition. Therefore, she substitutes /r/ with /l/, which is relatively unmarked. As the process of acquisition starts from unmarked to marked so /l/ is acquired before /r/, making all the substitutions.

This is not the only substitution where she replaces /r/ with /l/, In the process of language acquisition the subject also changes /z/ into /ʒ/ in different words. Although /ʒ/ sound is not a part of Saraiki consonantal inventory. The following input output differences confirm the substitution of /z/ with /ʒ/.

	Input	**output**	**meanings**
i.	/a:.vaz/	[vaʒ]	voice
ii.	/ni.maz/	[i.ma ʒ]	prayer
iii.	/xər.buz/	[buʒa]	melon
iv.	/a.za:n/	[ʒa:n]	azaan

In the above examples, /z/ substitutes with /ʒ/ at word medial and final position. Although in all these words, unstressed syllable is deleted but it is not a part of our discussion. The most important thing is the production of /ʒ/ sound because it is not a part of input. The subject takes the input from the native Saraiki speakers and in Saraiki this sound does not exist. An important thing which is worth mentioning is that both these sounds are fricatives and /z/ is relatively unmarked than /ʒ/. According to Johnson and Reimers (2010) during acquisition process child replaces /ʃ/ with /s/ and alveolar /s/ with dental sounds and this process is known as fronting.

[2]/ C/ is [-ant] and is produced by the child .

However, in the current study, the subject changes the places of articulation in reverse direction. It means in the process of L1 acquisition there is no hard and fast rule in changing the place or manner of articulation. This analysis also makes it clear that the child acquires place and manner features in parallel form. It means every child can learn every sound and further activation and deactivation of sounds depends on the feature geometry of the L1.

3. Results and discussion

The analysis of the recorded data shows that in the process of language acquisition, the child follows the universal generalizations. For example, in the initial stage she can only produce coronal stops. At this stage, even, she changes nasal coronal stops into oral coronal stops. In the next stage, at the age of 32 months and 2 weeks she realizes the difference between stops and fricatives but cannot produce them correctly and substitutes with aspirated coronal stops. Later on, she changes the fricatives with the same place of articulation. It means the child first realizes the manner of articulation then comes to the place. However, the whole process of acquisition confirms the universal generalization of markedness regarding manner of articulation,

*GLIDES >> *LIQUIDS>>*NASALA >> *FRICATIVES >> *STOPS.

In place of articulation, the current data shows that coronals are the first sounds acquired but in case of dorsal and labial, it is not clear which place is acquired first. It is because at the same time labial fricative /f/ is changed into labial aspirated stop /p^h/ and velar fricative /x/ is changed into velar aspirated stop /k^h/. So the direction of place of articulation may be COR>LAB>DOR or COR>DOR>LAB. CORONAL>LAB, DOR

After acquiring the obstruent, the subject changes all nasal sounds with stops of the same place of articulation. Coronal nasal /n/ is changed into coronal stop/d/ and labial /m/ is changed into labial stop /b/. It means, at a stage she can also realize the difference between voiced and devoiced sounds because she did not replace /n/ with /t/ and /m/ with /p/. The process of Denazalization in the lexicon of the child implies that at the age of 33 still nasal features is not active in the subject's grammar. However, the most interesting thing at this stage is the deletion of all stops at initial position in disyllabic words. Although, at this stage, she was 34 and was able to produce stops but she deletes. The process of language acquisition, varies from child to child. Some children prefer to produce maximum phonemes and some want to maintain the

prosodic structure of the word. Therefore, the subject prefers to maintain the prosodic structure rather to produce the complete phonemes.

Two things, which are very important to note is the substitution of /r/ with /l/ and /z/ with /ʒ/. In the process of lateralization the child changes /r/ into /l/ and it happened when in child grammar the features of /r/ are not active. In the subject grammar, all features are active but she is not able to produce /r/. She can differtiate between these sounds when they are used in different words. The reason of the subject's failure to learn /r/ is the articulation of active articulator. There is a difference of tongue position in the articulation for /r/ and /l/ sounds. For /l/ position of tongue is relatively easier than in /r/ sound so, for ease of articulation the child produces /l/ instead of /r/. This is the reason that rhotics are learned later. The substitution of /z/ with /ʒ/ is the most interesting and important case in this study. Because it is said that every child learns the language of his/her own environment and Saraiki does not have /ʒ/ sound. So the question is, without input, how a baby can learn this sound? The answer is UG. It is clear that universal grammar remains active throughout the process of language acquisition and every child can learn every sound in different environments.

As the data is so small and it is collected from one baby so, we are not in a position to develop generalizations, but they can solve some problems in the field of L1 acquisition and pave the ways for further researchers.

Appendix Consonant inventory of Saraiki (Syed, 2013b)

	Voice	Aspirate	Labial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Plosive	- - + +	- + - +	p p^h b b^h	ʈ̪ $ʈ̪^h$ ɖ̪ $ɖ̪^h$		ʈ $ʈ^h$ ɖ $ɖ^h$	C c^h ɟ $ɟ^h$	K k^h g g^h	
Implosive			ɓ		ɗ		ʄ	ɠ	
Fricative	- +		f		s z		ʃ	X ɣ	ɦ

Nasal	+ +	- +	m m^h		n n^h	ɳ $ɳ^h$	ɲ $ɲ^h$	ŋ	
Flaps					R r^h	ɽ $ɽ^h$			
Lateral					L l^h				
Semi-Vowel			ʋ $ʋ^h$				j		

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