THE CONSTRUCTION OF A MIXED UNIT INVENTORY FOR MACEDONIAN TEXT-TO-SPEECH SYNTHESIS

Branislav Gerazov and Zoran Ivanovski, *Faculty of Electrical Engineering and Information Technologies, Skopje, Macedonia*

Abstract - *The paper presents in detail the construction process of the mixed inventory unit database used for the text-to-speech (TTS) system "Speak Macedonian". Units called quasi-diphones form the basis of the system's mixed inventory. The selection of the quasi-diphone units to be recorded from the complete diphone set of Macedonian is discussed in detail and a list of the chosen diphones is included in the paper. The selection was made to provide maximum synthesized speech quality at minimum inventory size. Details have been given of the recording and the unit segmentation process. The interface between the recorded audio and the TTS system was also discussed. The presented information may be of use for the development of future databases for TTS systems both for Macedonian and for other languages.*

Key words – *TTS, unit, mixed inventory, diphone, segmentation, recording*

1. INTRODUCTION

The three paradigms of Text-to-Speech (TTS) synthesis are articulatory, formant and concatenative synthesis, [1 - 3]. Up until the 1990's, TTS synthesizers predominately used articulatory and formant synthesis, both based on modeling the speech production process and thus both with a high development cost. Since then TTS systems became increasingly based on concatenative synthesis, which uses concatenation of prerecorded natural speech segments, also called units, to generate the requested speech output. This approach gives the synthetic speech a very natural sound while avoiding the expensive speech model development process, thus concatenative speech synthesis is extremely cost-effective and has allowed the proliferation of TTS systems across the globe.

Various unit lengths are used in concatenative synthesis, the longer the units the more natural the output speech, but the bigger the database. Most systems are based on diphones, which comprise two half-phones and the transition between them. Diphones usually number around 1000 per language and provide for reasonable speech quality. The most popular diphone based systems are AT&T's diphone based TTS system and Dutoit's MBROLA synthesizer [4, 5]. These systems are called monorepresented inventory systems because they mostly have only one recording of each unit to use for synthesis.

Modern state-of-the-art TTS system use expanded inventories with large unit databases with multiple units per phonetic content. The quality these systems relies heavily on the algorithms used for the selection of the most appropriate unit for concatenation, giving them the name unit-selection TTS systems. Famous unit-selection TTS systems are the Festival System from the University of Edinburgh and AT&T's NextGen synthesizer [6, 7].

To date two high quality systems have been developed for TTS synthesis in Macedonian: TTS-MK, a diphone based system developed at FON University, [8], and "Speak Macedonian", a mixed-length unit inventory system developed by the authors [9]. Both are monorepresented inventory systems.

The quality of the unit inventory is detrimental to the output speech quality of the TTS system, especially in monorepresented inventory systems. Because of this the creation of the inventory i.e. the recording and segmentation of the speech audio material is crucial to the overall quality of the TTS system, [10, 11, 12, 13].

This paper presents in detail the recording and segmentation process used in the creation of the unit inventory of the system "Speak Macedonian". It is by disseminating this information that we hope to contribute to future unit inventory developments.

2. DIPHONES VS. QUASI-DIPHONES

Although the phone is the basic acoustic unit of speech, synthesizing speech by concatenating phones yields poor results. This is because of the great difficulty in simulating the interphone transition. The more common approach is to use a unit that includes half of each phone and the transition between them, called a diphone.

The TTS system "Speak Macedonian" uses a unique mixed-rank inventory featuring two sets of units: phones and quasi-diphones. The quasi-diphone (further written q-diphone) is a unit we created as a variation of the classic diphone concept. The q-diphone differs to the diphone in the respect that it comprises the two phones in their entirety. This allows q-diphones to be concatenated naturally with regular phones and vice versa.

When the need arises of concatenation of two succeeding q-diphones, q-diphones are easily demoted to classic diphones by trimming and can thus be concatenated. The trimming is facilitated using transition markers that give the boundary location between the two phones within each q-diphone, with the cut set to half way between the transition marker and the end to be trimmed.

The use of q-diphones decreased the necessary size of the inventory which in turn decreased the development cost of the inventory, while maintaining high-quality output.

3. MACEDONIAN PHONES

Macedonian is comprised of 34 basic phones, 28 of which are represented with a unique letter in the alphabet. The letters together with their IPA (International Phonetic Alphabet) equivalents are presented in Table I. Of these, five

are vowels (/a/, /ɛ/, /i/, /ɔ/ and /u/), and the rest are consonants. Grouped according to the manner of articulation the consonants are comprised of: 6 plosives (/b/, /p/, /g/, /k/, /d/, /t/), 3 approximants (/j/, /r/), 7 fricatives (/v/, /f/, /z/, /s/, /ʒ/, /ʃ/, /h/), 6 affricates (/dʒ/, /tʃ/, /dz/, /ts/, /ʤ/, /c/) and 3 nasals (/m/, /n/, /ŋ/) [14]. The letter "л" reads /ɫ/ but also /l/ when preceding the front vowels /ɛ/ and /i/, and the approximant /j/. The letter "љ" reads /lj/. The cluster /lj/ was treated as a phone, due to its compactness and the tendency to palatize it in common speech. The phone /r/ can become syllabic /r̩/ when enclosed by consonants, as it is in: "првиот" /pr̩viɔ t/ (eng. the first), " 'рбет" / r̩bɛt/ (eng. spine) etc. Finally /n/ is velarized to /ŋ/ before /k, g/, as in "банка" /baŋka/ or "англиски" /aŋgliski/, [15]. The phones /l/, /r̩/ and /ŋ/ are coded with "w", "q" and "n" further in the text.

TABLE I
PHONE INVENTORY OF MACEDONIAN WITH CORRESPONDING IPA EQUIVALENTS

А	/ a /	И	/ i /	С	/ s /
Б	/ b /	Ј	/ j /	Т	/ t /
В	/ v /	К	/ k /	Ќ	/ c /
Г	/ g /	Л	/ ɫ /, / l /	У	/ u /
Д	/ d /	Љ	/ lj /	Ф	/ f /
Ѓ	/ ʤ /	М	/ m /	Х	/ x/
Е	/ ɛ /	Н	/ n /, / ŋ /	Ц	/ ʦ /
Ж	/ ʒ /	Њ	/ ɲ /	Ч	/ ʧ /
З	/ z /	О	/ ɔ /	Џ	/ ʤ /
S	/ ʃ /	П	/ p /	Ш	/ ʃ /
		Р	/ r /, / r̩ /		

3. MACEDONIAN DIPHONES

The set of diphones found in a language is an essential starting point for developing a diphone-based TTS system for that particular language. This is highly specific to the language at hand, and calls for its thorough phonetic analysis. Such an analysis for the Macedonian language was undertaken by the authors as presented in [16]. In the analysis, a set of 707 unique diphones was extracted from a large body of text in Macedonian, that totaled more than 2,3 million words. This diphone set served as the basis for the recording of the q-diphone unit inventory used by our system.

3. UNIT DATABASE

A. Selecting the Quasi-Diphones

A selection of diphones was made from the complete set of diphones for the recording of the q-diphone set in the unit inventory. The following sets of diphones were eliminated from the final recording list:

i) diphones that began or ended with silence – 62 in total. This was directly provided by the use of q-diphones which allow using a simple fade-in/fade-out at the boundary of word instead of diphones comprising silence.

ii) diphones that ended with a voiceless plosive (/p/, /k/, /t/) or affricate (/tʃ/, /ts/, /c/) – 114 in total. These phones are always preceded by a short period of silence due to their manner of articulation, i.e. there is a short stop in the airflow through the vocal tract which generates a build up of air pressure, that is released in a short burst to articulate the phone. This separates their waveform completely from the preceding phones, which have also little influence on their spectral content. This is because spectral coloring of a phone is largely influenced by the succeeding phone, because the vocal tract is already preparing to articulate it, termed coarticulation. The coarticulation effects of plosives on previous phones was seen as minor and disregarded. Fig. 1 shows spectral coloring for the plosive /k/ in two different phonetic contexts - /uka/ and /aku/. We can see that the coloring is influenced by the phones succeeding /k/ and not preceding. Also we can see that /k/ itself has little influence on the spectral content of its predecessors.

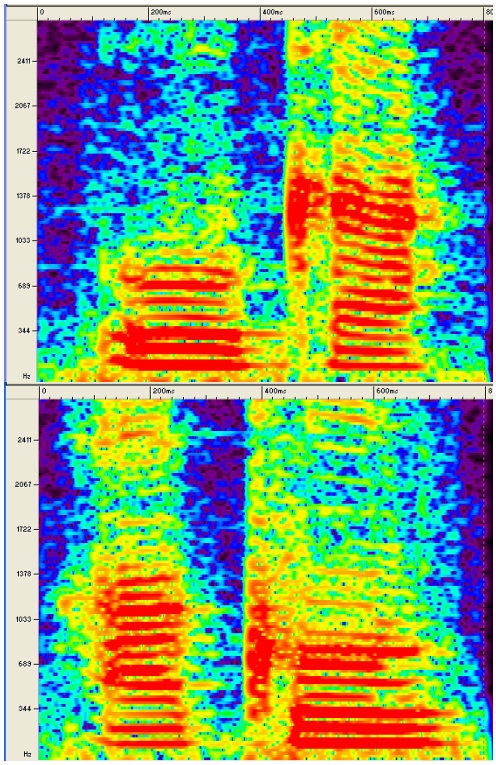

Fig. 1 – Spektral coloring of /k/ in two phonetic contexts: /uka/ (*top*) and /aku/ (*bottom*)

iii) diphones that ended with a voiced plosive (/b/, /g/, /d/),or affricate (/dʒ/, /dz/, /ʤ/) – 87 in total. In contrast to voiceless plosives and affricates these phones do not feature a complete stop in vocalization. Rather during the pressure buildup process airflow is maintained through the nasal cavity giving a nasal sound. Because of the low level of this nasal sound a smooth transition to it was seen as unnecessary to maintaining a high output speech quality. Fig. 2 illustrates the spectral behavior of /g/ in two phonetic contexts: /uga/ and /agu/. We can see that although /g/ is heavily influenced by the following phoneme it has little influence on its predecessors.

iv) diphones that comprised two identical phones – 12 in total. These can be easily obtained using the phone set.

Other q-diphone groups where also considered for elimination such as those containing fricatives, however due to coarticulation effects, they were included in the database, Fig. 3. This increased the database from the original 131 to 449 q-diphones, giving a reduction of 36% from the 707 full diphone inventory size. The recorded q-diphones are given in Table II at the end of this paper.

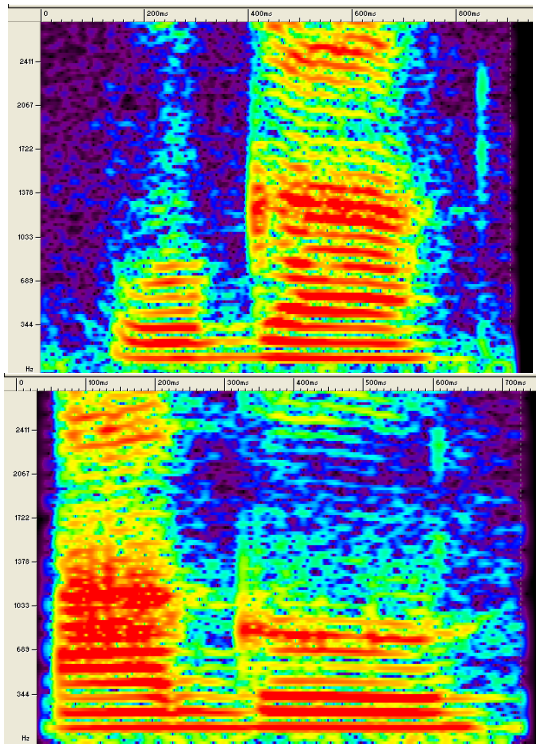

Fig. 2 – Spektral coloring of /g/ in two phonetic contexts: /uga/ (*left*) and /agu/ (*right*)

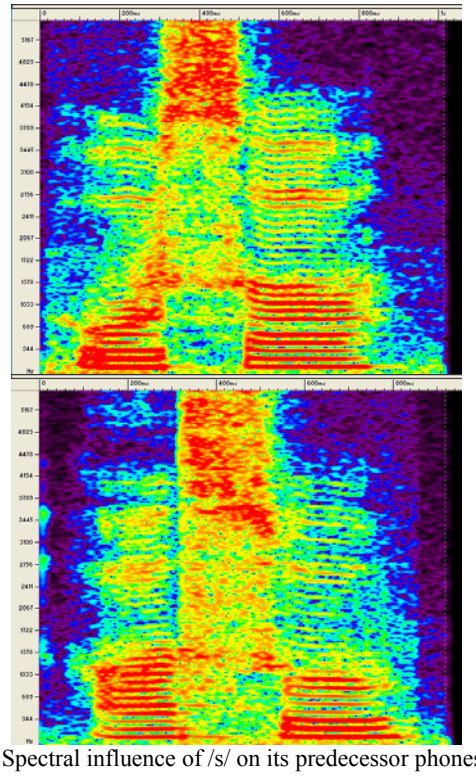

Fig. 3 – Spectral influence of /s/ on its predecessor phones can be seen in both phonetic contexts: /usa/ (*left*) and /asu/ (*right*)

B. Recording and segmentation

The set-up used for recording the audio needed for building the database featured a standard consumer microphone connected to a Lexicon Lambda audio interface, and a personal computer with audio editing software. The microphone was positioned at a 25 cm distance from the speaker at a 30^{o} angle from the speaker's central axis. This gave a good signal quality eliminating puffs from plosives and high levels from fricatives, while maintaining an acceptable signal level. The digitization was done with a 44.1 kHz sampling rate and a 16-bit resolution.

The total set of q-diphones was recorded in several sessions over a 3-day period. Each of the sessions was divided into recording time and segmentation. One of the authors' voices was used for the recording process. The units were extracted from direct unit vocalization, not from continuous speech. This allowed for a much more efficient recording and inventory creation process. A short subset (up to 10) diphones were spoken and recorded at a time, each of them spoken a minimum of 2, but for some diphones up to 10 times. Special attention was put on the clear pronunciation of the diphones at hand while maintaining normal speaking rhythm. The latter was important because putting the speaking focus on the diphones increased their duration in respect to their duration in normal speech. This was seen as problematic during the segmentation of some phones, such as plosives and affricates (/k/, /t▪/ etc.) which needed to be preserved in their entirety.

During pronunciation the q-diphones were enclosed in carrier syllables with no semantic meaning that were made up by the speaker during the recording process. These carrier syllables mainly comprised of two vowels added on each end of the q-diphone, except for the q-diphones that contained a vowel already. This was necessary in order to get proper amplitude levels for the diphones, which were not provided when the q-diphone was used at the beginning or the end of an utterances. Devoicing also precluded the use of some q-diphones at the end of utterances. Pitch frequency of the q-diphones was maintained by playing a reference 120 Hz drone to the speaker in the recording process.

These short recordings were then processed with a denoising algorithm based on spectral subtraction with a setting of -6 dB noise reduction at a +3 dB offset to the predicted noise level. This was necessary to eliminate the high frequency noise present in the recording due to the low quality microphone used.

After each diphone subset was recorded and denoised, the recording was analyzed and the best quality diphones were selected for segmentation. These were copied together with their surrounding phones to a master *wav* audio file where they were normalized. Normalization was based on the vowels as they are the loudest and were included in all carrier syllables. The following normalization levels were used: -8 dB for open and mid vowels (/a/, /ɛ/, /i/), -10 dB for closed vowels (/ɔ/, /u/), and -12 dB if the previous choices amplified the diphone of interest too much, e.g. when surrounding vowels were spoken at a lower level than usual. Some fricatives, such as /▪/, were normalized on their own to lower their level.

Finally, each q-diphone was marked with three markers. The first gives the start point of the first of the phones in the pair. This marker also holds the name of the q-diphone. The second marker gives the transition point between the phones, and the third the end of the q-diphone, Fig. 4. The marker data is saved in a separate *mrk* file, that is parsed by the system to extract the units from the audio file. The use of markers and a single audio file, allow easy database management. All unit corrections can now be done with simple marker repositioning, and the addition of new q-diphones is easily achieved by adding the q-diphone to the audio file and marking it. The TTS system automatically applies the changes to its inventory at run-time.

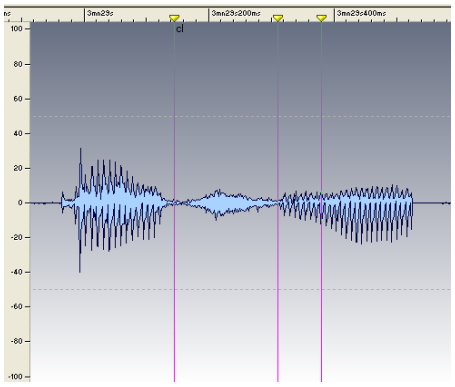

Fig. 4 - The quasi-diphone /c✖/ as contained in the master audio file delimited with markers

During the marker positioning special attention was paid to the unit length. As mentioned, due to the deliberate focus on the diphones, recorded phone lengths were greater than their average lengths in normal speech. Several unit lengths were used as standard for segmentation: 100 ms for vowels, 80ms for fricatives and affricates, 70ms for approximants, and 60ms for the rest. Some units were necessarily included whole such as plosives and affricates which were segmented with an included 30 ms stop duration. The absolute unit duration in the inventory is not detrimental to the rhythm of the output speech as unit lengths are modified using the pitch-synchronous overlap-add (PSOLA) algorithm during synthesis, however, the closer they are to the length required in synthesis the better the speech output quality.

At the end representative segments for each phone were chosen from the master audio file and were copied to another audio file that would comprise the phone set. The set contains 32 phones. The phones /l/ and /ŋ/ were not included, as they appear only in the diphones already contained in the q-diphone set. Two markers were used to select the phones.

The master audio file has a total duration of 3 min 50 s with a total q-diphone unit duration of 1 min 20 s, at a 175 ms q-diphone duration average. The size of the *wav* file is 19.4 MB, of which 6.63 MB go to the q-diphones. This gives a 34% efficiency which is understandable giving that q-diphones are usually selected from parts of the phone durations and other phones are included in the file as well as periods of silence. The second *wav* file has a total duration of 8.5 s with 2.6 s of phones at 30% efficiency, averaging to 82 ms per phone. The file size is 742 KB, of which 227 KB go to the phones. This data is summarized in Table III.

The TTS system used the marker data to create the unit inventory from the audio file. The names of the segments are extracted from the start markers and stored in a name matrix. No list of q-diphones is required in the TTS system for the inventory to be built. This allows easy inventory scalability. The audio for each q-diphone is extracted from the start marker to the stop marker and stored in a cell array. The positions of the transition markers for the q-diphones are also stored for use in the synthesis algorithm. Namely if one phone is mapped to two consecutive q-diphones such as /ɔ/ and /n/ are in the q-diphone mapping of the word /makɛdɔnski/ i.e. /ma/-/kɛ/-/dɔ/-/ɔn/-/ns/-/ki/, then the q-diphones /dɔ/, /ɔ n/ and /ns/ are degraded to classic diphones at the borders where they meet by disregarding the halves of the phones at borders relative to the transition markers. Transition markers are also used in the PSOLA algorithm to determine which part of the q-diphone is voiced and which is unvoiced, which is important for the pitch and duration modification process.

TABLE III – Q-DIPHONE AND PHONE UNIT SET DATA SUMMARY

		unit set	
		q-diphone	phone
wav total	duration	3min 50s	8.5s
	filesize	19.4 MB	742 KB
wav unit	duration	1min 20s	2.6s
	filesize	6.63 MB	227 KB
unit count		449	32
average duration		175 ms	82 ms
peak level [dB]		-5 dB	-7 dB
RMS power [dB]	maximum	-13 dB	-15 dB
	minimum	-35 dB	-52 dB
	average	-21 dB	-23 dB

4. CONCLUSION

The paper presents in detail the creation process of the mixed inventory unit database used for the TTS system "Speak Macedonian". The unit inventory is based on q-diphone units a set of which was selected from the complete diphone set of Macedonian. The criteria used in the selection process are discussed in detail and a list of the recorded q-diphones is included in the paper. The selection made provides maximum speech quality at minimum inventory size. Details have been given of the recording and the unit segmentation process. At the end, the interface between the recorded audio and the TTS system was also discussed. The presented information may be of use for the development of future databases for TTS systems both for Macedonian and for other languages.

REFERENCES

[1] Jurafsky D., J. H. Martin, "Speech and Language Processing: An introduction to natural language processing, computational linguistics, and speech recognition", 2 ed., Prentice Hall, May 2008

[2] O'Shaughnessy D., "Modern Methods of Speech Synthesis," IEEE Circuits and Systems Magazine, vol. 7, No 3, 3rd Quarter 2007, pp. 6 – 23.

[3] Lemmetty S., "Review of Speech Synthesis Technology", Ms. Thesis, Helsinki University of Technology, 1999

[4] Olive J., J. van Santen, B. Möbius and C. Shih. "Synthesis". In R. Sproat (Ed.), *Multilingual Text-to-Speech Synthesis: The Bell Labs Approach*, Kluwer, 1998.

[5] Dutoit T., V. Pagel, N. Pierret, F. Bataille and O. Vrecken, "The MBROLA Project: Towards a Set of High Quality Speech Synthesizers Free of Use for Non-Commercial Purposes", Proceedings of ICSLP 96, 1996.

[6] Black A., P. Taylor, "The Festival Speech Synthesis System: system documentation," Techincal Report HCRC/TR-83. Human Communications Research Centre, University of Edinburgh, Scotland, UK, Jan 1997.

[7] Beutnagel M., A. Conkie, J. Schroeter, Y. Stylianou, A. Syrdal, “The AT&T Next-Gen TTS System," Proc.of the Joint Meeting of ASA, EAA, and DAGA, Berlin, Germany, 1999.
[8] Чунгурски С., *Говорни синтетизатори на македонски јазик*, Докторска дисертација, Факултет за електротехника и информациски технологии, Скопје, Македонија, 2009.
[9] Gerazov B., G. Shutinoski and G. Arsov, “A Novel Quasi-Diphone Inventory Approach to Text-To-Speech Synthesis”, MELECON ’08, Ajaccio, France, May 5-7, 2008.
[10] Black, A. W. and Lenzo, K. "Optimal Utterance Selection for Unit Selection Speech Synthesis Databases", International Journal of Speech Technology, Vol. 6, p. 357−363, 2003.
[11] Lambert T., A. Breen, “A Database Design for a TTS Synthesis System Using Lexical Diphones”, INTERSPEECH 2004, Jeju Island, Korea, Oct 4-8, 2004.
[12] François H., O Boëffard, “Design of an Optimal Continuous Speech Database for Text-to-Speech Synthesis Considered as a Set Covering Problem”, Eurospeech 2001, Aalborg, Denmark, Sep 3-7, 2001.
[13] Bozkurt B., O. Ozturk, T. Dutoit, “Text Design for TTS Speech Corpus Building Using a Modified Greedy Selection”, Proc. of Eurospeech 2003, Geneva, Switzerland Sep 1-4, 2003.
[14] Бојковска С., Л. Минова-Ѓуркова, Д. Пандев и Ж. Цветковски, *Општа Граматика на Македонскиот Јазик*, Просветно Дело, 2008.
[15] Friedman V., “Macedonian”, SEELRC, Chapel Hill, USA, Aug 1-10, 2001.
[16] Gerazov B., Z. Ivanovski, “Diphone Analysis of the Macedonian Language for the Purpose of Text-to-Speech Synthesis”, ICEST 2009, Veliko Tarnovo, Bulgaria, Jun 25 – 27, 2009.

TABLE II
Q-DIPHONES INCLUDED IN THE UNIT INVENTORY

1	qn	51	бо	101	ѓе	151	зо	201	кв	251	нж	301	пф	351	ту	401	хн
2	qw	52	бр	102	ѓи	152	зр	202	ке	252	нз	302	пх	352	тф	402	хо
3	qв	53	бу	103	ѓн	153	зу	203	ки	253	ни	303	пш	353	тх	403	хр
4	qж	54	вq	104	ѓо	154	sq	204	кл	254	нл	304	pw	354	тш	404	ху
5	qз	55	вw	105	ѓу	155	sa	205	км	255	но	305	ра	355	ќа	405	цq
6	qл	56	ва	106	en	156	sв	206	кн	256	нр	306	рв	356	ќв	406	цw
7	qљ	57	ве	107	ew	157	se	207	књ	257	нс	307	ре	357	ќе	407	ца
8	qм	58	вж	108	еа	158	sи	208	ко	258	ну	308	рж	358	ќи	408	цв
9	qн	59	вз	109	ев	159	sp	209	кр	259	нф	309	рз	359	ќн	409	це
10	qњ	60	ви	110	еж	160	sy	210	кс	260	нх	310	ри	360	ќо	410	ци
11	qр	61	вј	111	ез	161	иn	211	ку	261	нш	311	рј	361	ќу	411	цл
12	qс	62	вл	112	еи	162	иw	212	кш	262	ња	312	рл	362	уn	412	цм
13	qф	63	вљ	113	ej	163	иа	213	лn	263	ње	313	рм	363	уw	413	цн
14	qх	64	вм	114	ел	164	ив	214	ла	264	њи	314	рн	364	уа	414	цо
15	qш	65	вн	115	ељ	165	ие	215	лв	265	њо	315	ро	365	ув	415	цр
16	we	66	во	116	ем	166	иж	216	лж	266	њс	316	рс	366	уе	416	цу
17	wи	67	вр	117	ен	167	из	217	лз	267	њу	317	ру	367	уж	417	чq
18	wj	68	ву	118	ењ	168	ij	218	лм	268	оn	318	рф	368	уз	418	чw
19	аn	69	гq	119	ео	169	ил	219	лн	269	ow	319	рх	369	уи	419	ча
20	аw	70	гw	120	ер	170	им	220	љњ	270	оа	320	рш	370	уј	420	чв
21	ав	71	га	121	ес	171	ин	221	ло	271	ов	321	сq	371	ул	421	че
22	ае	72	гв	122	еу	172	иња	222	лс	272	ое	322	сw	372	ум	422	чи
23	аж	73	ге	123	еф	173	ио	223	лу	273	ож	323	са	373	ун	423	чj
24	аз	74	гз	124	ех	174	ир	224	лф	274	оз	324	св	374	уњ	424	чл
25	аи	75	ги	125	еш	175	ис	225	лх	275	ои	325	се	375	уо	425	чм
26	ај	76	гл	126	жq	176	иу	226	лш	276	ој	326	си	376	ур	426	чн
27	ал	77	гм	127	жw	177	иф	227	ља	277	ол	327	сј	377	ус	427	чњ
28	аљ	78	гн	128	жа	178	их	228	љи	278	ољ	328	сл	378	уу	428	чо
29	ам	79	гњ	129	жв	179	иш	229	љо	279	ом	329	см	379	уф	429	чу
30	ан	80	го	130	же	180	jw	230	љу	280	он	330	сн	380	ух	430	ца
31	ањ	81	гр	131	жи	181	jа	231	мq	281	оњ	331	со	381	уш	431	цв
32	ао	82	гу	132	жј	182	jв	232	мw	282	ор	332	ср	382	фq	432	це
33	ар	83	дq	133	жл	183	jе	233	ма	283	ос	333	су	383	фw	433	ци
34	ас	84	дw	134	жм	184	jж	234	мв	284	оу	334	сф	384	фа	434	цм
35	ау	85	да	135	жн	185	jз	235	ме	285	оф	335	сх	385	фе	435	цо
36	аф	86	дв	136	жо	186	ји	236	ми	286	ох	336	сш	386	фи	436	цу
37	ах	87	де	137	жр	187	јл	237	мј	287	ош	337	тq	387	фл	437	шw
38	аш	88	дж	138	жу	188	јљ	238	мл	288	пq	338	тw	388	фн	438	ша
39	бq	89	дз	139	зq	189	јм	239	мн	289	пw	339	та	389	фо	439	шв
40	бw	90	ди	140	зw	190	јн	240	мњ	290	па	340	тв	390	фр	440	ше
41	ба	91	дј	141	за	191	јо	241	мо	291	пе	341	те	391	фс	441	ши
42	бв	92	дл	142	зв	192	јр	242	мр	292	пи	342	ти	392	фу	442	шј
43	бе	93	дљ	143	зе	193	јс	243	мс	293	пј	343	тј	393	фш	443	шл
44	бз	94	дм	144	зж	194	ју	244	му	294	пл	344	тл	394	хq	444	шм
45	би	95	дн	145	зи	195	јф	245	мф	295	пљ	345	тљ	395	ха	445	шн
46	бј	96	дњ	146	зј	196	јх	246	мш	296	пн	346	тм	396	хв	446	шњ
47	бл	97	до	147	зл	197	јш	247	нw	297	по	347	тн	397	хе	447	шо
48	бљ	98	др	148	зљ	198	кq	248	на	298	пр	348	то	398	хи	448	шр
49	бм	99	ду	149	зм	199	кw	249	нв	299	пс	349	тр	399	хл	449	шу
50	бн	100	ѓа	150	зн	200	ка	250	не	300	пу	350	тс	400	хм		