Sound Correspondences in the World's Languages: Online Supplementary Materials

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SOUND CORRESPONDENCES IN THE WORLD'S LANGUAGES: ONLINE SUPPLEMENTARY MATERIALS

CECIL H. BROWN
Northern Illinois University
and *University of West Florida*

ERIC W. HOLMAN
University of California, Los Angeles

SØREN WICHMANN
Max Planck Institute for Evolutionary Anthropology

Application of the sound correspondence-recognition program to the ASJP database identifies 692 correspondences between nonidentical symbols. These are transcribed in ASJPcode. There are a total of 139 different symbols involved in the correspondences, including simple, modified, and compound symbols, along with *, ", and Ø (the null set) counted as simple symbols. Detailed description of ASJPcode is given in §2.1 of the main article. For convenience in interpreting the phonological symbols of ASJPcode used in this supplement, Tables 1 and 2 of §2.1 of the main article, which give the description of and IPA values for simple ASJPcode symbols, are repeated here, labeled as Table S1 and Table S2.

ASJPCODE SYMBOL	DESCRIPTION	IPA SYMBOLS
p	voiceless bilabial stop and fricative	p, ɸ
b	voiced bilabial stop and fricative	b, β
f	voiceless labiodental fricative	f
v	voiced labiodental fricative	v
m	bilabial nasal	m
w	voiced bilabial-velar approximant	w
8	voiceless and voiced dental fricative	θ, ð
4	dental nasal	n̪
t	voiceless alveolar stop	t
d	voiced alveolar stop	d
s	voiceless alveolar fricative	s
z	voiced alveolar fricative	z
c	voiceless and voiced alveolar affricate	ʦ, ʣ
n	alveolar nasal	n
r	voiced apico-alveolar flap and all other varieties of 'r-sounds'	ɾ, r, ʀ, ɽ
l	voiced alveolar lateral approximate	l
S	voiceless postalveolar fricative	ʃ
Z	voiced postalveolar fricative	ʒ
C	voiceless palato-alveolar affricate	ʧ
j	voiced palato-alveolar affricate	ʤ
T	voiceless and voiced palatal stop	c, ɟ
5	palatal nasal	ɲ

(Table S1. *Continues*)

ASJPcode symbol	description	IPA symbols
y	palatal approximant	j
g	voiced velar stop	ɡ
x	voiceless and voiced velar fricative	x, ɣ
N	velar nasal	ŋ
q	voiceless uvular stop	q
G	voiced uvular stop	ɢ
X	voiceless and voiced uvular fricative, voiceless and voiced pharyngeal fricative	χ, ʁ, ħ, ʕ
h	voiceless and voiced glottal fricative	h, ɦ
7	voiceless glottal stop	ʔ
L	all other laterals	ʟ, ɭ, ʎ
!	all varieties of ‘click-sounds’	!, ǀ, ǁ, ǂ

TABLE S1. ASJPcode consonant symbols and their IPA values.

ASJPcode symbol	description	IPA symbols
i	high front vowel, rounded and unrounded	i, ɪ, y, ʏ
e	mid front vowel, rounded and unrounded	e, ø
E	low front vowel, rounded and unrounded	æ, ɛ, œ, ɶ
3	high and mid central vowel, rounded and unrounded	ɨ, ɘ, ə, ɜ, ʉ, ɵ, ɞ
a	low central vowel, unrounded	a, ɐ
u	high back vowel, rounded and unrounded	ɯ, u
o	mid and low back vowel, rounded and unrounded	ɤ, ʌ, ɑ, o, ɔ, ɒ

TABLE S2. ASJPcode vowel symbols and their IPA values.

The 692 correspondences are presented in Appendices A and B (below), along with three properties relevant to the frequency of each correspondence**. NG** is the number of language genera in which the correspondence is identified. **AG** is the number of genera in which the two corresponding sounds are frequent enough for a correspondence between them to be identified if it is actually present. **CP** is the correspondence percentage, which is **NG/AG**, expressed as a percentage. These properties, especially **CP**, are described in more detail in §2.3 of the main article.

Appendix A lists correspondences rank-ordered by value of NG within each of three sections. Section A1 is restricted to the 582 correspondences involving consonants. These include correspondences in which consonants are paired with consonants and in which *, ”, and Ø as simple symbols are paired with consonants. Section A2 is restricted to the sixty-four correspondences involving vowels. These include correspondences in which vowels are paired with vowels and with Ø. Section A3 is restricted to the forty-six correspondences in which vowels are paired with consonants and with * and ”.

Appendix B presents every correspondence in which any of the 139 symbols occurs. This appendix is designed to enhance the efficiency of manual search for correspondences. Correspondence groups for consonantal symbols are listed first, ordered by the position in the oral cavity in which consonants are produced, from front to back. These are followed by groups for *, ”, and Ø, and then by groups for vowel symbols, rank-ordered by position, from front to back, and then by height within position rank, from high to low.

Appendix C presents a matrix of CP for all pairs of the thirty-one most common simple consonants. Appendix D presents a matrix of CP for all pairs of the seven simple vowels. Appendix E presents the correlations and *p*-values between CP and published similarities that are summarized in §5 of the main article. Appendix F presents the matrices from Mielke 2012 that are used in §6.

APPENDIX A: COMPENDIUM OF WORLDWIDE SOUND CORRESPONDENCES

Appendix A lists all 692 sound correspondences produced through automation, and gives NG, CP, and AG for each correspondence. The appendix has three sections: §A1, restricted to the 582 correspondences in which no vowels are involved, including correspondences in which *, ”, and Ø as simple symbols are paired with consonants, in addition to consonants paired with consonants; §A2, restricted to the sixty-four correspondences in which no consonants are involved, including correspondences in which vowels are paired with vowels and with Ø; and §A3, restricted to the forty-six correspondences in which vowels are paired with consonants and with * and ”. In each of these sections, correspondences are rank-ordered by NG from largest to smallest. Within each NG rank, correspondences are further ordered by CP from largest to smallest.

Section A1: Correspondences not involving vowels

CORRESPONDENCE		NG	CP	AG
Ø	h	55	20.68	266
l	r	48	18.39	261
d	t	32	12.08	265
g	k	31	12.86	241
N	n	30	14.02	214
Ø	k	30	9.04	332
S	s	29	19.08	152
b	p	29	11.79	246
h	x	27	20.45	132
Ø	n	25	7.44	336
Ø	7	24	12.57	191
r	d	23	9.31	247
Ø	y	23	7.32	314
Ø	w	22	7.28	302
Ø	l	20	6.85	292
Ø	r	20	6.60	303

CORRESPONDENCE		NG	CP	AG
C	c	19	16.24	117
h	s	19	7.79	244
v	b	18	15.93	113
kh	k	17	25.00	68
w	v	17	15.89	107
7	k	17	9.19	185
Ø	t	17	5.18	328
L	l	16	20.00	80
5	n	16	10.46	153
c	s	15	10.71	140
Ø	m	15	4.46	336
T	C	14	19.72	71
f	p	13	11.71	111
*	n	13	11.50	113
y	j	13	10.92	119
w	b	13	5.02	259
th	t	12	17.39	69
q	k	12	15.79	76
z	s	12	11.01	109
x	k	12	7.59	158
Ø	g	12	4.80	250
h	k	12	4.63	259
n	d	12	4.44	270
y	r	12	4.35	276
7	h	11	6.67	165
C	s	11	6.11	180
C	t	11	5.88	187
h	p	11	4.80	229
y	l	11	4.07	270
l	n	11	3.81	289
Ø	s	11	3.65	301
X	x	10	23.26	43
Ø	N	10	4.65	215
l	d	10	4.20	238
r	t	10	3.42	292
s	t	10	3.39	295
r	n	10	3.34	299
kh	x	9	21.43	42
j	Z	9	18.75	48
Ø	x	9	5.63	160
r	z	8	7.48	107

CORRESPONDENCE		NG	CP	AG
Ø	d	8	2.93	273
m	b	8	2.83	283
n	m	8	2.41	332
ph	p	7	16.67	42
t	8	7	12.28	57
q	x	7	11.86	59
*	N	7	10.77	65
v	f	7	10.29	68
Ø	q	7	8.97	78
x	g	7	5.93	118
x	r	7	5.00	140
c	t	7	4.83	145
7	t	7	3.74	187
Ø	b	7	2.45	286
k	t	7	2.19	320
h	X	6	13.64	44
X	r	6	12.77	47
T	j	6	10.71	56
s	8	6	10.34	58
j	z	6	8.82	68
nd	n	6	8.33	72
y	Z	6	8.22	73
T	d	6	5.77	104
h	f	6	5.36	112
N	5	6	4.96	121
h	S	6	4.72	127
Ø	j	6	4.65	129
7	g	6	4.17	144
h	r	6	2.58	233
h	w	6	2.56	234
w	p	6	2.33	257
b”	b	5	41.67	12
ng	N	5	35.71	14
ny	5	5	21.74	23
ty	t	5	14.71	34
T	Z	5	12.82	39
7	q	5	9.62	52
Ø	X	5	9.43	53
d	8	5	9.09	55
T	c	5	8.47	59
j	c	5	7.81	64

CORRESPONDENCE		NG	CP	AG
L	r	5	7.46	67
nd	d	5	7.04	71
y	z	5	4.63	108
j	l	5	4.31	116
f	b	5	4.07	123
x	s	5	3.36	149
y	5	5	3.33	150
Ø	S	5	3.21	156
h	g	5	2.59	193
N	m	5	2.33	215
h	l	5	2.26	221
g	l	5	2.25	222
g	r	5	2.15	233
l	t	5	1.79	279
sy	S	4	44.44	9
d”	d	4	30.77	13
dy	d	4	21.05	19
Ch	C	4	18.18	22
ly	l	4	16.00	25
ny	n	4	14.29	28
ky	k	4	11.76	34
mb	b	4	8.89	45
X	k	4	7.84	51
nd	t	4	5.56	72
L	y	4	4.94	81
j	C	4	4.26	94
x	S	4	4.08	98
z	d	4	3.96	101
7	x	4	3.81	105
k	T	4	3.74	107
j	d	4	3.51	114
w	f	4	3.36	119
C	S	4	3.25	123
x	l	4	2.94	136
x	y	4	2.72	147
C	d	4	2.63	152
h	C	4	2.53	158
7	l	4	2.44	164
7	y	4	2.30	174
k	C	4	2.15	186
N	y	4	2.08	192

CORRESPONDENCE		NG	CP	AG
N	k	4	1.90	210
h	b	4	1.75	229
h	y	4	1.67	240
r	s	4	1.51	265
y	s	4	1.45	275
n	t	4	1.23	325
dh	d	3	33.33	9
sh	s	3	27.27	11
dy	T	3	23.08	13
Nk	k	3	18.75	16
ly	L	3	16.67	18
ty	d	3	11.11	27
ky	C	3	10.34	29
X	q	3	8.57	35
”	7	3	7.32	41
th	c	3	6.52	46
Z	z	3	5.88	51
l	8	3	5.36	56
th	h	3	5.00	60
th	s	3	4.62	65
x	v	3	4.11	73
S	z	3	3.85	78
Z	r	3	3.85	78
g	T	3	3.23	93
T	s	3	3.09	97
l	z	3	3.03	99
T	t	3	2.86	105
y	T	3	2.78	108
v	p	3	2.63	114
Ø	z	3	2.63	114
h	c	3	2.48	121
c	d	3	2.46	122
j	t	3	2.44	123
Ø	f	3	2.27	132
y	c	3	2.10	143
k	S	3	1.97	152
C	r	3	1.81	166
7	r	3	1.80	167
7	w	3	1.76	170
N	g	3	1.75	171
7	n	3	1.58	190

CORRESPONDENCE		NG	CP	AG
h	d	3	1.39	216
g	d	3	1.36	221
s	d	3	1.26	239
y	d	3	1.21	247
l	s	3	1.17	256
h	t	3	1.16	259
Ø	p	3	1.02	293
w	m	3	1.00	299
y	n	3	0.96	311
qh	kh	2	50.00	4
Sy	S	2	40.00	5
rh	r	2	40.00	5
nh	n	2	33.33	6
dh	T	2	33.33	6
tr	k	2	33.33	6
nk	k	2	25.00	8
dh	t	2	25.00	8
4	n	2	22.22	9
ng	Ng	2	22.22	9
sy	s	2	22.22	9
sh	S	2	20.00	10
b”	p	2	18.18	11
gy	g	2	14.29	14
C”	C	2	9.52	21
ky	c	2	8.00	25
Ng	g	2	6.25	32
ty	y	2	6.06	33
z	8	2	5.71	35
T	8	2	5.41	37
7	X	2	5.26	38
mb	m	2	4.44	45
T	z	2	4.00	50
L	c	2	3.92	51
Z	c	2	3.85	52
q	g	2	3.77	53
y	8	2	3.57	56
kh	h	2	3.33	60
h	q	2	3.08	65
L	h	2	2.99	67
Ø	kh	2	2.90	69
c	z	2	2.78	72

CORRESPONDENCE		NG	CP	AG
nd	r	2	2.78	72
j	S	2	2.74	73
L	t	2	2.60	77
kw	k	2	2.60	77
C	z	2	2.47	81
h	z	2	2.20	91
N	x	2	2.02	99
g	j	2	1.85	108
g	c	2	1.82	110
*	m	2	1.79	112
Ø	T	2	1.77	113
z	t	2	1.75	114
7	N	2	1.64	122
Ø	v	2	1.57	127
x	d	2	1.56	128
l	c	2	1.55	129
Ø	c	2	1.34	149
S	t	2	1.32	151
5	m	2	1.30	154
h	N	2	1.27	157
7	d	2	1.24	161
C	l	2	1.21	165
N	r	2	1.03	194
g	b	2	0.89	224
g	y	2	0.88	227
d	b	2	0.82	244
l	b	2	0.81	246
r	w	2	0.75	268
k	d	2	0.75	266
m	p	2	0.69	288
k	w	2	0.68	294
n	s	2	0.67	297
k	s	2	0.67	298
k	y	2	0.65	307
w”	b”	1	100.00	1
T”	c”	1	100.00	1
g”	k	1	100.00	1
N”	N	1	100.00	1
g!	!	1	100.00	1
!N	!n	1	100.00	1
!k	!	1	100.00	1

CORRESPONDENCE		NG	CP	AG
Nw	w*	1	100.00	1
mbw	pw	1	100.00	1
kpw	p	1	100.00	1
kpw	kw	1	100.00	1
kpw	mb	1	100.00	1
kpw	Ngw	1	100.00	1
fh	h	1	100.00	1
mpy	nC	1	100.00	1
mpy	my	1	100.00	1
mbv	mbw	1	100.00	1
tx	ty	1	100.00	1
ndr	Nk	1	100.00	1
tr	Nk	1	100.00	1
kl	tl	1	100.00	1
hv	f	1	100.00	1
ddy	T	1	100.00	1
Sh	sh	1	100.00	1
xh	x	1	100.00	1
syh	sy	1	100.00	1
mZ	by	1	100.00	1
mz	by	1	100.00	1
npl	mpl	1	100.00	1
7d	d	1	100.00	1
7d	n	1	100.00	1
7d	l	1	100.00	1
7n	n	1	100.00	1
nq	k	1	100.00	1
nq	g	1	100.00	1
T”	C”	1	50.00	2
!”	!	1	50.00	2
tl	d	1	50.00	2
nC	ns	1	50.00	2
Ngw	p	1	50.00	2
zh	d	1	50.00	2
Sw	f	1	50.00	2
mbw	p	1	50.00	2
mbw	Ngw	1	50.00	2
mp	Ngw	1	50.00	2
mp	mbw	1	50.00	2
Sy	Ch	1	50.00	2
my	nC	1	50.00	2

CORRESPONDENCE		NG	CP	AG
ndr	t	1	50.00	2
ndr	d	1	50.00	2
ndr	c	1	50.00	2
ndr	r	1	50.00	2
ndr	C	1	50.00	2
ndr	k	1	50.00	2
ndr	nd	1	50.00	2
tr	nd	1	50.00	2
tr	ndr	1	50.00	2
kl	d	1	50.00	2
nx	n	1	50.00	2
t8	t	1	50.00	2
t8	th	1	50.00	2
dn	n	1	50.00	2
Sh	s	1	50.00	2
Sh	S	1	50.00	2
k”y	k”	1	50.00	2
Nh	h	1	50.00	2
c7	d	1	50.00	2
Ø	tx	1	50.00	2
!7	!	1	33.33	3
nC	nc	1	33.33	3
xw	k”w	1	33.33	3
xw	hw	1	33.33	3
mv	mb	1	33.33	3
pw	bw	1	33.33	3
dh	ty	1	33.33	3
dh	dy	1	33.33	3
hn	n	1	33.33	3
tn	n	1	33.33	3
7y	y	1	33.33	3
lh	L	1	33.33	3
khy	S	1	33.33	3
k”y	C”	1	33.33	3
t7	k	1	33.33	3
hk	k	1	33.33	3
fw	w	1	25.00	4
ns	s	1	25.00	4
zy	c	1	25.00	4
cy	j	1	25.00	4
Ny	5	1	25.00	4

CORRESPONDENCE		NG	CP	AG
tr	c	1	25.00	4
w”	b	1	20.00	5
fw	f	1	20.00	5
Sy	C	1	20.00	5
cy	c	1	20.00	5
cy	Z	1	20.00	5
mh	m	1	20.00	5
dh	z	1	20.00	5
Cy	C	1	20.00	5
ch	Th	1	20.00	5
xy	h	1	20.00	5
tr	C	1	20.00	5
dr	r	1	20.00	5
b”	v	1	16.67	6
n”	n	1	16.67	6
q”	7	1	16.67	6
gh	x	1	16.67	6
by	j	1	16.67	6
cy	S	1	16.67	6
dh	th	1	16.67	6
tr	t	1	16.67	6
tr	d	1	16.67	6
by	b	1	14.29	7
bh	p	1	14.29	7
Th	Ch	1	14.29	7
4	5	1	12.50	8
G	x	1	12.50	8
G	q	1	12.50	8
t”	8	1	12.50	8
q”	k”	1	12.50	8
kh	k”	1	12.50	8
nj	j	1	12.50	8
mw	m	1	12.50	8
by	d	1	12.50	8
pw	p	1	12.50	8
mp	mb	1	12.50	8
dh	C	1	12.50	8
G	k	1	11.11	9
G	X	1	11.11	9
hw	p	1	11.11	9
hw	h	1	11.11	9

CORRESPONDENCE		NG	CP	AG
Nk	Ng	1	11.11	9
xw	x	1	11.11	9
ly	Z	1	11.11	9
dy	ty	1	11.11	9
my	m	1	11.11	9
dh	y	1	11.11	9
qh	x	1	11.11	9
b”	7	1	10.00	10
q”	X	1	10.00	10
ry	b	1	10.00	10
Nk	c	1	10.00	10
dy	Z	1	10.00	10
Th	th	1	10.00	10
ch	T	1	10.00	10
Nw	w	1	9.09	11
Ø	q”	1	9.09	11
d”	T	1	8.33	12
th	t”	1	8.33	12
Nk	C	1	8.33	12
dy	c	1	8.33	12
Th	T	1	8.33	12
Nw	m	1	7.69	13
Nk	nd	1	7.69	13
dy	j	1	7.69	13
mp	p	1	7.69	13
gy	k	1	7.14	14
py	p	1	7.14	14
dy	z	1	7.14	14
Th	C	1	7.14	14
C”	c”	1	6.67	15
k”	X	1	6.67	15
k”	c”	1	6.67	15
Ø	Th	1	6.67	15
c”	c	1	6.25	16
ty	j	1	6.25	16
Nk	t	1	6.25	16
Nk	d	1	6.25	16
Nk	r	1	6.25	16
Nk	N	1	6.25	16
ly	c	1	6.25	16
k”	C”	1	5.88	17

CORRESPONDENCE		NG	CP	AG
kh	q	1	5.88	17
kp	p	1	5.88	17
k”	q	1	5.56	18
th	8	1	5.56	18
ng	k	1	5.56	18
Ch	S	1	5.56	18
dy	g	1	5.26	19
ch	c	1	5.26	19
ch	C	1	5.26	19
Ø	ng	1	5.26	19
ty	S	1	5.00	20
gw	v	1	5.00	20
dy	r	1	5.00	20
t”	c	1	4.76	21
c”	s	1	4.76	21
k”	g	1	4.76	21
ph	f	1	4.76	21
gw	kw	1	4.76	21
dy	l	1	4.76	21
kw	q	1	4.55	22
ty	T	1	4.55	22
dy	m	1	4.55	22
dy	y	1	4.55	22
Ø	ch	1	4.55	22
mb	kw	1	4.35	23
ty	C	1	4.35	23
Ø	dy	1	4.35	23
kh	Z	1	4.17	24
th	L	1	4.00	25
Ng	N	1	3.70	27
L	Z	1	3.57	28
t”	t	1	3.57	28
ny	m	1	3.57	28
th	T	1	3.33	30
k”	k	1	3.03	33
Ng	k	1	2.94	34
gw	w	1	2.94	34
Ø	k”	1	2.94	34
Ø	ty	1	2.94	34
th	z	1	2.78	36
L	T	1	2.70	37

CORRESPONDENCE		NG	CP	AG
gw	t	1	2.70	37
Ø	gw	1	2.70	37
S	8	1	2.56	39
nd	c	1	2.56	39
c	8	1	2.44	41
L	z	1	2.44	41
kw	f	1	2.38	42
mb	p	1	2.38	42
X	C	1	2.33	43
th	S	1	2.33	43
th	x	1	2.33	43
Ø	ph	1	2.27	44
th	7	1	2.08	48
kh	g	1	2.04	49
Z	S	1	1.96	51
X	s	1	1.96	51
L	7	1	1.92	52
L	x	1	1.89	53
th	C	1	1.89	53
nd	C	1	1.89	53
g”	s	1	1.82	55
Ø	8	1	1.72	58
th	d	1	1.69	59
C	Z	1	1.67	60
T	S	1	1.59	63
kh	y	1	1.59	63
q	r	1	1.56	64
th	r	1	1.56	64
th	l	1	1.56	64
L	d	1	1.54	65
kw	p	1	1.54	65
kh	s	1	1.47	68
nd	l	1	1.47	68
h	Z	1	1.45	69
x	z	1	1.43	70
Ø	th	1	1.41	71
L	s	1	1.39	72
Z	l	1	1.37	73
g	Z	1	1.37	73
x	j	1	1.37	73
Ø	nd	1	1.37	73

CORRESPONDENCE		NG	CP	AG
*	7	1	1.32	76
x	5	1	1.32	76
L	w	1	1.32	76
kw	t	1	1.32	76
Z	d	1	1.30	77
Z	s	1	1.30	77
q	t	1	1.30	77
q	n	1	1.28	78
Ø	kw	1	1.28	78
Ø	Z	1	1.23	81
N	f	1	1.19	84
L	n	1	1.19	84
7	f	1	1.16	86
g	z	1	1.09	92
g	v	1	0.99	101
z	w	1	0.98	102
S	c	1	0.97	103
T	l	1	0.96	104
l	v	1	0.95	105
T	w	1	0.95	105
T	r	1	0.95	105
h	v	1	0.95	105
d	v	1	0.94	106
h	j	1	0.94	106
x	C	1	0.90	111
d	f	1	0.88	114
z	m	1	0.88	113
j	w	1	0.87	115
j	s	1	0.85	118
s	f	1	0.81	124
j	r	1	0.81	124
m	v	1	0.80	125
j	m	1	0.79	127
j	n	1	0.79	126
r	c	1	0.78	128
k	f	1	0.78	129
m	f	1	0.77	130
n	f	1	0.77	130
t	f	1	0.76	131
S	r	1	0.75	133
g	C	1	0.75	134

CORRESPONDENCE		NG	CP	AG
x	b	1	0.74	135
5	l	1	0.71	140
x	w	1	0.70	142
c	m	1	0.69	145
y	S	1	0.68	148
k	c	1	0.68	146
S	n	1	0.65	155
x	t	1	0.63	159
x	n	1	0.63	158
7	b	1	0.61	165
7	p	1	0.59	169
y	C	1	0.57	174
7	s	1	0.55	182
N	d	1	0.54	184
C	n	1	0.53	190
Ø	C	1	0.53	190
N	l	1	0.52	193
N	t	1	0.49	204
g	s	1	0.45	223
g	m	1	0.40	247
g	n	1	0.40	247
l	w	1	0.39	257
s	p	1	0.38	261
d	m	1	0.37	268
y	w	1	0.36	276
k	p	1	0.35	285
k	l	1	0.35	285
l	m	1	0.34	291
k	r	1	0.34	295
r	m	1	0.33	299
y	t	1	0.33	301
t	m	1	0.31	324
k	n	1	0.30	328

Section A2: Correspondences not involving consonants

CORRESPONDENCE		NG	CP	AG
a	e	98	30.25	324
o	u	95	29.69	320
e	i	95	29.23	325

CORRESPONDENCE		NG	CP	AG
o	a	94	29.28	321
a	3	62	26.96	230
a	E	61	35.67	171
E	e	60	36.36	165
a	i	59	17.40	339
Ø	a	55	16.18	340
Ø	i	54	15.93	339
3	i	53	23.14	229
u	3	50	21.83	229
u	i	50	14.79	338
3	e	48	21.62	222
o	3	38	17.19	221
o	e	37	12.01	308
u	a	37	10.95	338
Ø	o	36	11.21	321
Ø	u	33	9.76	338
E	i	31	18.13	171
Ø	e	31	9.54	325
Ø	3	30	13.04	230
o	i	30	9.35	321
o	E	27	16.17	167
3	E	25	19.53	128
u	e	20	6.17	324
a*	a	15	17.86	84
i*	i	14	20.00	70
o*	o	13	18.57	70
Ø	E	12	7.02	171
u	E	11	6.47	170
u*	u	9	14.06	64
e*	e	4	9.52	42
o*	u*	4	9.09	44
3*	3	3	13.64	22
a*	e*	3	8.57	35
o*	u	3	4.35	69
Ø	i*	3	4.29	70
3*	o	2	9.09	22
e*	i*	2	6.67	30
e*	i	2	4.76	42
o*	a*	2	4.17	48
o*	E	2	4.00	50
u*	o	2	3.13	64

CORRESPONDENCE		NG	CP	AG
i*	e	2	2.99	67
a*	e	2	2.47	81
3*	E	1	5.56	18
E*	i*	1	5.00	20
a*	E*	1	4.76	21
3*	u	1	4.55	22
E*	E	1	4.17	24
E*	i	1	3.57	28
Ø	E*	1	3.57	28
e*	E	1	3.33	30
e*	a	1	2.38	42
i*	E	1	2.22	45
i*	3	1	1.92	52
a*	E	1	1.89	53
a*	3	1	1.61	62
i*	o	1	1.45	69
o*	e	1	1.45	69
o*	i	1	1.41	71
o*	a	1	1.41	71
Ø	o*	1	1.41	71

Section A3: Vowel : consonant correspondences

CORRESPONDENCE		NG	CP	AG
i	y	25	7.99	313
u	w	11	3.67	300
o	w	5	1.77	282
i	l	5	1.72	291
i	n	4	1.19	335
i	j	2	1.56	128
i	x	2	1.26	159
i	N	2	0.93	215
3	y	2	0.93	215
o	l	2	0.73	273
e	y	2	0.67	299
i	r	2	0.66	302
i	k	2	0.60	332
a	n	2	0.60	336
”	i	1	1.79	56
3	L	1	1.67	60

CORRESPONDENCE		NG	CP	AG
*	u	1	0.89	112
*	a	1	0.88	113
3	x	1	0.87	115
o	v	1	0.80	125
a	v	1	0.79	126
o	5	1	0.70	143
E	l	1	0.66	151
o	x	1	0.65	154
E	r	1	0.63	159
a	x	1	0.63	160
E	y	1	0.62	162
E	n	1	0.59	169
3	h	1	0.55	183
u	7	1	0.53	190
i	7	1	0.52	191
3	w	1	0.49	206
3	r	1	0.48	207
u	N	1	0.47	212
e	d	1	0.38	261
u	h	1	0.38	263
e	r	1	0.34	290
u	l	1	0.34	290
i	s	1	0.33	300
a	w	1	0.33	302
a	s	1	0.33	301
a	r	1	0.33	303
u	r	1	0.33	302
a	y	1	0.32	313
u	y	1	0.32	311
u	n	1	0.30	334

APPENDIX B: COMPENDIUM OF WORLDWIDE SOUND CORRESPONDENCES ORGANIZED FOR EFFICIENT MANUAL SEARCH

Appendix B presents for each of the 139 simple and compound symbols found in correspondences produced through automation, every correspondence in which the symbol is found. Correspondence groups for consonant symbols are listed first, ordered by position in the oral cavity in which consonants are produced, from front to back. These are followed by groups for *, ”, and Ø, and then by groups of vowel symbols, ordered by position, from front to back, and then by height within position rank, from high to low. As in Appendix A, NG, CP, and AG are given for each correspondence. Within groups, cor-

respondences are ordered by NG from largest to smallest, and by CP, from largest to smallest, within each NG rank. The specific order of group listing for simple symbols is:

p, b, f, v, m, w, 8, 4, t, d, s, z, c, n, r, l, S, Z, C, j, T, 5, y, k, g, x, N, q, G, X, h, 7, L, !, *, ”, Ø, i, e, E, 3, a, u, o

Compound symbols are listed within this basic order as follows (where C is any consonant and V is any vowel):

C, C”, Cw, Cy, Ch, mC, nC, mC”, nCh, etc., and V, V*

Note that when the first element of a multi-element compound symbol is a nasal (*m, 4, n, 5, N*), then the correspondence is ordered by the second element. Thus, for example, *mb* is ordered by *b* rather than by *m*. There also are some other combinations, for example, *kp* and *hv*, in which the group is ordered by the second element.

CORRESPONDENCE		NG	CP	AG
p	b	29	11.79	246
p	f	13	11.71	111
p	h	11	4.80	229
p	ph	7	16.67	42
p	w	6	2.33	257
p	v	3	2.63	114
p	Ø	3	1.02	293
p	b”	2	18.18	11
p	m	2	0.69	288
p	kpw	1	100.00	1
p	Ngw	1	50.00	2
p	mbw	1	50.00	2
p	bh	1	14.29	7
p	pw	1	12.50	8
p	hw	1	11.11	9
p	mp	1	7.69	13
p	py	1	7.14	14
p	kp	1	5.88	17
p	mb	1	2.38	42
p	kw	1	1.54	65
p	7	1	0.59	169
p	s	1	0.38	261
p	k	1	0.35	285
pw	mbw	1	100.00	1

CORRESPONDENCE		NG	CP	AG
pw	bw	1	33.33	3
pw	p	1	12.50	8
py	p	1	7.14	14
ph	p	7	16.67	42
ph	f	1	4.76	21
ph	Ø	1	2.27	44
mp	Ngw	1	50.00	2
mp	mbw	1	50.00	2
mp	mb	1	12.50	8
mp	p	1	7.69	13
kp	p	1	5.88	17
mpl	npl	1	100.00	1
npl	mpl	1	100.00	1
kpw	p	1	100.00	1
kpw	kw	1	100.00	1
kpw	mb	1	100.00	1
kpw	Ngw	1	100.00	1
b	p	29	11.79	246
b	v	18	15.93	113
b	w	13	5.02	259
b	m	8	2.83	283
b	Ø	7	2.45	286
b	b”	5	41.67	12
b	f	5	4.07	123
b	mb	4	8.89	45
b	h	4	1.75	229
b	g	2	0.89	224
b	d	2	0.82	244
b	l	2	0.81	246
b	w”	1	20.00	5
b	by	1	14.29	7
b	ry	1	10.00	10
b	x	1	0.74	135
b	7	1	0.61	165

CORRESPONDENCE		NG	CP	AG
b”	b	5	41.67	12
b”	p	2	18.18	11
b”	w”	1	100.00	1
b”	v	1	16.67	6
b”	7	1	10.00	10
bw	pw	1	33.33	3
by	mZ	1	100.00	1
by	mz	1	100.00	1
by	j	1	16.67	6
by	b	1	14.29	7
by	d	1	12.50	8
bh	p	1	14.29	7
mb	b	4	8.89	45
mb	m	2	4.44	45
mb	kpw	1	100.00	1
mb	mv	1	33.33	3
mb	mp	1	12.50	8
mb	kw	1	4.35	23
mb	p	1	2.38	42
mbv	mbw	1	100.00	1
mbw	pw	1	100.00	1
mbw	mbv	1	100.00	1
mbw	p	1	50.00	2
mbw	Ngw	1	50.00	2
mbw	mp	1	50.00	2
f	p	13	11.71	111
f	v	7	10.29	68
f	h	6	5.36	112
f	b	5	4.07	123
f	w	4	3.36	119
f	Ø	3	2.27	132
f	hv	1	100.00	1
f	Sw	1	50.00	2
f	fw	1	20.00	5

CORRESPONDENCE		NG	CP	AG
f	ph	1	4.76	21
f	kw	1	2.38	42
f	N	1	1.19	84
f	7	1	1.16	86
f	d	1	0.88	114
f	s	1	0.81	124
f	k	1	0.78	129
f	m	1	0.77	130
f	n	1	0.77	130
f	t	1	0.76	131
fw	w	1	25.00	4
fw	f	1	20.00	5
fh	h	1	100.00	1
v	b	18	15.93	113
v	w	17	15.89	107
v	f	7	10.29	68
v	x	3	4.11	73
v	p	3	2.63	114
v	Ø	2	1.57	127
v	b”	1	16.67	6
v	gw	1	5.00	20
v	g	1	0.99	101
v	l	1	0.95	105
v	h	1	0.95	105
v	d	1	0.94	106
v	m	1	0.80	125
v	o	1	0.80	125
v	a	1	0.79	126
hv	f	1	100.00	1
mv	mb	1	33.33	3
m	Ø	15	4.46	336
m	b	8	2.83	283
m	n	8	2.41	332
m	N	5	2.33	215
m	w	3	1.00	299

CORRESPONDENCE		NG	CP	AG
m	mb	2	4.44	45
m	*	2	1.79	112
m	5	2	1.30	154
m	p	2	0.69	288
m	mh	1	20.00	5
m	mw	1	12.50	8
m	my	1	11.11	9
m	Nw	1	7.69	13
m	dy	1	4.55	22
m	ny	1	3.57	28
m	z	1	0.88	113
m	v	1	0.80	125
m	j	1	0.79	127
m	f	1	0.77	130
m	c	1	0.69	145
m	g	1	0.40	247
m	d	1	0.37	268
m	l	1	0.34	291
m	r	1	0.33	299
m	t	1	0.31	324
w	Ø	22	7.28	302
w	v	17	15.89	107
w	b	13	5.02	259
w	u	11	3.67	300
w	h	6	2.56	234
w	p	6	2.33	257
w	o	5	1.77	282
w	f	4	3.36	119
w	7	3	1.76	170
w	m	3	1.00	299
w	r	2	0.75	268
w	k	2	0.68	294
w	fw	1	25.00	4
w	Nw	1	9.09	11
w	gw	1	2.94	34
w	L	1	1.32	76
w	z	1	0.98	102
w	T	1	0.95	105
w	j	1	0.87	115
w	x	1	0.70	142

CORRESPONDENCE		NG	CP	AG
w	3	1	0.49	206
w	l	1	0.39	257
w	y	1	0.36	276
w	a	1	0.33	302
w”	b”	1	100.00	1
w”	b	1	20.00	5
w*	Nw	1	100.00	1
8	t	7	12.28	57
8	s	6	10.34	58
8	d	5	9.09	55
8	l	3	5.36	56
8	z	2	5.71	35
8	T	2	5.41	37
8	y	2	3.57	56
8	t”	1	12.50	8
8	th	1	5.56	18
8	S	1	2.56	39
8	c	1	2.44	41
8	Ø	1	1.72	58
4	n	2	22.22	9
4	5	1	12.50	8
t	d	32	12.08	265
t	Ø	17	5.18	328
t	th	12	17.39	69
t	C	11	5.88	187
t	r	10	3.42	292
t	s	10	3.39	295
t	8	7	12.28	57
t	c	7	4.83	145
t	7	7	3.74	187
t	k	7	2.19	320
t	ty	5	14.71	34
t	l	5	1.79	279
t	nd	4	5.56	72
t	n	4	1.23	325
t	T	3	2.86	105

CORRESPONDENCE		NG	CP	AG
t	j	3	2.44	123
t	h	3	1.16	259
t	dh	2	25.00	8
t	L	2	2.60	77
t	z	2	1.75	114
t	S	2	1.32	151
t	ndr	1	50.00	2
t	t8	1	50.00	2
t	tr	1	16.67	6
t	Nk	1	6.25	16
t	t”	1	3.57	28
t	gw	1	2.70	37
t	kw	1	1.32	76
t	q	1	1.30	77
t	f	1	0.76	131
t	x	1	0.63	159
t	N	1	0.49	204
t	y	1	0.33	301
t	m	1	0.31	324
t”	8	1	12.50	8
t”	th	1	8.33	12
t”	c	1	4.76	21
t”	t	1	3.57	28
t8	t	1	50.00	2
t8	th	1	50.00	2
tn	n	1	33.33	3
tr	k	2	33.33	6
tr	Nk	1	100.00	1
tr	nd	1	50.00	2
tr	ndr	1	50.00	2
tr	c	1	25.00	4
tr	C	1	20.00	5
tr	t	1	16.67	6
tr	d	1	16.67	6
tl	kl	1	100.00	1
tl	d	1	50.00	2

CORRESPONDENCE		NG	CP	AG
ty	t	5	14.71	34
ty	d	3	11.11	27
ty	y	2	6.06	33
ty	tx	1	100.00	1
ty	dh	1	33.33	3
ty	dy	1	11.11	9
ty	j	1	6.25	16
ty	S	1	5.00	20
ty	T	1	4.55	22
ty	C	1	4.35	23
ty	Ø	1	2.94	34
tx	ty	1	100.00	1
tx	Ø	1	50.00	2
th	t	12	17.39	69
th	c	3	6.52	46
th	h	3	5.00	60
th	s	3	4.62	65
th	t8	1	50.00	2
th	dh	1	16.67	6
th	Th	1	10.00	10
th	t”	1	8.33	12
th	8	1	5.56	18
th	L	1	4.00	25
th	T	1	3.33	30
th	z	1	2.78	36
th	S	1	2.33	43
th	x	1	2.33	43
th	7	1	2.08	48
th	C	1	1.89	53
th	d	1	1.69	59
th	r	1	1.56	64
th	l	1	1.56	64
th	Ø	1	1.41	71
t7	k	1	33.33	3
d	t	32	12.08	265
d	r	23	9.31	247
d	n	12	4.44	270

CORRESPONDENCE		NG	CP	AG
d	l	10	4.20	238
d	Ø	8	2.93	273
d	T	6	5.77	104
d	8	5	9.09	55
d	nd	5	7.04	71
d	d”	4	30.77	13
d	dy	4	21.05	19
d	z	4	3.96	101
d	j	4	3.51	114
d	C	4	2.63	152
d	dh	3	33.33	9
d	ty	3	11.11	27
d	c	3	2.46	122
d	h	3	1.39	216
d	g	3	1.36	221
d	s	3	1.26	239
d	y	3	1.21	247
d	x	2	1.56	128
d	7	2	1.24	161
d	b	2	0.82	244
d	k	2	0.75	266
d	7d	1	100.00	1
d	tl	1	50.00	2
d	zh	1	50.00	2
d	ndr	1	50.00	2
d	kl	1	50.00	2
d	c7	1	50.00	2
d	tr	1	16.67	6
d	by	1	12.50	8
d	Nk	1	6.25	16
d	th	1	1.69	59
d	L	1	1.54	65
d	Z	1	1.30	77
d	v	1	0.94	106
d	f	1	0.88	114
d	N	1	0.54	184
d	e	1	0.38	261
d	m	1	0.37	268
d”	d	4	30.77	13
d”	T	1	8.33	12

CORRESPONDENCE		NG	CP	AG
dn	n	1	50.00	2
dr	r	1	20.00	5
dy	d	4	21.05	19
dy	T	3	23.08	13
dy	dh	1	33.33	3
dy	ty	1	11.11	9
dy	Z	1	10.00	10
dy	c	1	8.33	12
dy	j	1	7.69	13
dy	z	1	7.14	14
dy	g	1	5.26	19
dy	r	1	5.00	20
dy	l	1	4.76	21
dy	m	1	4.55	22
dy	y	1	4.55	22
dy	Ø	1	4.35	23
dh	d	3	33.33	9
dh	T	2	33.33	6
dh	t	2	25.00	8
dh	ty	1	33.33	3
dh	dy	1	33.33	3
dh	z	1	20.00	5
dh	th	1	16.67	6
dh	C	1	12.50	8
dh	y	1	11.11	9
nd	n	6	8.33	72
nd	d	5	7.04	71
nd	t	4	5.56	72
nd	r	2	2.78	72
nd	ndr	1	50.00	2
nd	tr	1	50.00	2
nd	Nk	1	7.69	13
nd	c	1	2.56	39
nd	C	1	1.89	53
nd	l	1	1.47	68
nd	Ø	1	1.37	73

CORRESPONDENCE		NG	CP	AG
ndr	Nk	1	100.00	1
ndr	t	1	50.00	2
ndr	d	1	50.00	2
ndr	c	1	50.00	2
ndr	r	1	50.00	2
ndr	C	1	50.00	2
ndr	k	1	50.00	2
ndr	nd	1	50.00	2
ndr	tr	1	50.00	2
ddy	T	1	100.00	1
s	S	29	19.08	152
s	h	19	7.79	244
s	c	15	10.71	140
s	z	12	11.01	109
s	C	11	6.11	180
s	Ø	11	3.65	301
s	t	10	3.39	295
s	8	6	10.34	58
s	x	5	3.36	149
s	r	4	1.51	265
s	y	4	1.45	275
s	sh	3	27.27	11
s	th	3	4.62	65
s	T	3	3.09	97
s	d	3	1.26	239
s	l	3	1.17	256
s	sy	2	22.22	9
s	n	2	0.67	297
s	k	2	0.67	298
s	Sh	1	50.00	2
s	ns	1	25.00	4
s	c”	1	4.76	21
s	X	1	1.96	51
s	”	1	1.82	55
s	kh	1	1.47	68
s	L	1	1.39	72
s	Z	1	1.30	77
s	j	1	0.85	118
s	f	1	0.81	124

CORRESPONDENCE		NG	CP	AG
s	7	1	0.55	182
s	g	1	0.45	223
s	p	1	0.38	261
s	i	1	0.33	300
s	a	1	0.33	301
sy	S	4	44.44	9
Sy	S	2	40.00	5
sy	s	2	22.22	9
sy	syh	1	100.00	1
syh	sy	1	100.00	1
sh	s	3	27.27	11
sh	S	2	20.00	10
sh	Sh	1	100.00	1
ns	nC	1	50.00	2
ns	s	1	25.00	4
z	s	12	11.01	109
z	r	8	7.48	107
z	j	6	8.82	68
z	y	5	4.63	108
z	d	4	3.96	101
z	Z	3	5.88	51
z	S	3	3.85	78
z	l	3	3.03	99
z	Ø	3	2.63	114
z	8	2	5.71	35
z	T	2	4.00	50
z	c	2	2.78	72
z	C	2	2.47	81
z	h	2	2.20	91
z	t	2	1.75	114
z	dh	1	20.00	5
z	dy	1	7.14	14
z	th	1	2.78	36
z	L	1	2.44	41
z	x	1	1.43	70
z	g	1	1.09	92

CORRESPONDENCE		NG	CP	AG
z	w	1	0.98	102
z	m	1	0.88	113
zy	c	1	25.00	4
zh	d	1	50.00	2
c	C	19	16.24	117
c	s	15	10.71	140
c	t	7	4.83	145
c	T	5	8.47	59
c	j	5	7.81	64
c	th	3	6.52	46
c	h	3	2.48	121
c	d	3	2.46	122
c	y	3	2.10	143
c	ky	2	8.00	25
c	L	2	3.92	51
c	Z	2	3.85	52
c	z	2	2.78	72
c	g	2	1.82	110
c	l	2	1.55	129
c	Ø	2	1.34	149
c	ndr	1	50.00	2
c	zy	1	25.00	4
c	tr	1	25.00	4
c	cy	1	20.00	5
c	Nk	1	10.00	10
c	dy	1	8.33	12
c	c”	1	6.25	16
c	ly	1	6.25	16
c	ch	1	5.26	19
c	t”	1	4.76	21
c	nd	1	2.56	39
c	8	1	2.44	41
c	S	1	0.97	103
c	r	1	0.78	128
c	m	1	0.69	145
c	k	1	0.68	146
c”	T”	1	100.00	1

CORRESPONDENCE		NG	CP	AG
c”	C”	1	6.67	15
c”	k”	1	6.67	15
c”	c	1	6.25	16
c”	s	1	4.76	21
cy	j	1	25.00	4
cy	c	1	20.00	5
cy	Z	1	20.00	5
cy	S	1	16.67	6
ch	Th	1	20.00	5
ch	T	1	10.00	10
ch	c	1	5.26	19
ch	C	1	5.26	19
ch	Ø	1	4.55	22
c7	d	1	50.00	2
nc	nC	1	33.33	3
n	N	30	14.02	214
n	Ø	25	7.44	336
n	5	16	10.46	153
n	*	13	11.50	113
n	d	12	4.44	270
n	l	11	3.81	289
n	r	10	3.34	299
n	m	8	2.41	332
n	nd	6	8.33	72
n	ny	4	14.29	28
n	t	4	1.23	325
n	i	4	1.19	335
n	7	3	1.58	190
n	y	3	0.96	311
n	nh	2	33.33	6
n	4	2	22.22	9
n	s	2	0.67	297
n	a	2	0.60	336
n	7d	1	100.00	1
n	7n	1	100.00	1
n	nx	1	50.00	2

CORRESPONDENCE		NG	CP	AG
n	dn	1	50.00	2
n	hn	1	33.33	3
n	tn	1	33.33	3
n	n”	1	16.67	6
n	q	1	1.28	78
n	L	1	1.19	84
n	j	1	0.79	126
n	f	1	0.77	130
n	S	1	0.65	155
n	x	1	0.63	158
n	E	1	0.59	169
n	C	1	0.53	190
n	g	1	0.40	247
n	k	1	0.30	328
n	u	1	0.30	334
n”	n	1	16.67	6
ny	5	5	21.74	23
ny	n	4	14.29	28
ny	m	1	3.57	28
nh	n	2	33.33	6
hn	n	1	33.33	3
r	l	48	18.39	261
r	d	23	9.31	247
r	Ø	20	6.60	303
r	y	12	4.35	276
r	t	10	3.42	292
r	n	10	3.34	299
r	z	8	7.48	107
r	x	7	5.00	140
r	X	6	12.77	47
r	h	6	2.58	233
r	L	5	7.46	67
r	g	5	2.15	233
r	s	4	1.51	265
r	Z	3	3.85	78
r	C	3	1.81	166

CORRESPONDENCE		NG	CP	AG
r	7	3	1.80	167
r	rh	2	40.00	5
r	nd	2	2.78	72
r	N	2	1.03	194
r	w	2	0.75	268
r	i	2	0.66	302
r	ndr	1	50.00	2
r	dr	1	20.00	5
r	Nk	1	6.25	16
r	dy	1	5.00	20
r	q	1	1.56	64
r	th	1	1.56	64
r	T	1	0.95	105
r	j	1	0.81	124
r	c	1	0.78	128
r	S	1	0.75	133
r	E	1	0.63	159
r	3	1	0.48	207
r	k	1	0.34	295
r	e	1	0.34	290
r	m	1	0.33	299
r	a	1	0.33	303
r	u	1	0.33	302
ry	b	1	10.00	10
rh	r	2	40.00	5
l	r	48	18.39	261
l	Ø	20	6.85	292
l	L	16	20.00	80
l	y	11	4.07	270
l	n	11	3.81	289
l	d	10	4.20	238
l	j	5	4.31	116
l	h	5	2.26	221
l	g	5	2.25	222
l	t	5	1.79	279
l	i	5	1.72	291
l	ly	4	16.00	25
l	x	4	2.94	136

CORRESPONDENCE		NG	CP	AG
l	7	4	2.44	164
l	8	3	5.36	56
l	z	3	3.03	99
l	s	3	1.17	256
l	c	2	1.55	129
l	C	2	1.21	165
l	b	2	0.81	246
l	o	2	0.73	273
l	7d	1	100.00	1
l	dy	1	4.76	21
l	th	1	1.56	64
l	nd	1	1.47	68
l	Z	1	1.37	73
l	T	1	0.96	104
l	v	1	0.95	105
l	5	1	0.71	140
l	E	1	0.66	151
l	N	1	0.52	193
l	w	1	0.39	257
l	k	1	0.35	285
l	m	1	0.34	291
l	u	1	0.34	290
ly	l	4	16.00	25
ly	L	3	16.67	18
ly	Z	1	11.11	9
ly	c	1	6.25	16
lh	L	1	33.33	3
S	s	29	19.08	152
S	h	6	4.72	127
S	Ø	5	3.21	156
S	sy	4	44.44	9
S	x	4	4.08	98
S	C	4	3.25	123
S	z	3	3.85	78
S	k	3	1.97	152
S	Sy	2	40.00	5
S	sh	2	20.00	10
S	j	2	2.74	73

CORRESPONDENCE		NG	CP	AG
S	t	2	1.32	151
S	Sh	1	50.00	2
S	khy	1	33.33	3
S	cy	1	16.67	6
S	Ch	1	5.56	18
S	ty	1	5.00	20
S	8	1	2.56	39
S	th	1	2.33	43
S	Z	1	1.96	51
S	T	1	1.59	63
S	c	1	0.97	103
S	r	1	0.75	133
S	y	1	0.68	148
S	n	1	0.65	155
Sw	f	1	50.00	2
Sy	Ch	1	50.00	2
Sy	C	1	20.00	5
Sh	sh	1	100.00	1
Sh	s	1	50.00	2
Sh	S	1	50.00	2
Z	j	9	18.75	48
Z	y	6	8.22	73
Z	T	5	12.82	39
Z	z	3	5.88	51
Z	r	3	3.85	78
Z	c	2	3.85	52
Z	cy	1	20.00	5
Z	ly	1	11.11	9
Z	dy	1	10.00	10
Z	kh	1	4.17	24
Z	L	1	3.57	28
Z	S	1	1.96	51
Z	C	1	1.67	60
Z	h	1	1.45	69
Z	l	1	1.37	73
Z	g	1	1.37	73
Z	d	1	1.30	77

CORRESPONDENCE		NG	CP	AG
Z	s	1	1.30	77
Z	Ø	1	1.23	81
C	c	19	16.24	117
C	T	14	19.72	71
C	s	11	6.11	180
C	t	11	5.88	187
C	Ch	4	18.18	22
C	j	4	4.26	94
C	S	4	3.25	123
C	d	4	2.63	152
C	h	4	2.53	158
C	k	4	2.15	186
C	ky	3	10.34	29
C	r	3	1.81	166
C	C”	2	9.52	21
C	z	2	2.47	81
C	l	2	1.21	165
C	ndr	1	50.00	2
C	Sy	1	20.00	5
C	Cy	1	20.00	5
C	tr	1	20.00	5
C	dh	1	12.50	8
C	Nk	1	8.33	12
C	Th	1	7.14	14
C	ch	1	5.26	19
C	ty	1	4.35	23
C	X	1	2.33	43
C	th	1	1.89	53
C	nd	1	1.89	53
C	Z	1	1.67	60
C	x	1	0.90	111
C	g	1	0.75	134
C	y	1	0.57	174
C	n	1	0.53	190
C	Ø	1	0.53	190
C”	C	2	9.52	21
C”	T”	1	50.00	2
C”	k”y	1	33.33	3
C”	c”	1	6.67	15

CORRESPONDENCE		NG	CP	AG
C”	k”	1	5.88	17
Cy	C	1	20.00	5
Ch	C	4	18.18	22
Ch	Sy	1	50.00	2
Ch	Th	1	14.29	7
Ch	S	1	5.56	18
nC	mpy	1	100.00	1
nC	ns	1	50.00	2
nC	my	1	50.00	2
nC	nc	1	33.33	3
j	y	13	10.92	119
j	Z	9	18.75	48
j	T	6	10.71	56
j	z	6	8.82	68
j	Ø	6	4.65	129
j	c	5	7.81	64
j	l	5	4.31	116
j	C	4	4.26	94
j	d	4	3.51	114
j	t	3	2.44	123
j	S	2	2.74	73
j	g	2	1.85	108
j	i	2	1.56	128
j	cy	1	250	4
j	by	1	16.67	6
j	nj	1	12.50	8
j	dy	1	7.69	13
j	ty	1	6.25	16
j	x	1	1.37	73
j	h	1	0.94	106
j	w	1	0.87	115
j	s	1	0.85	118
j	r	1	0.81	124
j	m	1	0.79	127
j	n	1	0.79	126
nj	j	1	12.50	8

CORRESPONDENCE		NG	CP	AG
T	C	14	19.72	71
T	j	6	10.71	56
T	d	6	5.77	104
T	Z	5	12.82	39
T	c	5	8.47	59
T	k	4	3.74	107
T	dy	3	23.08	13
T	g	3	3.23	93
T	s	3	3.09	97
T	t	3	2.86	105
T	y	3	2.78	108
T	dh	2	33.33	6
T	8	2	5.41	37
T	z	2	4.00	50
T	Ø	2	1.77	113
T	ddy	1	100.00	1
T	ch	1	10.00	10
T	d”	1	8.33	12
T	Th	1	8.33	12
T	ty	1	4.55	22
T	th	1	3.33	30
T	L	1	2.70	37
T	S	1	1.59	63
T	l	1	0.96	104
T	w	1	0.95	105
T	r	1	0.95	105
T”	c”	1	100.00	1
T”	C”	1	50.00	2
Th	ch	1	20.00	5
Th	Ch	1	14.29	7
Th	th	1	10.00	10
Th	T	1	8.33	12
Th	C	1	7.14	14
Th	Ø	1	6.67	15
5	n	16	10.46	153
5	N	6	4.96	121
5	ny	5	21.74	23
5	y	5	3.33	150

CORRESPONDENCE		NG	CP	AG
5	m	2	1.30	154
5	Ny	1	25.00	4
5	4	1	12.50	8
5	x	1	1.32	76
5	l	1	0.71	140
5	o	1	0.70	143
y	i	25	7.99	313
y	Ø	23	7.32	314
y	j	13	10.92	119
y	r	12	4.35	276
y	l	11	4.07	270
y	Z	6	8.22	73
y	z	5	4.63	108
y	5	5	3.33	150
y	L	4	4.94	81
y	x	4	2.72	147
y	7	4	2.30	174
y	N	4	2.08	192
y	h	4	1.67	240
y	s	4	1.45	275
y	T	3	2.78	108
y	c	3	2.10	143
y	d	3	1.21	247
y	n	3	0.96	311
y	ty	2	6.06	33
y	8	2	3.57	56
y	3	2	0.93	215
y	g	2	0.88	227
y	e	2	0.67	299
y	k	2	0.65	307
y	7y	1	33.33	3
y	dh	1	11.11	9
y	dy	1	4.55	22
y	kh	1	1.59	63
y	S	1	0.68	148
y	E	1	0.62	162
y	C	1	0.57	174
y	w	1	0.36	276
y	t	1	0.33	301
y	a	1	0.32	313

CORRESPONDENCE		NG	CP	AG
y	u	1	0.32	311
k	g	31	12.86	241
k	Ø	30	9.04	332
k	kh	17	25.00	68
k	7	17	9.19	185
k	q	12	15.79	76
k	x	12	7.59	158
k	h	12	4.63	259
k	t	7	2.19	320
k	ky	4	11.76	34
k	X	4	7.84	51
k	T	4	3.74	107
k	C	4	2.15	186
k	N	4	1.90	210
k	Nk	3	18.75	16
k	S	3	1.97	152
k	tr	2	33.33	6
k	nk	2	25.00	8
k	kw	2	2.60	77
k	d	2	0.75	266
k	w	2	0.68	294
k	s	2	0.67	298
k	y	2	0.65	307
k	i	2	0.60	332
k	g”	1	100.00	1
k	nq	1	100.00	1
k	ndr	1	50.00	2
k	t7	1	33.33	3
k	hk	1	33.33	3
k	G	1	11.11	9
k	gy	1	7.14	14
k	ng	1	5.56	18
k	k”	1	3.03	33
k	Ng	1	2.94	34
k	f	1	0.78	129
k	c	1	0.68	146
k	p	1	0.35	285
k	l	1	0.35	285
k	r	1	0.34	295
k	n	1	0.30	328

CORRESPONDENCE		NG	CP	AG
k”	k”y	1	50.00	2
k”	q”	1	12.50	8
k”	kh	1	12.50	8
k”	X	1	6.67	15
k”	c”	1	6.67	15
k”	C”	1	5.88	17
k”	q	1	5.56	18
k”	g	1	4.76	21
k”	k	1	3.03	33
k”	Ø	1	2.94	34
kp	p	1	5.88	17
kpw	p	1	100.00	1
kpw	kw	1	100.00	1
kpw	mb	1	100.00	1
kpw	Ngw	1	100.00	1
kw	k	2	2.60	77
kw	kpw	1	100.00	1
kw	gw	1	4.76	21
kw	q	1	4.55	22
kw	mb	1	4.35	23
kw	f	1	2.38	42
kw	p	1	1.54	65
kw	t	1	1.32	76
kw	Ø	1	1.28	78
k”w	xw	1	33.33	3
kl	tl	1	100.00	1
kl	d	1	50.00	2
ky	k	4	11.76	34
ky	C	3	10.34	29
ky	c	2	8.00	25
k”y	k”	1	50.00	2
k”y	C”	1	33.33	3
kh	k	17	25.00	68

CORRESPONDENCE		NG	CP	AG
kh	x	9	21.43	42
kh	qh	2	50.00	4
kh	h	2	3.33	60
kh	Ø	2	2.90	69
kh	k”	1	12.50	8
kh	q	1	5.88	17
kh	Z	1	4.17	24
kh	g	1	2.04	49
kh	y	1	1.59	63
kh	s	1	1.47	68
khy	S	1	33.33	3
nk	k	2	25.00	8
Nk	k	3	18.75	16
Nk	ndr	1	100.00	1
Nk	tr	1	100.00	1
Nk	Ng	1	11.11	9
Nk	c	1	10.00	10
Nk	C	1	8.33	12
Nk	nd	1	7.69	13
Nk	t	1	6.250	16
Nk	d	1	6.25	16
Nk	r	1	6.25	16
Nk	N	1	6.25	16
hk	k	1	33.33	3
g	k	31	12.86	241
g	Ø	12	4.80	250
g	x	7	5.93	118
g	7	6	4.17	144
g	h	5	2.59	193
g	l	5	2.25	222
g	r	5	2.15	233
g	T	3	3.23	93
g	N	3	1.75	171
g	d	3	1.36	221
g	gy	2	14.29	14
g	Ng	2	6.25	32

CORRESPONDENCE		NG	CP	AG
g	q	2	3.77	53
g	j	2	1.85	108
g	c	2	1.82	110
g	b	2	0.89	224
g	y	2	0.88	227
g	nq	1	100.00	1
g	dy	1	5.26	19
g	k”	1	4.76	21
g	kh	1	2.04	49
g	Z	1	1.37	73
g	z	1	1.09	92
g	v	1	0.99	101
g	C	1	0.75	134
g	s	1	0.45	223
g	m	1	0.40	247
g	n	1	0.40	247
g”	k	1	100.00	1
gw	v	1	5.00	20
gw	kw	1	4.76	21
gw	w	1	2.94	34
gw	t	1	2.70	37
gw	Ø	1	2.70	37
gy	g	2	14.29	14
gy	k	1	7.14	14
gh	x	1	16.67	6
g!	!	1	100.00	1
ng	N	5	35.71	14
ng	Ng	2	22.22	9
ng	k	1	5.56	18
ng	Ø	1	5.26	19
Ng	ng	2	22.22	9
Ng	g	2	6.25	32
Ng	Nk	1	11.11	9
Ng	N	1	3.70	27

CORRESPONDENCE		NG	CP	AG
Ng	k	1	2.94	34
Ngw	kpw	1	100.00	1
Ngw	p	1	50.00	2
Ngw	mbw	1	50.00	2
Ngw	mp	1	50.00	2
x	h	27	20.45	132
x	k	12	7.59	158
x	X	10	23.26	43
x	kh	9	21.43	42
x	Ø	9	5.63	160
x	q	7	11.86	59
x	g	7	5.93	118
x	r	7	5.00	140
x	s	5	3.36	149
x	S	4	4.08	98
x	7	4	3.81	105
x	l	4	2.94	136
x	y	4	2.72	147
x	v	3	4.11	73
x	N	2	2.02	99
x	d	2	1.56	128
x	i	2	1.26	159
x	xh	1	100	1
x	gh	1	16.67	6
x	G	1	12.50	8
x	xw	1	11.11	9
x	qh	1	11.11	9
x	th	1	2.33	43
x	L	1	1.89	53
x	z	1	1.43	70
x	j	1	1.37	73
x	5	1	1.32	76
x	C	1	0.90	111
x	3	1	0.87	115
x	b	1	0.74	135
x	w	1	0.70	142
x	o	1	0.65	154
x	t	1	0.63	159
x	n	1	0.63	158

CORRESPONDENCE		NG	CP	AG
x	a	1	0.63	160
xw	k”w	1	33.33	3
xw	hw	1	33.33	3
xw	x	1	11.11	9
xy	h	1	20.00	5
xh	x	1	100.00	1
nx	n	1	50.00	2
N	n	30	14.02	214
N	Ø	10	4.65	215
N	*	7	10.77	65
N	5	6	4.96	121
N	ng	5	35.71	14
N	m	5	2.33	215
N	y	4	2.08	192
N	k	4	1.90	210
N	g	3	1.75	171
N	x	2	2.02	99
N	7	2	1.64	122
N	h	2	1.27	157
N	r	2	1.03	194
N	i	2	0.93	215
N	N”	1	100.00	1
N	Nk	1	6.25	16
N	Ng	1	3.70	27
N	f	1	1.19	84
N	d	1	0.54	184
N	l	1	0.52	193
N	t	1	0.49	204
N	u	1	0.47	212
N”	N	1	100.00	1
Nw	w*	1	100.00	1
Nw	w	1	9.09	11
Nw	m	1	7.69	13

CORRESPONDENCE		NG	CP	AG
Ny	5	1	25.00	4
Nh	h	1	50.00	2
q	k	12	15.79	76
q	x	7	11.86	59
q	Ø	7	8.97	78
q	7	5	9.62	52
q	X	3	8.57	35
q	g	2	3.77	53
q	h	2	3.08	65
q	G	1	12.50	8
q	kh	1	5.88	17
q	k”	1	5.56	18
q	kw	1	4.55	22
q	r	1	1.56	64
q	t	1	1.30	77
q	n	1	1.28	78
q”	7	1	16.67	6
q”	k”	1	12.50	8
q”	X	1	10.00	10
q”	Ø	1	9.09	11
qh	kh	2	50.00	4
qh	x	1	11.11	9
nq	k	1	100.00	1
nq	g	1	100.00	1
G	x	1	12.50	8
G	q	1	12.50	8
G	k	1	11.11	9
G	X	1	11.11	9
X	x	10	23.26	43
X	h	6	13.64	44
X	r	6	12.77	47
X	Ø	5	9.43	53
X	k	4	7.84	51
X	q	3	8.57	35

CORRESPONDENCE		NG	CP	AG
X	7	2	5.26	38
X	G	1	11.11	9
X	q”	1	10.00	10
X	k”	1	6.67	15
X	C	1	2.33	43
X	s	1	1.96	51
h	Ø	55	20.68	266
h	x	27	20.45	132
h	s	19	7.79	244
h	k	12	4.63	259
h	7	11	6.67	165
h	p	11	4.80	229
h	X	6	13.64	44
h	f	6	5.36	112
h	S	6	4.72	127
h	r	6	2.58	233
h	w	6	2.56	234
h	g	5	2.59	193
h	l	5	2.26	221
h	C	4	2.53	158
h	b	4	1.75	229
h	y	4	1.67	240
h	th	3	5.00	60
h	c	3	2.48	121
h	d	3	1.39	216
h	t	3	1.16	259
h	kh	2	3.33	60
h	q	2	3.08	65
h	L	2	2.99	67
h	z	2	2.20	91
h	N	2	1.27	157
h	fh	1	100.00	1
h	Nh	1	50.00	2
h	xy	1	20.00	5
h	hw	1	11.11	9
h	Z	1	1.45	69
h	v	1	0.95	105
h	j	1	0.94	106
h	3	1	0.55	183
h	u	1	0.38	263

CORRESPONDENCE		NG	CP	AG
hw	xw	1	33.33	3
hw	p	1	11.11	9
hw	h	1	11.11	9
7	Ø	24	12.57	191
7	k	17	9.19	185
7	h	11	6.67	165
7	t	7	3.74	187
7	g	6	4.17	144
7	q	5	9.62	52
7	x	4	3.81	105
7	l	4	2.44	164
7	y	4	2.30	174
7	”	3	7.32	41
7	r	3	1.80	167
7	w	3	1.76	170
7	n	3	1.58	190
7	X	2	5.26	38
7	N	2	1.64	122
7	d	2	1.24	161
7	q”	1	16.67	6
7	b”	1	10.00	10
7	th	1	2.08	48
7	L	1	1.92	52
7	*	1	1.32	76
7	f	1	1.16	86
7	b	1	0.61	165
7	p	1	0.59	169
7	s	1	0.55	182
7	u	1	0.53	190
7	i	1	0.52	191
7d	d	1	100.00	1
7d	n	1	100.00	1
7d	l	1	100.00	1
7n	n	1	100.00	1
7y	y	1	33.33	3
L	l	16	20.00	80

CORRESPONDENCE		NG	CP	AG
L	r	5	7.46	67
L	y	4	4.94	81
L	ly	3	16.67	18
L	c	2	3.92	51
L	h	2	2.99	67
L	t	2	2.60	77
L	lh	1	33.33	3
L	th	1	4.00	25
L	Z	1	3.57	28
L	T	1	2.70	37
L	z	1	2.44	41
L	7	1	1.92	52
L	x	1	1.89	53
L	3	1	1.67	60
L	d	1	1.54	65
L	s	1	1.39	72
L	w	1	1.32	76
L	n	1	1.19	84
!	g!	1	100.00	1
!	!k	1	100.00	1
!	!”	1	50.00	2
!	!7	1	33.33	3
!”	!	1	50.00	2
!n	!N	1	100.00	1
!k	!	1	100.00	1
!N	!n	1	100.00	1
!7	!	1	33.33	3
*	n	13	11.50	113
*	N	7	10.77	65
*	m	2	1.79	112
*	7	1	1.32	76
*	u	1	0.89	112
*	a	1	0.88	113

CORRESPONDENCE		NG	CP	AG
”	7	3	7.32	41
”	s	1	1.82	55
”	i	1	1.79	56
Ø	h	55	20.68	266
Ø	a	55	16.18	340
Ø	i	54	15.93	339
Ø	o	36	11.21	321
Ø	u	33	9.76	338
Ø	e	31	9.54	325
Ø	3	30	13.04	230
Ø	k	30	9.04	332
Ø	n	25	7.44	336
Ø	7	24	12.57	191
Ø	y	23	7.32	314
Ø	w	22	7.28	302
Ø	l	20	6.85	292
Ø	r	20	6.60	303
Ø	t	17	5.18	328
Ø	m	15	4.46	336
Ø	E	12	7.02	171
Ø	g	12	4.80	250
Ø	s	11	3.65	301
Ø	N	10	4.65	215
Ø	x	9	5.63	160
Ø	d	8	2.93	273
Ø	q	7	8.97	78
Ø	b	7	2.45	286
Ø	j	6	4.65	129
Ø	X	5	9.43	53
Ø	S	5	3.21	156
Ø	i*	3	4.29	70
Ø	z	3	2.63	114
Ø	f	3	2.27	132
Ø	p	3	1.02	293
Ø	kh	2	2.90	69
Ø	T	2	1.77	113
Ø	v	2	1.57	127
Ø	c	2	1.34	149
Ø	tx	1	50.00	2
Ø	q”	1	9.09	11

CORRESPONDENCE		NG	CP	AG
Ø	Th	1	6.67	15
Ø	ng	1	5.26	19
Ø	ch	1	4.55	22
Ø	dy	1	4.35	23
Ø	E*	1	3.57	28
Ø	k”	1	2.94	34
Ø	ty	1	2.94	34
Ø	gw	1	2.70	37
Ø	ph	1	2.27	44
Ø	8	1	1.72	58
Ø	o*	1	1.41	71
Ø	th	1	1.41	71
Ø	nd	1	1.37	73
Ø	kw	1	1.28	78
Ø	Z	1	1.23	81
Ø	C	1	0.53	190
i	e	95	29.23	325
i	a	59	17.40	339
i	Ø	54	15.93	339
i	3	53	23.14	229
i	u	50	14.79	338
i	E	31	18.13	171
i	o	30	9.35	321
i	y	25	7.99	313
i	i*	14	20.00	70
i	l	5	1.72	291
i	n	4	1.19	335
i	e*	2	4.76	42
i	j	2	1.56	128
i	x	2	1.26	159
i	N	2	0.93	215
i	r	2	0.66	302
i	k	2	0.60	332
i	E*	1	3.57	28
i	”	1	1.79	56
i	o*	1	1.41	71
i	7	1	0.52	191
i	s	1	0.33	300
i*	i	14	20.00	70

CORRESPONDENCE		NG	CP	AG
i*	Ø	3	4.29	70
i*	e*	2	6.67	30
i*	e	2	2.99	67
i*	E*	1	5.00	20
i*	E	1	2.22	45
i*	3	1	1.92	52
i*	o	1	1.45	69
e	a	98	30.25	324
e	i	95	29.23	325
e	E	60	36.36	165
e	3	48	21.62	222
e	o	37	12.01	308
e	Ø	31	9.54	325
e	u	20	6.17	324
e	e*	4	9.52	42
e	i*	2	2.99	67
e	a*	2	2.47	81
e	y	2	0.67	299
e	o*	1	1.45	69
e	d	1	0.38	261
e	r	1	0.34	290
e*	e	4	9.52	42
e*	a*	3	8.57	35
e*	i*	2	6.67	30
e*	i	2	4.76	42
e*	E	1	3.33	30
e*	a	1	2.38	42
E	a	61	35.67	171
E	e	60	36.36	165
E	i	31	18.13	171
E	o	27	16.17	167
E	3	25	19.53	128
E	Ø	12	7.02	171
E	u	11	6.47	170
E	o*	2	4.00	50
E	3*	1	5.56	18
E	E*	1	4.17	24
E	e*	1	3.33	30

CORRESPONDENCE		NG	CP	AG
E	i*	1	2.22	45
E	a*	1	1.89	53
E	l	1	0.66	151
E	r	1	0.63	159
E	y	1	0.62	162
E	n	1	0.59	169
E*	i*	1	5.00	20
E*	a*	1	4.76	21
E*	E	1	4.17	24
E*	i	1	3.57	28
E*	Ø	1	3.57	28
3	a	62	26.96	230
3	i	53	23.14	229
3	u	50	21.83	229
3	e	48	21.62	222
3	o	38	17.19	221
3	Ø	30	13.04	230
3	E	25	19.53	128
3	3*	3	13.64	22
3	y	2	0.93	215
3	i*	1	1.92	52
3	L	1	1.67	60
3	a*	1	1.61	62
3	x	1	0.87	115
3	h	1	0.55	183
3	w	1	0.49	206
3	r	1	0.48	207
3*	3	3	13.64	22
3*	o	2	9.09	22
3*	E	1	5.56	18
3*	u	1	4.55	22
a	e	98	30.25	324
a	o	94	29.28	321
a	3	62	26.96	230
a	E	61	35.67	171
a	i	59	17.40	339
a	Ø	55	16.18	340

CORRESPONDENCE		NG	CP	AG
a	u	37	10.95	338
a	a*	15	17.86	84
a	n	2	0.60	336
a	e*	1	2.38	42
a	o*	1	1.41	71
a	*	1	0.88	113
a	v	1	0.79	126
a	x	1	0.63	160
a	w	1	0.33	302
a	s	1	0.33	301
a	r	1	0.33	303
a	y	1	0.32	313
a*	a	15	17.86	84
a*	e*	3	8.57	35
a*	o*	2	4.17	48
a*	e	2	2.47	81
a*	E*	1	4.76	21
a*	E	1	1.89	53
a*	3	1	1.61	62
u	o	95	29.69	320
u	3	50	21.83	229
u	i	50	14.79	338
u	a	37	10.95	338
u	Ø	33	9.76	338
u	e	20	6.17	324
u	E	11	6.47	170
u	w	11	3.67	300
u	u*	9	14.06	64
u	o*	3	4.35	69
u	3*	1	4.55	22
u	*	1	0.89	112
u	7	1	0.53	190
u	N	1	0.47	212
u	h	1	0.38	263
u	l	1	0.34	290
u	r	1	0.33	302
u	y	1	0.32	311
u	n	1	0.30	334

CORRESPONDENCE		NG	CP	AG
u*	u	9	14.06	64
u*	o*	4	9.09	44
u*	o	2	3.13	64
o	u	95	29.69	320
o	a	94	29.28	321
o	3	38	17.19	221
o	e	37	12.01	308
o	Ø	36	11.21	321
o	i	30	9.35	321
o	E	27	16.17	167
o	o*	13	18.57	70
o	w	5	1.77	282
o	3*	2	9.09	22
o	u*	2	3.13	64
o	l	2	0.73	273
o	i*	1	1.45	69
o	v	1	0.80	125
o	5	1	0.70	143
o	x	1	0.65	154
o*	o	13	18.57	70
o*	u*	4	9.09	44
o*	u	3	4.35	69
o*	a*	2	4.17	48
o*	E	2	4.00	50
o*	e	1	1.45	69
o*	i	1	1.41	71
o*	a	1	1.41	71
o*	Ø	1	1.41	71

APPENDIX C: CORRESPONDENCE PERCENTAGE (CP) MATRIX FOR THIRTY-ONE ASJPCODE SIMPLE CONSONANTS

	p	b	f	v	m	w	8	t	d	s	z	c	n	r	l
p															
b	11.79														
f	11.71	4.07													
v	2.63	15.93	10.29												
m	0.69	2.83	0.77	0.80											
w	2.33	5.02	3.36	15.89	1.00										
8	0	0	0	0	0	0									
t	0	0	0.76	0	0.31	0	12.28								
d	0	0.82	0.88	0.94	0.37	0	9.09	12.08							
s	0.38	0	0.81	0	0	0	10.34	3.39	1.26						
z	0	0	0	0	0.88	0.98	5.71	1.75	3.96	11.01					
c	0	0	0	0	0.69	0	2.44	4.83	2.46	10.71	2.78				
n	0	0	0.77	0	2.41	0	0	1.23	4.44	0.67	0	0			
r	0	0	0	0	0.33	0.75	0	3.42	9.31	1.51	7.48	0.78	3.34		
l	0	0.81	0	0.95	0.34	0.39	5.36	1.79	4.2	1.17	3.03	1.55	3.81	18.39	
S	0	0	0	0	0	0	2.56	1.32	0	19.08	3.85	0.97	0.65	0.75	0
Z	0	0	0	0	0	0	0	0	1.30	1.30	5.88	3.85	0	3.85	1.37
C	0	0	0	0	0	0	0	5.88	2.63	6.11	2.47	16.24	0.53	1.81	1.21
j	0	0	0	0	0.79	0.87	0	2.44	3.51	0.85	8.82	7.81	0.79	0.81	4.31
T	0	0	0	0	0	0.95	5.41	2.86	5.77	3.09	4	8.47	0	0.95	0.96
5	0	0	0	0	1.30	0	0	0	0	0	0	0	10.46	0	0.71
y	0	0	0	0	0	0.36	3.57	0.33	1.21	1.45	4.63	2.10	0.96	4.35	4.07
k	0.35	0	0.78	0	0	0.68	0	2.19	0.75	0.67	0	0.68	0.30	0.34	0.35
g	0	0.89	0	0.99	0.40	0	0	0	1.36	0.45	1.09	1.82	0.40	2.15	2.25
x	0	0.74	0	4.11	0	0.70	0	0.63	1.56	3.36	1.43	0	0.63	5.00	2.94
N	0	0	1.19	0	2.33	0	0	0.49	0.54	0	0	0	14.02	1.03	0.52
q	0	0	0	0	0	0	0	1.30	0	0	0	0	1.28	1.56	0
X	0	0	0	0	0	0	0	0	0	1.96	0	0	0	12.77	0
h	4.80	1.75	5.36	0.95	0	2.56	0	1.16	1.39	7.79	2.20	2.48	0	2.58	2.26
7	0.59	0.61	1.16	0	0	1.76	0	3.74	1.24	0.55	0	0	1.58	1.80	2.44
L	0	0	0	0	0	1.32	0	2.6	1.54	1.39	2.44	3.92	1.19	7.46	20.00

	S	Z	C	j	T	5	y	k	g	x	N	q	X	h	7	L
S																
Z	1.96															
C	3.25	1.67														
j	2.74	18.75	4.26													
T	1.59	12.82	19.72	10.71												
5	0	0	0	0	0											
y	0.68	8.22	0.57	10.92	2.78	3.33										
k	1.97	0	2.15	0	3.74	0	0.65									
g	0	1.37	0.75	1.85	3.23	0	0.88	12.86								
x	4.08	0	0.90	1.37	0	1.32	2.72	7.59	5.93							
N	0	0	0	0	0	4.96	2.08	1.90	1.75	2.02						
q	0	0	0	0	0	0	0	15.79	3.77	11.86	0					
X	0	0	2.33	0	0	0	0	7.84	0	23.26	0	8.57				
h	4.72	1.45	2.53	0.94	0	0	1.67	4.63	2.59	20.45	1.27	3.08	13.64			
7	0	0	0	0	0	0	2.3	9.19	4.17	3.81	1.64	9.62	5.26	6.67		
L	0	3.57	0	0	2.70	0	4.94	0	0	1.89	0	0	0	2.99	1.92	

APPENDIX D: CORRESPONDENCE PERCENTAGE (CP) MATRIX FOR SEVEN ASJPCODE SIMPLE VOWELS

	i	e	E	3	a	u
i						
e	29.23					
E	18.13	36.36				
3	23.14	21.62	19.53			
a	17.40	30.25	35.67	26.96		
u	14.79	6.17	6.47	21.83	10.95	
o	9.35	12.01	16.17	17.19	29.28	29.69

APPENDIX E: COMPARISON OF THE CORRESPONDENCE PERCENTAGE MATRIX WITH MATRICES BASED ON OTHER MEASURES OF SOUND SIMILARITY

Appendix E provides the correlations between the correspondence percentage matrix and the published similarity matrices described in §5, for the thirteen consonants shared by all of the matrices. Each row compares a published similarity matrix with the correspondence percentage matrix. The published matrices are identified by the first author of the study followed by the number of the table in the original publication. For each matrix, the table gives the value of Goodman-Kruskal gamma and the *p*-value from a Mantel test of significance.

MATRIX	GAMMA	*p*-VALUE
PERCEPTUAL CONFUSIONS		
Miller 1	0.26	< 0.001
Miller 2	0.27	0.005
Miller 3	0.35	0.001
Miller 4	0.44	0.001
Miller 5	0.44	< 0.001
Miller 6	0.33	0.020
Miller 7	0.25	0.007
Miller 8	0.25	0.004
Miller 9	0.29	0.003
Miller 10	0.20	0.025
Miller 11	0.34	0.002
Miller 12	0.36	0.001
Miller 13	0.28	0.003
Miller 14	0.37	< 0.001
Miller 15	0.37	< 0.001
Miller 16	0.33	< 0.001
Miller 17	0.16	0.008
Phatak 2	0.71	< 0.001
Phatak 3	0.55	< 0.001
Phatak 4	0.51	< 0.001
Phatak 5	0.44	< 0.001
Phatak 6	0.37	< 0.001
Phatak 7	0.42	< 0.001
Phatak 8	0.33	< 0.001
Phatak 9	0.28	< 0.001
Smits 4 upper	0.34	< 0.001
Smits 4 lower	0.32	0.001

Cutler 1	0.38	0.001
Cutler 2	0.32	< 0.001
Cutler 5	0.34	< 0.001
Cutler 6	0.38	< 0.001
RATINGS AND JUDGMENTS OF SIMILARITY		
Singh exp. 1	0.35	< 0.001
Singh exp. 2	0.24	0.002
Singh exp. 3	0.53	< 0.001
Black exp. 1	0.24	0.004
Black exp. 2	0.32	0.001
SPEECH ERRORS		
Goldstein	0.39	< 0.001
Shattuck-H	0.54	< 0.001
Jaeger	0.33	< 0.001
PUNS		
Sobkowiak	0.42	< 0.001
CONFUSIONS IN SHORT-TERM MEMORY		
Wickelgren exp. 1	0.28	< 0.001
Wickelgren exp. 2	0.28	< 0.001

APPENDIX F: PHONETIC AND PHONOLOGICAL MATRICES BASED ON DATA DESCRIBED BY MIELKE (2012)

Appendix F provides, with the generous permission of Jeff Mielke, his matrices for the twenty-eight consonants and seven vowels that are correlated with correspondence percentages in §6. For each property, the consonant matrix is followed by the vowel matrix. The matrices contain distances, which were converted to similarities by subtraction from a constant.

Nasal airflow

	p	b	f	v	m	w	t	d	s
p									
b	0.014911								
f	0.122882	0.107971							
v	0.052231	0.03732	0.070651						
m	5.245829	5.230918	5.122947	5.193598					
w	0.062506	0.077417	0.185387	0.114737	5.308334				
t	0.034921	0.02001	0.087961	0.01731	5.210908	0.097427			
d	0.015009	0.000098	0.107873	0.037222	5.23082	0.077515	0.019912		
s	0.032772	0.047682	0.155653	0.085002	5.2786	0.029734	0.067693	0.04778	
z	0.044381	0.059292	0.167263	0.096612	5.29021	0.018125	0.079302	0.05939	0.01161
c	0.129324	0.144235	0.252206	0.181555	5.375153	0.066818	0.164245	0.144333	0.096552
n	5.080674	5.065763	4.957792	5.028443	0.165155	5.14318	5.045753	5.065665	5.113445
r	0.133125	0.148036	0.256007	0.185356	5.378954	0.07062	0.168046	0.148134	0.100354
l	0.010531	0.025442	0.133413	0.062762	5.25636	0.051975	0.045452	0.02554	0.02224
S	0.14095	0.126039	0.018069	0.088719	5.104878	0.203456	0.106029	0.125941	0.173722
Z	0.015654	0.030565	0.138536	0.067885	5.261483	0.046851	0.050575	0.030663	0.017117
C	0.136818	0.151729	0.2597	0.189049	5.382647	0.074313	0.171739	0.151827	0.104047
j	0.107452	0.122363	0.230334	0.159683	5.353281	0.044946	0.142373	0.122461	0.07468
T	0.059223	0.074134	0.182105	0.111454	5.305052	0.003283	0.094144	0.074232	0.026452
5	5.892748	5.877837	5.769866	5.840517	0.646919	5.955254	5.857827	5.877739	5.925519
y	0.092104	0.107015	0.214986	0.144335	5.337933	0.029598	0.127025	0.107113	0.059333
k	0.143521	0.158431	0.266402	0.195751	5.389349	0.081015	0.178442	0.15853	0.110749
g	0.025645	0.010734	0.097237	0.026586	5.220184	0.08815	0.009276	0.010636	0.058416
x	0.080918	0.066007	0.041963	0.028687	5.164911	0.143424	0.045997	0.065909	0.11369
N	4.67196	4.657049	4.549078	4.619729	0.573869	4.734466	4.637039	4.656951	4.704731
h	0.403892	0.388981	0.28101	0.351661	4.841937	0.466397	0.368971	0.388883	0.436663
7	0.133854	0.148764	0.256735	0.186084	5.379682	0.071348	0.168775	0.148862	0.101082
L	0.161102	0.146192	0.038221	0.108872	5.084726	0.223608	0.126181	0.146094	0.193874

	z	c	n	r	l	S	Z	C	j
z									
c	0.084943								
n	5.125055	5.209998							
r	0.088744	0.003801	5.213799						
l	0.03385	0.118793	5.091205	0.122594					
S	0.185331	0.270274	4.939724	0.274076	0.151481				
Z	0.028727	0.11367	5.096328	0.117471	0.005123	0.156605			
C	0.092437	0.007494	5.217492	0.003693	0.126287	0.277769	0.121164		
j	0.063071	0.021872	5.188126	0.025673	0.096921	0.248402	0.091798	0.029366	
T	0.014842	0.070101	5.139897	0.073902	0.048692	0.200174	0.043569	0.077595	0.048229
5	5.937129	6.022072	0.812074	6.025873	5.903279	5.751798	5.908402	6.029566	6.0002
y	0.047723	0.03722	5.172778	0.041021	0.081573	0.233055	0.07645	0.044714	0.015348
k	0.099139	0.014197	5.224195	0.010395	0.132989	0.284471	0.127866	0.006702	0.036069
g	0.070026	0.154969	5.055029	0.15877	0.036176	0.115306	0.041299	0.162463	0.133097
x	0.125299	0.210242	4.999756	0.214044	0.091449	0.060032	0.096573	0.217737	0.18837
N	4.716341	4.801284	0.408714	4.805085	4.682491	4.53101	4.687614	4.808778	4.779412
h	0.448273	0.533215	4.676783	0.537017	0.414423	0.262941	0.419546	0.54071	0.511344
7	0.089472	0.00453	5.214528	0.000728	0.123322	0.274804	0.118199	0.002965	0.026401
L	0.205484	0.290426	4.919571	0.294228	0.171634	0.020152	0.176757	0.297921	0.268555

	T	5	y	k	g	x	N	h	7
T									
5	5.951971								
y	0.032881	5.984852							
k	0.084297	6.036268	0.051416						
g	0.084868	5.867103	0.117749	0.169165					
x	0.140141	5.81183	0.173022	0.224439	0.055274				
N	4.731183	1.220788	4.764064	4.815481	4.646316	4.591042			
h	0.463115	5.488856	0.495996	0.547412	0.378247	0.322973	4.268068		
7	0.07463	6.026601	0.041749	0.009667	0.159498	0.214772	4.805813	0.537745	
L	0.220326	5.731646	0.253207	0.304623	0.135458	0.080184	4.510858	0.242789	0.294956

	i	e	E	3	a	u
i						
e	0.118312					
E	0.032112	0.0862				
3	0.042187	0.076125	0.010075			
a	0.039412	0.078899	0.0073	0.002775		
u	0.045879	0.16419	0.07799	0.088065	0.085291	
o	0.070685	0.047626	0.038574	0.028499	0.031273	0.116564

Oral airflow

	p	b	f	v	m	w	t	d	s
p									
b	0.166811								
f	2.689139	2.85595							
v	1.413989	1.5808	1.27515						
m	0.045774	0.121038	2.734912	1.459762					
w	0.476936	0.643747	2.212203	0.937053	0.522709				
t	0.164818	0.001993	2.853957	1.578807	0.119045	0.641754			
d	0.255156	0.088345	2.944295	1.669145	0.209383	0.732092	0.090338		
s	1.917223	2.084035	0.771916	0.503235	1.962997	1.440288	2.082042	2.172379	
z	1.193855	1.360667	1.495283	0.220133	1.239629	0.71692	1.358674	1.449012	0.723368
c	0.043985	0.210796	2.645154	1.370004	0.089758	0.432951	0.208803	0.299141	1.873239
n	0.184312	0.017501	2.873451	1.598301	0.138539	0.661248	0.019494	0.070844	2.101535
r	0.23742	0.404231	2.451719	1.176569	0.283193	0.239516	0.402238	0.492576	1.679803
l	0.544331	0.711142	2.144808	0.869658	0.590105	0.067395	0.709149	0.799487	1.372892
S	3.455197	3.622009	0.766059	2.041209	3.500971	2.978262	3.620016	3.710354	1.537974
Z	2.212659	2.37947	0.47648	0.79867	2.258432	1.735723	2.377477	2.467815	0.295436
C	0.802035	0.968846	1.887104	0.611954	0.847809	0.3251	0.966854	1.057191	1.115188
j	0.448417	0.615228	2.240722	0.965572	0.494191	0.028519	0.613236	0.703573	1.468806
T	0.14547	0.021342	2.834609	1.559458	0.099696	0.622405	0.019349	0.109687	2.062693
5	0.422682	0.255871	3.111821	1.836671	0.376909	0.899618	0.257864	0.167526	2.339905
y	0.656811	0.823623	2.032328	0.757177	0.702585	0.179876	0.82163	0.911968	1.260412
k	0.409384	0.242573	3.098523	1.823373	0.363611	0.88632	0.244566	0.154228	2.326608
g	0.160096	0.006716	2.849235	1.574084	0.114322	0.637031	0.004723	0.095061	2.077319
x	4.361226	4.528038	1.672087	2.947237	4.407	3.88429	4.526044	4.616383	2.444003
N	0.148059	0.018752	2.837198	1.562048	0.102286	0.624995	0.016759	0.107097	2.065282
h	4.924498	5.091309	2.235359	3.510509	4.970272	4.447562	5.089316	5.179654	3.007275
7	0.275168	0.108356	2.964307	1.689156	0.229394	0.752103	0.110349	0.020011	2.192391
L	0.427035	0.593846	2.262104	0.986954	0.472809	0.049901	0.591853	0.682191	1.490188

	z	c	n	r	l	S	Z	C	j
z									
c	1.149871								
n	1.378168	0.228297							
r	0.956436	0.193435	0.421732						
l	0.649525	0.500346	0.728643	0.306911					
S	2.261342	3.411213	3.639509	3.217777	2.910866				
Z	1.018803	2.168674	2.396971	1.975239	1.668328	1.242539			
C	0.39182	0.75805	0.986347	0.564615	0.257704	2.653162	1.410624		
j	0.745438	0.404432	0.632729	0.210997	0.095914	3.00678	1.764242	0.353618	
T	1.339325	0.189454	0.038842	0.38289	0.689801	3.600667	2.358129	0.947505	0.593887
5	1.616537	0.466667	0.23837	0.660102	0.967013	3.877879	2.635341	1.224717	0.871099
y	0.537044	0.612827	0.841123	0.419391	0.11248	2.798386	1.555848	0.145224	0.208394
k	1.60324	0.453369	0.225072	0.646804	0.953715	3.864582	2.622043	1.211419	0.857801
g	1.353951	0.20408	0.024216	0.397516	0.704427	3.615293	2.372755	0.962131	0.608513
x	3.167371	4.317241	4.545538	4.123806	3.816895	0.906029	2.148567	3.559191	3.912809
N	1.341915	0.192044	0.036253	0.385479	0.69239	3.603256	2.360718	0.950094	0.596476
h	3.730642	4.880513	5.10881	4.687078	4.380167	1.4693	2.711839	4.122463	4.476081
7	1.469023	0.319152	0.090856	0.512588	0.819499	3.730365	2.487827	1.077203	0.723585
L	0.76682	0.38305	0.611347	0.189615	0.117296	3.028162	1.785624	0.375	0.021382

	T	5	y	k	g	x	N	h	7
T									
5	0.277212								
y	0.802281	1.079493							
k	0.263915	0.013298	1.066196						
g	0.014626	0.262586	0.816907	0.249289					
x	4.506696	4.783908	3.704415	4.77061	4.521322				
N	0.002589	0.274623	0.80487	0.261325	0.012037	4.509285			
h	5.069968	5.34718	4.267686	5.333882	5.084594	0.563272	5.072557		
7	0.129698	0.147514	0.931979	0.134217	0.115072	4.636394	0.127109	5.199666	
L	0.572505	0.849717	0.229776	0.836419	0.587131	3.934191	0.575094	4.497463	0.702203

	i	e	E	3	a	u
i						
e	0.041566					
E	0.064048	0.105614				
3	0.042836	0.001271	0.106884			
a	0.132078	0.173643	0.06803	0.174914		
u	0.13915	0.097584	0.203198	0.096314	0.271228	
o	0.168047	0.126481	0.232095	0.125211	0.300125	0.028897

Larynx height

	p	b	f	v	m	w	t	d	s
p									
b	1.003141								
f	0.646427	1.649568							
v	0.50453	0.498611	1.150957						
m	0.15191	0.851232	0.798337	0.352621					
w	0.043036	1.046177	0.603391	0.547566	0.194946				
t	0.543648	0.459493	1.190075	0.039118	0.391738	0.586684			
d	1.284377	0.281236	1.930804	0.779846	1.132467	1.327413	0.740729		
s	0.316191	1.319332	0.330236	0.820721	0.468101	0.273155	0.859839	1.600568	
z	0.802931	0.20021	1.449358	0.298401	0.651022	0.845967	0.259283	0.481445	1.119122
c	0.482605	1.485747	0.163822	0.987136	0.634515	0.439569	1.026253	1.766982	0.166415
n	0.123557	1.126699	0.52287	0.628088	0.275467	0.080521	0.667206	1.407934	0.192633
r	0.465596	0.537546	1.112023	0.038935	0.313686	0.508632	0.078052	0.818781	0.781786
l	0.23633	0.766812	0.882757	0.268201	0.08442	0.279366	0.307319	1.048047	0.55252
S	0.557361	1.560503	0.089066	1.061892	0.709271	0.514325	1.101009	1.841738	0.24117
Z	0.590756	0.412385	1.237183	0.086226	0.438847	0.633792	0.047108	0.693621	0.906947
C	0.178473	1.181614	0.467954	0.683003	0.330382	0.135437	0.722121	1.462849	0.137718
j	1.536647	0.533506	2.183074	1.032117	1.384738	1.579683	0.992999	0.252271	1.852838
T	0.288446	0.714695	0.934873	0.216084	0.136537	0.331482	0.255202	0.995931	0.604637
5	0.583586	0.419555	1.230013	0.079056	0.431676	0.626622	0.039938	0.700791	0.899777
y	0.428277	1.431418	0.21815	0.932807	0.580187	0.385241	0.971925	1.712654	0.112086
k	0.071035	0.932106	0.717462	0.433495	0.080875	0.114071	0.472613	1.213342	0.387226
g	1.453441	0.4503	2.099868	0.948911	1.301532	1.496477	0.909793	0.169064	1.769632
x	0.415117	1.418258	0.23131	0.919647	0.567027	0.372081	0.958765	1.699494	0.098926
N	0.396386	0.606755	1.042813	0.108144	0.244476	0.439422	0.147262	0.887991	0.712577
h	0.691726	1.694868	0.045299	1.196257	0.843636	0.64869	1.235374	1.976103	0.375536
7	1.269106	2.272248	0.622679	1.773637	1.421016	1.22607	1.812754	2.553483	0.952915
L	0.479874	1.483015	0.166553	0.984404	0.631783	0.436838	1.023522	1.764251	0.163683

	z	c	n	r	l	S	Z	C	j
z									
c	1.285537								
n	0.926489	0.359048							
r	0.337336	0.948201	0.589153						
l	0.566602	0.718935	0.359887	0.229266					
S	1.360293	0.074756	0.433804	1.022957	0.793691				
Z	0.212175	1.073362	0.714314	0.125161	0.354427	1.148118			
C	0.981404	0.304133	0.054915	0.644068	0.414802	0.378889	0.769229		
j	0.733716	2.019253	1.660205	1.071052	1.300318	2.094009	0.945891	1.71512	
T	0.514485	0.771052	0.412004	0.177149	0.052117	0.845807	0.30231	0.466919	1.248201
5	0.219345	1.066191	0.707143	0.117991	0.347257	1.140947	0.00717	0.762059	0.953061
y	1.231208	0.054329	0.304719	0.893872	0.664606	0.129084	1.019033	0.249804	1.964924
k	0.731896	0.55364	0.194593	0.394561	0.165294	0.628396	0.519721	0.249508	1.465612
g	0.65051	1.936047	1.576999	0.987846	1.217112	2.010803	0.862685	1.631914	0.083206
x	1.218048	0.067488	0.29156	0.880713	0.651447	0.142244	1.005873	0.236644	1.951764
N	0.406545	0.878991	0.519944	0.06921	0.160057	0.953747	0.19437	0.574859	1.140261
h	1.494658	0.209121	0.568169	1.157322	0.928056	0.134365	1.282483	0.513254	2.228374
7	2.072038	0.786501	1.145549	1.734702	1.505436	0.711745	1.859863	1.090634	2.805754
L	1.282805	0.002732	0.356316	0.945469	0.716203	0.077487	1.07063	0.301401	2.016521

	T	5	y	k	g	x	N	h	7
T									
5	0.29514								
y	0.716723	1.011863							
k	0.217411	0.512551	0.499312						
g	1.164995	0.869855	1.881718	1.382406					
x	0.703563	0.998703	0.01316	0.486152	1.868558				
N	0.10794	0.1872	0.824663	0.325351	1.057055	0.811503			
h	0.980173	1.275312	0.26345	0.762761	2.145168	0.276609	1.088112		
7	1.557552	1.852692	0.840829	1.340141	2.722548	0.853989	1.665492	0.57738	
L	0.76832	1.06346	0.051597	0.550909	1.933315	0.064757	0.87626	0.211853	0.789233

	e	E	3	a	u	o
i						
e	0.05261					
E	0.458092	0.405482				
3	0.868918	0.816308	0.410826			
a	0.413552	0.360941	0.04454	0.455366		
u	0.754377	0.701767	0.296285	0.114541	0.340826	
o	1.028263	0.975652	0.570171	0.159345	0.614711	0.273885

Voicing (vocal-fold contact area)

	p	b	f	v	m	w	t	d	s
p									
b	0.608409								
f	0.692254	1.300663							
v	0.905659	0.29725	1.597913						
m	1.820056	1.211648	2.512311	0.914397					
w	1.545347	0.936938	2.237601	0.639688	0.274709				
t	0.155207	0.763616	0.537047	1.060866	1.975263	1.700554			
d	0.830432	0.222023	1.522686	0.075227	0.989625	0.714915	0.985638		
s	0.263734	0.872143	0.42852	1.169393	2.08379	1.809081	0.108527	1.094166	
z	1.280127	0.671718	1.972381	0.374468	0.53993	0.26522	1.435333	0.449695	1.543861
c	0.134289	0.742697	0.557966	1.039948	1.954345	1.679635	0.020918	0.96472	0.129445
n	1.863152	1.254743	2.555407	0.957493	0.043096	0.317805	2.018359	1.032721	2.126886
r	1.587667	0.979258	2.279921	0.682008	0.232389	0.04232	1.742874	0.757235	1.851401
l	1.879174	1.270765	2.571428	0.973515	0.059118	0.333827	2.034381	1.048742	2.142908
S	0.378526	0.986934	0.313729	1.284185	2.198582	1.923872	0.223319	1.208957	0.114792
Z	1.289849	0.68144	1.982103	0.38419	0.530207	0.255498	1.445056	0.459417	1.553583
C	0.082013	0.526396	0.774267	0.823646	1.738043	1.463334	0.23722	0.748419	0.345747
j	1.030847	0.422439	1.723101	0.125188	0.789209	0.5145	1.186054	0.200416	1.294581
T	0.345129	0.26328	1.037383	0.56053	1.474927	1.200218	0.500336	0.485303	0.608863
5	1.934478	1.32607	2.626733	1.028819	0.114422	0.389132	2.089685	1.104047	2.198212
y	1.724184	1.115775	2.416439	0.818525	0.095872	0.178837	1.879391	0.893753	1.987918
k	0.052102	0.556306	0.744357	0.853557	1.767954	1.493244	0.207309	0.778329	0.315836
g	0.754368	0.145959	1.446622	0.151291	1.065688	0.790979	0.909575	0.076064	1.018102
x	0.127961	0.480448	0.820215	0.777698	1.692095	1.417386	0.283168	0.702471	0.391695
N	2.031794	1.423385	2.724048	1.126135	0.211738	0.486447	2.187001	1.201362	2.295528
h	0.897997	1.506406	0.205743	1.803656	2.718053	2.443344	0.74279	1.728429	0.634263
7	0.256535	0.864943	0.43572	1.162194	2.076591	1.801882	0.101328	1.086966	0.007199
L	1.514842	0.906433	2.207096	0.609183	0.305215	0.030505	1.670049	0.68441	1.778576

	z	c	n	r	l	S	Z	C	j
z									
c	1.414415								
n	0.583026	1.997441							
r	0.30754	1.721955	0.275485						
l	0.599047	2.013463	0.016022	0.291507					
S	1.658652	0.244237	2.241678	1.966192	2.257699				
Z	0.009722	1.424137	0.573303	0.297818	0.589325	1.668374			
C	1.198114	0.216301	1.781139	1.505654	1.797161	0.460538	1.207836		
j	0.249279	1.165136	0.832305	0.55682	0.848327	1.409373	0.259002	0.948834	
T	0.934998	0.479417	1.518023	1.242538	1.534045	0.723654	0.94472	0.263116	0.685718
5	0.654352	2.068767	0.071326	0.346812	0.055304	2.313004	0.64463	1.852466	0.903631
y	0.444058	1.858473	0.138968	0.136517	0.15499	2.10271	0.434335	1.642171	0.693337
k	1.228024	0.186391	1.81105	1.535564	1.827072	0.430628	1.237746	0.02991	0.978745
g	0.525759	0.888656	1.108784	0.833299	1.124806	1.132893	0.535481	0.672355	0.276479
x	1.152166	0.262249	1.735191	1.459706	1.751213	0.506486	1.161888	0.045948	0.902887
N	0.751667	2.166082	0.168642	0.444127	0.15262	2.410319	0.741945	1.949781	1.000947
h	2.178124	0.763709	2.761149	2.485664	2.777171	0.519472	2.187846	0.98001	1.928844
7	1.536661	0.122246	2.119687	1.844202	2.135709	0.121991	1.546384	0.338548	1.287382
L	0.234715	1.64913	0.34831	0.072825	0.364332	1.893367	0.224993	1.432829	0.483995

	T	5	y	k	g	x	N	h	7
T									
5	1.58935								
y	1.379055	0.210294							
k	0.293027	1.882376	1.672082						
g	0.409239	1.180111	0.969816	0.702265					
x	0.217168	1.806518	1.596223	0.075858	0.626407				
N	1.686665	0.097315	0.30761	1.979691	1.277426	1.903833			
h	1.243126	2.832476	2.622181	0.9501	1.652365	1.025958	2.929791		
7	0.601664	2.191013	1.980719	0.308637	1.010903	0.384496	2.288329	0.641462	
L	1.169713	0.419637	0.209342	1.462739	0.760474	1.386881	0.516952	2.412839	1.771376

	e	E	3	a	u	o
i						
e	0.166951					
E	0.037569	0.129382				
3	0.170837	0.003886	0.133268			
a	0.161168	0.328119	0.198738	0.332005		
u	0.010839	0.156112	0.02673	0.159998	0.172007	
o	0.068224	0.098727	0.030655	0.102613	0.229392	0.057385

Vocal-tract shape

	p	b	f	v	m	w	t	d	s
p									
b	0.032328								
f	0.121846	0.144218							
v	0.061862	0.062829	0.157301						
m	0.124756	0.142787	0.129509	0.171082					
w	0.874148	0.883411	0.872153	0.877522	0.939498				
t	1.199101	1.19903	1.226253	1.175909	1.234216	1.513584			
d	1.047328	1.053973	1.053892	1.045683	1.04168	1.467742	0.613153		
s	0.948361	0.948224	0.960089	0.927676	0.974937	1.409258	0.531553	0.634933	
z	0.950016	0.950379	0.964184	0.930577	0.97733	1.374219	0.500056	0.587461	0.116407
c	1.256924	1.25477	1.281311	1.232237	1.284969	1.695883	0.490746	0.643401	0.411475
n	1.062834	1.070609	1.063586	1.059197	1.028248	1.697801	0.883628	0.570708	0.686254
r	0.562605	0.577874	0.57184	0.548552	0.588325	0.920758	0.911894	0.797726	0.662039
l	0.603368	0.619772	0.589825	0.604942	0.564082	1.167405	1.033636	0.814256	0.71191
S	1.183849	1.187357	1.178226	1.182109	1.179636	1.576623	0.684508	0.785344	0.875845
Z	1.171362	1.175287	1.170383	1.16874	1.171763	1.536079	0.637459	0.671845	0.865109
C	1.725657	1.726767	1.734163	1.722873	1.716238	2.169343	0.958265	0.920545	1.221191
j	2.18092	2.181225	2.198174	2.173667	2.176215	2.609261	1.51922	1.393475	1.755915
T	2.162508	2.166073	2.179367	2.159974	2.162544	2.415677	1.577644	1.606968	1.949853
5	2.572828	2.576038	2.580879	2.574932	2.546827	3.02545	2.062871	1.897276	2.31187
y	2.503955	2.506247	2.517645	2.509354	2.474674	2.976035	2.260312	2.001358	2.421246
k	1.631899	1.638415	1.691412	1.633321	1.640726	1.535528	1.944664	1.880334	2.066358
g	1.81112	1.817753	1.864689	1.814394	1.814048	1.74423	2.063436	1.97791	2.229531
x	0.649525	0.669848	0.672194	0.667278	0.620875	0.891522	1.466806	1.254731	1.341287
N	1.272353	1.282807	1.315347	1.285102	1.27692	1.085155	1.813516	1.652069	1.837888
h	0.308802	0.340004	0.266083	0.312746	0.295926	0.850842	1.208312	1.020462	0.972933
7	0.346456	0.378018	0.298133	0.352699	0.32655	0.853906	1.221747	1.025798	0.988697
L	2.268739	2.273369	2.281467	2.274343	2.243515	2.643329	1.959663	1.795194	2.225181

	z	c	n	r	l	S	Z	C	j
z									
c	0.401541								
n	0.703749	0.753836							
r	0.643346	0.968676	0.846527						
l	0.706498	1.017084	0.697335	0.362558					
S	0.879727	0.983979	0.991311	1.114951	1.138042				
Z	0.85166	0.923865	0.969869	1.087537	1.132049	0.220353			
C	1.213943	1.085237	1.113797	1.579841	1.555784	0.825692	0.759642		
j	1.738563	1.527806	1.572714	2.053756	2.028024	1.526776	1.400922	0.800666	
T	1.943603	1.897011	1.817107	2.052115	2.106699	1.386677	1.348849	1.080356	1.283696
5	2.313105	2.17162	1.980737	2.503122	2.449704	1.862622	1.794119	1.224412	0.945316
y	2.418494	2.3169	2.063246	2.508366	2.437059	2.083576	1.987623	1.530887	1.109688
k	2.025448	2.218207	2.015727	1.597651	1.715434	2.021096	1.982154	2.349889	2.657831
g	2.18465	2.34826	2.154422	1.817939	1.905542	2.065572	2.004064	2.295564	2.485013
x	1.319483	1.605193	1.284666	0.769349	0.822684	1.433481	1.403272	1.945219	2.3631
N	1.791987	2.040007	1.822046	1.292018	1.417029	1.854528	1.803318	2.278678	2.627491
h	0.971415	1.280392	1.018561	0.47304	0.518741	1.189243	1.170631	1.734474	2.183079
7	0.98649	1.295936	1.022773	0.480418	0.520674	1.196268	1.177491	1.741427	2.190089
L	2.215968	2.169368	1.929827	2.269748	2.239683	1.674693	1.605066	1.284595	1.181712

	T	5	y	k	g	x	N	h	7
T									
5	1.053752								
y	1.420353	0.734659							
k	2.170589	2.823042	2.724773						
g	2.034328	2.630857	2.460175	0.610387					
x	2.187555	2.652476	2.555446	1.180223	1.398954				
N	2.28485	2.877188	2.761566	0.609609	0.914647	0.780616			
h	2.141333	2.554864	2.499457	1.600127	1.777792	0.540515	1.226178		
7	2.143853	2.556566	2.502107	1.600178	1.776679	0.532554	1.22232	0.041062	
L	0.854311	0.758073	0.795868	2.315123	2.040348	2.251061	2.390036	2.245645	2.245826

	e	E	3	a	u	o
i						
e	1.934696					
E	3.136785	1.237017				
3	4.399463	2.645619	1.715			
a	5.423678	3.543293	2.460112	1.374967		
u	2.888867	2.103987	2.384521	2.683305	3.800871	
o	3.936057	2.496687	2.050652	1.258082	2.295846	1.970193

Acoustic waveform

	p	b	f	v	m	w	t	d	s
p									
b	1.803959								
f	3.225607	3.683368							
v	2.538562	2.348334	2.279023						
m	3.887452	3.061697	5.481913	3.342732					
w	2.89782	2.265669	5.057293	2.876725	2.703263				
t	2.269935	2.621017	3.578785	3.053064	4.594501	3.813184			
d	2.461187	2.095131	3.699147	2.697879	3.509354	2.963515	2.140364		
s	5.45486	6.085604	3.207251	4.124299	8.670416	7.997583	4.620492	4.838055	
z	4.41377	4.34197	3.435594	2.923777	5.696306	5.218441	4.014085	3.485084	2.319677
c	4.228777	3.729064	5.264024	3.826637	3.462769	3.701991	3.830002	2.955802	6.474684
n	4.289966	3.458302	5.457696	3.55069	1.801101	3.205687	4.275707	3.18623	7.915981
r	3.187499	2.68668	3.98708	2.67457	3.116844	2.684222	3.078297	2.382196	5.689616
l	3.574823	2.963136	5.101404	3.102332	2.815732	2.654285	3.694992	2.766042	6.89054
S	5.73722	6.08277	3.876621	4.998234	8.137408	7.999132	4.550751	4.391677	4.09566
Z	4.691664	4.38826	4.030294	3.5304	5.575799	5.425282	3.985019	3.327564	4.251743
C	4.314454	4.826045	4.022938	4.422907	6.97888	6.764262	3.114207	3.434414	4.044574
j	4.641089	3.733605	6.099507	4.052515	2.181094	3.495731	4.794151	3.751073	9.141176
T	2.928342	3.477574	3.613564	3.676749	5.537152	4.823387	2.340702	2.763282	4.527983
5	4.545184	3.816356	5.531142	3.872376	2.464481	3.654127	4.408503	3.404936	7.455777
y	4.913101	4.273837	6.478886	4.444383	3.958251	4.15665	4.615366	3.585799	7.764228
k	2.389923	2.666542	3.521703	3.120542	4.194523	3.66766	2.461863	2.736587	5.552439
g	2.479515	2.232281	3.653943	2.731597	3.568603	2.932456	2.678473	2.187669	5.618404
x	3.673135	3.889518	2.76906	3.286342	5.031711	4.702999	3.848788	3.786366	4.664499
N	4.176438	3.330072	5.558136	3.578498	1.746225	2.997782	4.451578	3.396603	8.57911
h	3.273332	3.22449	3.279802	2.935831	4.166466	3.744337	3.603018	3.156177	5.482726
7	1.971467	1.991718	3.754616	2.795069	3.592329	2.823146	2.624175	2.588476	6.272191
L	3.389779	2.973256	3.909901	2.969742	3.438319	3.225909	3.33236	2.86008	5.793282

	z	c	n	r	l	S	Z	C	j
z									
c	4.121035								
n	5.14197	2.941262							
r	3.615318	2.702912	2.867846						
l	4.02205	2.746158	2.585083	2.23239					
S	4.605738	5.86729	7.288438	5.188159	6.586737				
Z	3.259117	3.681885	4.987256	3.520682	4.230706	2.220052			
C	4.337141	5.008212	6.286786	4.43685	5.728317	2.57831	3.149951		
j	6.195791	3.042158	1.872336	3.211685	3.115763	8.38359	5.784231	7.223178	
T	4.517895	4.285367	5.125336	3.624443	4.768447	4.164492	4.283773	3.183098	5.436736
5	4.93435	2.691286	1.926083	3.020434	3.129396	7.046832	4.926724	6.13323	2.212289
y	4.838971	2.360403	3.468858	2.92499	3.176665	6.952002	4.211103	5.946895	3.628266
k	4.7585	4.336115	4.232746	3.336734	4.00344	5.572347	4.920724	4.16764	4.567308
g	4.203354	3.420731	3.400539	2.621701	3.192709	5.719684	4.35557	4.44554	3.781999
x	4.410999	5.021475	4.984206	3.792208	4.610136	4.399343	4.414905	4.545415	5.569136
N	5.712012	3.15169	1.698014	2.991088	2.974363	8.231741	5.594162	6.871426	1.892194
h	4.43855	4.430683	4.217366	3.30473	3.666079	4.630737	3.969189	4.658662	4.919076
7	4.765367	4.22162	3.912017	3.036333	3.422497	6.413876	4.962496	4.909393	4.331876
L	4.291774	3.092803	3.108856	2.194734	2.837432	4.810006	3.748661	4.285592	2.972415

	T	5	y	k	g	x	N	h	7
T									
5	4.708402								
y	4.806257	3.340041							
k	2.591991	4.54477	4.883774						
g	2.863522	3.67367	3.762451	2.123698					
x	3.934853	5.432995	5.605927	3.126382	3.306456				
N	5.298728	1.984967	3.866684	4.108451	3.466588	5.103969			
h	3.934021	4.749538	4.74678	3.032657	3.059236	2.293884	4.367308		
7	3.175142	4.396489	4.464046	2.373444	2.461985	3.902826	3.861351	3.149082	
L	3.753857	3.447685	3.459067	3.35714	2.964523	3.732918	3.221777	3.592889	3.428032

	e	E	3	a	u	o
i						
e	2.47799					
E	3.560036	1.837505				
3	4.353228	2.756102	2.130584			
a	5.163721	3.46162	2.570565	1.836436		
u	3.748251	4.00416	4.491765	5.112707	5.934331	
o	4.46114	3.388397	3.248406	2.102216	2.488478	5.562897

Phonological patterns

	p	b	f	v	m	w	t	d	s
p									
b	0.963507								
f	0.949308	1.004059							
v	1.083799	0.996868	0.968611						
m	1.122031	1.08383	1.122429	1.099928					
w	1.186262	1.142514	1.12598	1.093966	1.082813				
t	0.873516	1.041991	1.008525	1.148879	1.165118	1.205697			
d	1.055103	0.90947	1.080818	1.072833	1.155067	1.189702	0.948751		
s	1.003676	1.08947	0.938521	1.109768	1.133945	1.146553	0.93006	1.027937	
z	1.137455	1.031729	1.06337	1.014434	1.165908	1.116476	1.092214	0.970019	0.978652
c	0.698381	0.824991	0.733673	0.874927	0.909027	0.88742	0.645611	0.780876	0.681553
n	1.19159	1.173778	1.177494	1.158694	0.85244	1.11962	1.143177	1.137107	1.10464
r	0.911571	0.853457	0.81441	0.755268	0.819523	0.756927	0.864224	0.843378	0.770388
l	1.176403	1.14753	1.14441	1.101426	1.022257	1.038272	1.128764	1.117552	1.073204
S	1.029647	1.103223	0.954997	1.114112	1.168087	1.147201	0.993456	1.092839	0.852706
Z	1.213217	1.049777	1.127647	1.051168	1.209244	1.102402	1.18222	1.050391	1.108718
C	0.966567	1.082848	0.995533	1.166087	1.184715	1.17443	0.924277	1.052566	0.952993
j	1.115631	0.987021	1.106574	1.126043	1.185501	1.173136	1.074423	0.951651	1.07513
T	0.956637	1.072516	1.035252	1.137081	1.238983	1.233259	0.930029	1.058258	1.022674
5	1.242676	1.191841	1.202295	1.207732	0.952712	1.142593	1.203611	1.166764	1.1537
y	1.222412	1.18007	1.177157	1.090364	1.101479	0.860591	1.210702	1.187624	1.159886
k	0.84305	1.03068	0.996398	1.129507	1.147875	1.181271	0.889019	1.060148	0.998359
g	1.04036	0.869952	1.065024	1.045626	1.129554	1.150519	1.061067	0.921648	1.089886
x	1.026303	1.132616	0.919955	1.09978	1.171688	1.132452	1.048923	1.174785	0.991057
N	1.26807	1.237378	1.278181	1.232497	0.928493	1.167044	1.288573	1.259302	1.259899
h	1.086483	1.110556	0.991961	1.047492	1.139036	1.070204	1.087266	1.14939	1.009981
7	1.088917	1.112891	1.014588	1.044582	1.134524	1.08708	1.100805	1.167579	1.067927
L	1.029025	0.990346	0.931514	0.842189	0.900909	0.872762	0.980801	0.954274	0.871009

	z	c	n	r	l	S	Z	C	j
z									
c	0.800588								
n	1.153457	0.897005							
r	0.752598	0.459384	0.774359						
l	1.102492	0.86252	0.950674	0.664987					
S	1.032205	0.692905	1.158077	0.784886	1.108818				
Z	0.916943	0.877207	1.210028	0.762549	1.140517	0.989779			
C	1.078673	0.574068	1.172335	0.845332	1.13862	0.902994	1.09163		
j	0.995235	0.760749	1.18426	0.853842	1.138403	1.029171	0.94531	0.922074	
T	1.096226	0.711971	1.257173	0.985648	1.241398	0.973205	1.079012	0.930937	0.989283
5	1.134054	0.9003	0.923484	0.844	1.084702	1.127954	1.126181	1.136322	1.096792
y	1.130842	0.88691	1.094364	0.75775	1.025427	1.13849	1.107634	1.148758	1.136865
k	1.148873	0.713334	1.182359	0.891499	1.163867	1.03263	1.206828	0.978757	1.111209
g	1.036241	0.829665	1.180132	0.85712	1.153422	1.111392	1.054535	1.087627	0.988238
x	1.12106	0.76192	1.199899	0.802634	1.175016	0.991474	1.184038	1.030431	1.16952
N	1.245523	0.996271	0.963739	0.955284	1.14081	1.281766	1.248326	1.295956	1.272998
h	1.080737	0.772871	1.151423	0.774469	1.091879	1.001326	1.070591	1.067097	1.15656
7	1.120179	0.798235	1.155915	0.782572	1.113377	1.048529	1.121702	1.061219	1.177259
L	0.854947	0.57968	0.85778	0.389379	0.746734	0.857725	0.830657	0.903222	0.870798

	T	5	y	k	g	x	N	h	7
T									
5	1.157382								
y	1.206062	1.072828							
k	0.980383	1.230253	1.214592						
g	1.077179	1.181447	1.177372	0.944569					
x	1.090857	1.172393	1.193291	0.970433	1.074578				
N	1.310537	0.95919	1.177438	1.222929	1.18713	1.234987			
h	1.117533	1.17154	1.101733	1.064849	1.09383	0.960975	1.232305		
7	1.15579	1.184886	1.104827	1.065644	1.100513	0.961319	1.223843	0.862058	
L	0.980698	0.796895	0.796798	1.02728	0.989429	0.915765	0.982054	0.846928	0.906789

	i	e	E	3	a	u
i						
e	0.824728					
E	0.911414	0.864512				
3	0.922699	0.882631	0.847923			
a	0.894286	0.85365	0.840641	0.842341		
u	0.84221	0.915348	0.981387	0.918031	0.881096	
o	0.912326	0.846282	0.933496	0.894452	0.834855	0.821018