A Study on Intervocalic Consonant Clusters in Manchu*

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I

Despite the fact that Manchu began to be recorded as late as in the beginning of the 17th century the phonological study of Manchu presents inherently difficult problems. They are as follows: Firstly, Manchu being almost a dead language, there is no modern Manchu now whose older form is reflected in the written record. Secondly, Manchu spelling is stable and almost fixed since it has mainly the same shape it took in the 17th century. Thirdly, as is usually the case with other written records, the Manchu orthography of the 17th century does not reflect the phonological phenomena of that period well enough.

This paper deals with the phonotactic structure of Manchu with special emphasis on the syntagmatic structure of the word-medial consonant clusters as a means of throwing a light on the 17th century Manchu phonology. In other words, this paper attempts to investigate the word-medial consonant clusters in terms of the distribution and combination of consonants in Manchu.

There are some syntagmatic features which can be considered 'universal' as they occur in all languages whereas some features seem to be specific only to certain languages. Similarly we can expect to find in the phonotactic restrictions on the medial consonant clusters of Manchu both 'general' patterns and 'specific' patterns, and hope that such phonological phenomena will help us discover natural classes of phonemes as well as some important phonological rules. All I am trying to do in this paper is to find out to what extent this type of approach is justifiable and, if possible, to formulate a few phonological rules of Manchu.

Medial consonant cluster is defined as an intervocalic consonant cluster in a word or word group which has no juncture after, before or within the cluster (A.A. Hill 1958: 84-85). However, in the case of Manchu, the spoken form of which, now virtually extinct, is not available for examination, one can not but investigate consonant clusters occurring within the written form of words. In any study of the intervocalic consonant clusters the question of syllable division should be considered. The syllable division can come either before, after, or within the medial cluster -CC- but in Manchu there is a good reason to regard the syllable division as coming within the cluster -CC-, since it is unreasonable to

assign the medial consonant cluster to a syllable in view of the phonotactic restrictions in Manchu which do not allow consonant cluster in word-initial and word-final positions.

Manchu offers a large number of examples where the morpheme boundary comes within the –CC– cluster. To be able to set up precise phonological rules in Manchu, therefore, it is desirable to divide the –CC– structure into two different types, i.e. those including the morpheme boundary within the cluster and those without it. However, as the morpheme boundary is not only difficult to set up but also likely to complicate the total picture of Manchu phonology at the present stage of Manchu study, I shall leave out the problems of the morphological restrictions imposed by morpheme boundary. Exceptional as well as unnatural phonotactic structures occurring in the course of discussion in this paper which does not take the morpheme boundary into account, may be considered to be subject to morphological restrictions.

Ideally, a study of medial consonant clusters in Manchu should be expanded to include that of Tungus languages so that an authentic comparative study can be undertaken. As was stated earlier, however, I have confined myself only to the written Manchu record in this paper.

II

Table 1, given below, shows the phonotactic patterns of word-medial consonants occurring between the first and second syllables of the word listed in Ch'ing-wen-tsung-hui(清文總彙).

Table 1. Medial consonant clusters occurring between the first and second syllables of the word.

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
m	●	●	●	●	●	●	(○)	●	×	●	×	(○)	(○)	●	●	○	●
n	×	●	(○)	(○)	●	(○)	(○)	×	(○)	×	×	×	×	(○)	×	●	●
ng	×	(○)	●	(○)	○	●	×	(○)	(○)	●	×	(○)	×	●	○	○	○
b	×	●	●	×	●	●	×	(○)	×	(○)	×	×	×	●	○	○	●
t	(○)	×	(○)	×	(○)	○	×	●	(○)	×	×	×	×	×	×	×	×
k	×	●	×	×	●	×	×	×	×	×	×	×	×	●	○	○	●
l	●	●	●	×	●	●	●	●	●	(○)	×	×	×	(○)	×	●	○
r	●	●	●	○	●	●	○	●	○	(○)	×	○	×	●	○	○	●
s	×	(○)	(○)	×	(○)	○	×	●	(○)	×	×	×	(○)	×	×	×	×
ś														○			

●=frequent occurrence   ○=less frequent
(○)=rare   ×=non-occurrence
C1=coda of the 1st syllable   C2=onset of the 2nd syllable
(See appendix for detailed distributions of medial consonant clusters occurring between the 1st and 2nd syllables of the word in Manchu.)

In the table given above we can state the phonotactic restrictions on the medial consonant

clusters as follows:

(1) Two identical consonants normally do not form a cluster, with the exception of -tt-, -ss-.

(2) When C1 is filled by b, t, k (phonologically and structurally b is p), C2 is never filled by a nasal or a liquid.

(3) If C1 is filled by a nasal, C2 is most frequently filled by a homorganic stop.

(4) If C1 and C2 are both filled by a stop and C1 is labial ($-$coronal, $-$back), then C2 may be either dental ($+$coronal) or velar ($-$coronal, $+$back); if C1 is velar ($-$coronal, $+$back), C2 can only be dental ($+$coronal); if C1 is dental ($+$coronal) C2 may rarely be filled by either a labial or velar ($-$coronal) consonant. Similarly, when C1 is filled by a stop and C2 an affricate, if C1 is either labial or velar ($-$coronal), C2 can be filled by a dental ($+$coronal) affricate; but if C1 is dental ($+$coronal), C2 is never filled by a dental ($+$coronal) affricate.

(5) If C1 is nasal and C2 a stop, and if C1 is labial ($-$coronal, $-$back), then C2 may be either dental ($+$coronal) or velar ($-$coronal, $+$back); but if C1 is velar ($-$coronal, $+$back), C2 can never be filled by a labial ($-$coronal, $-$back) stop as in the case where C1 was filled by a stop. It is to be noted that homorganic consonant clusters like -mb-, -nd-, -ngg-, -mp-, -nt-, ngk-, which violate the more general phonotactic restriction on the medial consonant clusters in Manchu (cf. rule (1)) are excluded here.

(6) ng, or r can never occur in the position of C2 any more than they can in word-initial position.

(7) When C1 is filled by a liquid, free combination is possible except when the rules (1) and (6) apply.

(8) The restriction on C2 is the same whether C1 is filled by s ($+$coronal, $-$interrupted, $+$strident) or t ($+$coronal, $+$interrupted, $-$strident).

Table 2. Medial Consonant Clusters Occurring after the 2nd syllable of the word.

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
m	●	×	×	●	×	×	×	(○)	×	●	×	×	(○)	●	●	●	○
n	×	●	×	×	●	×	×	×	×	(○)	×	○	×	(○)	(○)	●	●
ng	×	○	●	×	○	●	×	○	×	●	×	×	×	●	×	×	(○)
b	×	×	(○)	×	×	×	×	×	×	×	×	×	×	●	×	×	×
t	×	×	×	×	×	×	×	(○)	×	×	×	×	×	×	×	×	×
k	×	●	×	×	●	×	×	×	×	×	×	×	×	(○)	(○)	×	(○)
l	×	(○)	(○)	×	●	×	(○)	●	○	×	×	×	×	×	○	●	●
r	×	(○)	●	×	●	●	×	●	×	●	×	×	×	●	●	●	●
s	(○)	×	(○)	×	×	×	×	●	×	×	×	●	×	×	×	×	×
ś	×	×	×	×	×	×	×	×	×	×	×	×	×	×	(○)	×	×

Now let us move on to the syntagmatic structure of consonant clusters occurring after the second syllable of the word. The table 2 shows that the consonant clusters coming after the second syllable of the word are subject to further phonotactic restrictions. The consonant clusters given in Table 2 are all characterized by having the morpheme boundary within their –CC– structure. Apart from that, they are similar to those in Table 1, specially in the major phonotactic restrictions and conditions. If any, there seem to be different morphological conditions operating on phonological rules depending on the class of morphemes used. This problem, however, shall not be dealt with in the present paper.

III

In the tables 1 and 2 I have tried to work out phonotactic restrictions on the structure of medial consonant clusters in Manchu. As was mentioned earlier, this paper aims to examine the possibility of formulating the phonological rules of Manchu and of reassessing the phonological history of Manchu through a study of phonotactic restrictions on the consonant clusters.

It is worthwhile at this point to examine the way in which the consonant clusters have been formed in Manchu. Benzing (1955: 975-999) shows us in his reconstruction of the earlier state of Tungus the following medial consonant clusters:

　　*nb, *nd, *ns; *md, *mg, *mk, *ms; *lb, *lp, *ld,
　　*lt, *lg, *lk, *lm, *ls; *rb, *rp, *rg, *rk, *rm, *rs, *rč

Similarly, Ikegami (1971: 285-286) also shows the consonant clusters as follows:

　　*ns, *ng; *mg(*ŋb), *mŋ(*ŋm); *ŋg; *lb, *ld, *lt;
　　*rb, *rp, *rg, *rk; *bg(*gb), *pk(*kp); *gd, *ks, *kt

In this manner the medial consonant clusters are traced back to Proto-Tungus and ultimately to Proto-Altaic. As can be seen in the examples given above, some are phonetically very unnatural, but here suffice it to say that many consonant clusters in Manchu may have their origin in Proto-Tungus, thus confining myself to a discussion of Manchu.

In written Manchu the following word-final consonants occur (excluding loan-words): n, ng, r, k, b, s. All of these but n occur only in a small number of onomatopoeic or expressive words. Judging by the word-final syllable structure it seems that Manchu has basically an open syllable structure. And apparently the word-final syntagmatic structure has a very close relation to the syllable-final (coda). On the other hand one can see that in the written record of Manchu more consonants occur in the word-medial syllable-final position than in the word-final position. They are m, n, ng, b, t, k, l, r, s, ś, of which m, t, l, ś are not permitted in the word-final position. On the basis of the structural features mentioned so far one might surmise that some intervocalic –CC– clusters may have been derived from –CVC– when the intervening V dropped out.

That -CVC- structure gave rise to some medial consonant clusters -CC- in Manchu by dropping the intervening V is shown by deviation in Manchu spelling. For instance, the following examples of deviant spellings, selected from Hauer's dictionary (E. Hauer: 1952~1955) may be taken to testify the formation of some medial consonant clusters in Manchu:

A: Deviant spelling   B: Normal spelling

(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
(1) mC		nt	nd	bt	kt	lh	loh
man	mn	nt	nc	bt	mt	lś	liś
mud	mt	ns	nz	bś	bs	lj	lej
mut	mt	nś	ngkeś	**(5) tC**		lir	r
moh	mh	**(3) ngC**		tah	th	l	lag
meb	mb	ngd	ngt	th	tah	l	rul
mag	mg	ngj	ngg	th	ntah	lk	k
ms	mes	ngh(i)	ngs(i)	t	nt	l	nl
mh	mek	ngn	ngg	t	lt	lj	ld
mc	moc	nggiy	ny	tg	th	lj	lc
mś	moś	ngs(i)	nc(i)	tt	t	lf	lb
mn	men	ngs(i)	ngk(e)	**(6) d**		lm	mn
mk	mak	ngs	ngn	d	nd	ld	lt
mb(u)	b(u)	ngg	ngk	d	nt	lt	ld
mc	mj	ngk	ngg	**(7) kC**		lg	rg
mg	mh	ngn	n	kj	g	lj	lf
mj	mc	ngk	h	ks	s	ls	ms
(2) nC		**(4) bC**		kd	d	lg	lh
nd	nid	bih	bg	k	mg	lh	lg
nf	naf	bec	bc	k	ngk	**(9) rC**	
nl	l	bed	bd	kt	het	rec	rc
nc	c	buk	bk	kis(i)	kś	ruk	rk
nj	n	bk	buk	kć	kj	rug	rh
nj	j	bś	btaś	kd	kt	reg	rg
nt	t	bg	beh	kj	mc	reh	rh
n	nj	bs	bis	ks	ngs	remp	rp
n	nd	bh	bih	kt	kd	reś	rś
n(i)	ngg(i)	bk	g	**(8) lC**		rah	rh
nb	mb	bk	k	lah	lg	rak	rk
nc	nj	bed	b	lag	lg	ran	rn
nc	mc	bd	lt	lim	lm	roh	rh
nc(a)	nggiy(a)	bd	bk	lec	lc	rg	rag
nd	nt	bs	ks	ln	lan	rk	rek

(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
rn	ran	r	ril	rśuh	rsh	sk	sh
rs	res	rg	h	**(10) sC**		s	ngs
rk	rik	rś	r	suh	sh	**(11) others**	
rt	ret	ruk	k	sal	sl	ś	rj
rc	rac	rh	h	sc	saj	c	rc
rl	rul	rc	rj	sk	sok	c	nc
rn	ren	rh	·rs	sh	suh	j	nj
rd	rod	rg	rk	st	shút	ñk	bk
rc	rhoc	rh	lh	st	sut	h	sh
rś	raś	rk	rg	sk	suk	h(i)	ngg(i)
r	rah	rh	rg	sh	soh		
r	rul	rg	rh	sh	sg		

What could be the reason for such deviant spellings as are exemplified above? Presumably they may be due to dialectal differences, arbitrary change of pronunciation, different style of speech or spelling mistakes. Whatever the reason may be, it is not difficult to see that the normative spelling of Manchu presents many difficult problems from phonological view point. Here I would just like to point out that many –CC– clusters were derived from –CVC– structure and at the same time there were many instances of spelling alternation between –CVC– and –CC– in Manchu.

One can easily assume that in Manchu which has basically an open syllable type, the consonant cluster –CC– appeared within a morpheme or between morphemes as a result of vowel dropping and eventually, the resultant cluster –C1C2– underwent assimilation. The normative spelling of Manchu shows merely the result of such assimilation. But I should think that one could get an insight into the assimilation rules of Manchu consonants through the resultant forms.

In table 1 which shows the phonotactic patterns of the medial consonant clusters, one can postulate the following assimilation rules and these rules may be testified by deviant spellings in written Manchu and by some other means. Some of the important rules are given below.

1) Consonant assimilation in Manchu seems to be regressive in respect of the point of articulation. In the cluster –mb–, –nd–, –ngg– which have a fairly high frequency of occurrence (cf. Table 1), the nasals of C1 m, n, ng seem to have been assimilated regressively to b, d, g of C2. Non-occurrence of the clusters *nb, *n-g, *ngb, *ngd may be taken to mean that nasal(C1) has already been assimilated to stop(C2) in the place of articulation. This phenomenon is much more striking in Table 2. Likewise there are traces in Tongki Fuka Akú Hergen i Dangse which shows us that the same phenomenon occurred frequently between word boundary in a breath group.

　　　gisun be→gisumbe; morin be→morimbe

nasal→nasal /——(+) stop

    α point α point

There are some exceptions in Table 1 such as -md-, -mg-, -mt-, -mk- which violate the rules given above, but there are no such exceptions found in Table 2. Such exceptions also occur when two stops constitute a consonant cluster and they seem to be conditioned mainly by the strength of the influence of the determinant(C2) of assimilation.

2) When C2 is filled by a labial stop the clusters *-nb-, *-ngb-, *-tb-, *-kb- are not found to occur, which seems to testify to the strong influence of the labiality on the preceding consonant. If, however, C2 is dental it does not exert assimilative power on C1 filled by a labial or velar consonant (cf. -md-, -kd-), and when C2 is velar, it has assimilative power if the preceding C1 is dental whereas it does not if C1 is labial. In other words, as shown below, the three consonants may be arranged in the order of the strength of assimilative power as follows:

    b>g>d

3) Tables 1 and 2 seem to show that a very strong regressive assimilation of nasality existed in the history of Manchu. None-occurrence of the clusters -bn-, -tm-, -km-, -kn- etc. in Table 1 and 2 seems to be the result of nasal regressive assimilation.

    C→[+nasal]/——[+nasal]

4) In Tables 1 and 2 no clusters composed of two identical consonants are found to occur, which seems to indicate that a phonological rule was in operation which requires one of the two like consonants to be deleted. As an exception to the above rule, -tt-, -śś- may be quoted, but as a point of fact the examples of the -tt- cluster are very rare and it seems that forms like *uttu* and *tuttu* were actually pronounced [utu] and [tutu] (Seong 1976:97). Besides, many instances of -t-/-tt- alternation are found in Tongki Fuka Akú Hergen i Dangse:

    uttala(utala), batta(bata), tuttala(tutala), tuttabi(tutabi).

Despite the tendency in Manchu to avoid clusters composed of two like consonants or even two homorganic consonants (cf. -*bb-, -*bp-, -*bm-), clusters like -mb-, -nd-, -ngg-, -mp-, -nt-, -ngk- do occur. Of these exceptional clusters, however, -mb-, -nd-, -ngg- can be shown to have changed to mb→m, nd→n, ngg→ng by some general phonological rules (Seong 1976: 86-88; 1978:26), although this phonological rules seemed to be largely optional and at the same time morphologically restricted.

Up to now I have attempted to formulate a few assimilation rules operating between consonants in Manchu by examining the syntagmatic structure of word-medial consonant clusters. Although there are many points which I have not dealt with in detail in this paper, I shall be satisfied if the type of approach I have adopted in this study is justifiable.

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APPENDIX

Detailed Distribution of Intervocalic Consonant Clusters between 1st and 2nd Syllables of a word in Manchu

1. mC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
am	○	○	○		○	○		○						○		○	○
em	○	○	○	○	○	○		○									
im	○							○				○	○				○
om	○					○								○			○
um	○		○	○				○				○					
nam	○	○	○			○									○		
nem			○			○							○	○			

C1＼C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
nim								○									
nom								○									
kam	○				○	○				○							○
gam																○	
ham			○		○												
gom	○																
hom								○						○			
gúm	○																
húm	○																
bam	○																
bem	○																
bim	○														○		
bom	○																
bum	○																
pam				○													
pim				○													
sam	○	○		○										○			
sem	○					○				○				○			
sim	○				○			○		○							○
som	○									○							
sum	○			○													
śam	○			○													
śem				○													
śom	○																
śum	○		○	○													○
tam	○			○	○									○			
dam	○	○			○					○						○	
tem	○		○	○											○		○
dem	○				○					○							
tom														○			
dom	○									○							
tum			○	○										○			
lam				○													
lem				○													
lum	○																
mam			○	○			○										
mem	○																
mim	○													○			
cam	○	○						○		○				○			○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
cem	○																
cim						○											
com	○											○					
cum																	○
jam	○	○		○													
jem	○	○	○	○													
jim	○																
jom	○																
jum	○			○													
yam	○				○	○										○	
yem	○															○	
yom	○																
yum	○			○													
kem						○				○				○			
gen	○																
hem				○				○									
kim																	○
gim		○													○		
him																	○
kum	○	○	○														○
hum									○	○							
k'am		○															
fam	○							○									
fem	○			○													
fom	○																
fum	○			○													
wam	○																
wem	○			○													

2. nC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
an		○			○												○
en		○			○											○	○
in		○														○	○
on		○															○
un		○			○												○
nan		○			○												
nen		○															

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
nin					○	○										○	○
nun																○	
kan		○														○	
gan																○	○
han		○														○	○
kon																○	
gon																	○
hon		○			○												
hún					○												○
ban		○														○	○
ben																○	
bon					○				○								
bun																○	○
pan					○									○			
san		○												○			○
sen		○			○											○	○
sin		○															○
son					○											○	○
sun		○			○											○	
śan		○			○									○			○
śen					○												
tan					○											○	
dan					○											○	○
ten					○											○	
den		○															
ton		○			○											○	
don		○														○	
dun		○															
man		○											○			○	
men		○			○											○	○
min		○															○
mon																○	○
can																○	
cen		○															○
cin		○	○													○	○
con					○											○	○
jen		○															
jin																○	
jon		○															○
jun					○												

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
yan		○															
yen		○			○												
yon		○															
ken		○														○	
gen																	○
hen		○			○											○	○
gin		○			○											○	○
kun		○															
gun		○															
hun		○															○
fan		○															○
fin					○												
fon		○			○												
fun		○			○												
wan		○			○												○
wen		○														○	○

3. ngC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
ang			○														
eng			○			○											
ing			○		○												
ong			○		○	○											
ung			○			○											
nang			○														
neng			○														
ning		○	○			○											
niong			○							○							
nong			○														
nung			○							○							
kang			○	○						○				○			
gang			○														
hang			○			○				○				○			
kong			○											○			
gong			○														
hong			○			○											
gúng			○			○											
húng										○				○			
bang			○		○	○								○			

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
beng										○				○			
bing								○									
bong			○			○								○		○	○
bung			○							○						○	
pang			○											○			
ping	○		○														
pong					○												○
sang			○			○								○			
seng			○			○								○			
sing			○			○											
song			○			○											
sung			○			○											
śang			○			○				○				○			
śeng			○			○								○			
śong			○			○											
śung			○			○									○		
tang			○			○								○			
dang		○	○	○		○				○				○	○		
teng			○		○	○				○							
deng			○							○				○		○	
ting			○														
ding														○			
tong			○			○								○			
dong			○						○	○							
tung			○			○				○				○		○	
dung			○			○									○		
lang			○		○	○						○		○		○	○
leng			○		○	○						○		○			
ling			○											○			
long					○	○								○			
lung			○														
mang			○			○											
meng		○	○											○			
ming			○						○								
mong			○							○							
mung			○			○											
múng			○														
cang			○			○											
ceng									○								
cing			○			○				○							

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
cong			○			○											
cung			○														
jang			○													○	
jeng			○			○											
jing			○			○				○				○		○	
jong			○			○											
jung			○			○									○		
yang			○		○	○								○	○		
yeng			○											○			
yong			○			○								○			
yung			○		○	○											
keng			○			○								○			○
geng			○														
heng			○			○											
king			○			○											
kiong			○														
ging			○			○			○					○			
gioing			○														
hing			○			○			○					○			
hiong								○									
kung			○												○		
gung			○			○		○		○							
hung						○											
fang			○			○				○				○	○		
feng					○	○								○	○		
fing			○			○											
fong						○								○			
fung			○			○				○				○			
wang			○			○				○							
weng			○			○											

4. bC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
ab		○	○		○	○								○			
eb		○			○									○	○		○
ib					○	○											
ob			○		○												
nib																	○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	·c
kab						○								○			
gab					○									○			
hab			○		○										○		○
kob		○			○									○			○
gúb																	○
sab		○			○	○								○			○
seb		○				○								○		○	○
sib						○								○	○		○
sub						○								○			○
śab					○											○	
śeb					○					○							
śob						○											
tab														○	○		○
dab		○	○		○	○								○			○
teb						○								○			○
deb		○			○	○								○			
tob			○		○												○
dob					○	○											
lab		○			○									○			
leb		○				○											
lib						○											
mib														○			
mob														○			
cab		○	○			○											
ceb						○											
cib					○									○			
cob		○			○												
jab		○				○		○						○	○	○	○
jeb						○								○			
jib			○											○			○
jub						○											
yab														○	○		
yeb						○											○
keb														○			
geb			○			○								○			
heb		○			○												
hib					○									○			○
kub														○			○
gub														○			○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
hub						○											
feb			○											○			

5. tC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
at									○								
ot			○														
ut		○			○			○									
not								○									
gat								○									
kút						○		○									
bat						○			○								
bet								○									
bit								○									
but								○									
sit								○									
sot						○											
tat								○									
det								○									
tut					○												
dut								○									
cot								○									
het								○									
hit								○									
hut								○									
fat								○									
fet								○									
fit								○									

6. kC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
ak		○			○									○	○	○	
ek					○										○		○
ik		○			○												
ok		○			○									○		○	○
uk		○			○									○			○
nak																	○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
nek																	O
nik		O			O									O			O
nok																	O
nuk					O												O
kak														O			
gak		O															
hak														O	O		O
kok														O			
gok					O									O		O	O
hok					O									O			O
bak					O									O		O	O
bek		O			O												
bok					O									O	O		
buk		O			O									O			
pek					O												
pok														O			O
sak		O												O			
sek					O									O		O	
sik					O									O			
sok					O									O		O	
suk		O												O		O	
śak					O										O		
śok															O		
śuk															O		
tak		O			O									O			O
dak		O															
tek		O												O			
dek		O														O	
tok		O			O									O			
dok		O												O		O	
tuk		O			O									O	O		
duk		O												O		O	
lak		O															O
lek		O												O			O
lok		O												O			
luk		O												O			
mak					O									O		O	
mek					O												O
mik																	O
mok					O									O			O

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
muk		○			○									○		○	○
cak														○		○	○
cek																	○
cik					○									○		○	
cok					○												○
cuk																	○
jak		○			○									○		○	
jek		○												○	○		
jok					○									○		○	
juk		○			○											○	
yak														○			○
yek														○			
yok					○												○
kek					○									○			
gek		○															
hek		○			○												○
kuk		○														○	
guk		○												○			
huk					○									○	○		
fak		○												○		○	○
fek														○	○		○
fik					○												
fok					○											○	
fuk		○			○									○		○	
wak															○	○	
wek																○	○

7. 1C

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
al	○	○	○			○		○	○							○	○
el	○	○	○			○		○	○							○	○
il		○	○		○	○		○	○								
ol	○	○					○	○								○	
ul	○	○	○			○		○	○								○
nel								○									
nil			○		○			○									
kal	○				○	○	○									○	○
gal	○		○					○								○	
hal	○	○	○				○	○	○								

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
gol	○	○			○				○								○
hol	○	○			○	○		○									
gúl	○	○	○					○	○							○	
húl			○					○									
bal	○	○			○			○								○	
bel			○					○									○
bil			○		○			○								○	○
bol			○					○	○							○	
bul		○	○		○			○								○	○
pal					○												
pil			○														
sal			○					○	○							○	
sel	○		○				○	○	○								
sil		○	○		○	○		○	○							○	
sul		○			○	○	○										
śal								○									
śil			○														
śul		○						○	○								
tal	○		○		○	○	○		○								
dal	○	○	○					○								○	
tel			○														
del	○					○		○									
til		○						○									
dil	○																
tol	○	○	○					○									
dol	○								○								
tul	○		○			○		○									
dul	○	○	○														
mal			○		○	○		○								○	
mel	○					○			○							○	
mol					○			○									
mul		○			○	○		○	○								
cal			○			○		○									○
cel								○	○								
cil	○																○
col			○			○		○									
cul			○														
jal	○	○	○						○								
jel	○		○			○			○								

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
jil	○		○			○		○									
jol	○	○						○									
jul			○			○		○									
yal		○	○					○	○								
yel								○									
kel					○		○										
gel							○	○	○								
hel									○	○							
kil					○			○									
gil	○		○		○			○	○							○	
hil					○												
kul			○			○											
gul	○							○									
fal			○						○								
fel								○									
fiil					○												
fol						○		○									
ful		○	○			○	○	○	○	○				○			○
wal			○														
wel		○	○					○	○								

8. rC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
ar	○	○	○		○	○	○							○	○	○	○
er		○	○	○	○	○		○						○	○		
ir			○			○		○	○								
or		○	○					○						○			
ur			○					○						○			
nar			○					○									
ner			○			○											
nir			○			○		○									
nur								○									
kar			○		○	○		○	○								○
gar		○	○						○			○		○	○	○	
har		○	○		○	○		○						○	○		
kor		○				○								○			○
gor			○														
hor			○			○		○									
kúr		○															○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
gúr	○		○														
húr		○	○			○	○	○									
bar	○	○	○		○	○		○									
ber			○		○			○									
bir	○		○					○									
bor	○	○			○			○								○	○
bur		○	○		○	○						○					
búr					○												
par				○										○			
por				○													
pur				○													
sar	○		○	○	○	○		○		○		○		○			○
ser	○		○		○									○			
sir	○	○	○		○			○						○			
sor	○				○									○			
sur		○	○		○			○						○			
śar					○			○						○			
śer					○			○									○
śor		○	○					○									
śur		○	○		○			○									
tar	○		○				○	○	○	○				○			○
dar		○	○		○	○		○	○								
ter	○		○		○	○			○								
der	○	○	○		○	○		○						○			○
tor			○					○									
dor		○	○														
tur	○		○		○		○	○								○	
dur	○	○	○											○			
lar	○		○		○			○						○			
ler			○														
lir								○				○					
lor	○											○					
lur			○														
mar		○	○						○								
mer			○	○		○		○						○			
mor								○									
mur					○	○	○	○						○			○
car			○			○											○
cer			○														
cir			○			○		○									○

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
cor	○	○						○									○
cur	○		○					○									
jar			○			○		○								○	
jer		○	○	○		○											
jir			○					○									○
jor		○	○		○			○									
jur			○		○			○						○		○	○
yar		○	○		○	○	○	○						○		○	
yer					○			○									
yor		○															
ker						○			○								○
ger	○	○	○			○		○									○
her		○	○											○			○
kir							○	○						○			
gir		○			○	○		○									
hir			○					○									
kur	○	○				○											○
gur			○									○				○	
hur			○			○		○						○			○
far			○		○		○	○						○	○		
fer			○		○	○		○									
fir			○				○										
for			○		○	○	○									○	
fur		○	○				○	○		○				○			○
war		○	○			○											
wer		○															

9.　sC

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
as								○									
es								○									
is								○									
os								○									
us								○									
nas								○									
nis								○									
nus								○									
kas						○											

C1\C2	b	d	g	p	t	k	f	h	m	n	ng	l	r	s	ś	j	c
gas								○									
has								○					○				
kos						○		○									
hos								○									
hús								○									
bos								○									
bus								○									
ses								○									
sis								○									
śus								○									
tas			○					○	○								
das								○									
dos								○									
tus								○									
dus						○		○									
las								○									
los					○			○									
lus								○									
mis								○									
mos								○									
mus								○									
cas								○									
cis					○												
cos								○									
jus					○			○									
yas								○									
gis					○												
his		○						○									
kus						○											
gus								○									
fes								○									
fis								○									
fus								○									
was								○									