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Yao Yao, Charles B. Chang

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ON THE COGNITIVE BASIS OF CONTACT-INDUCED SOUND CHANGE: VOWEL MERGER REVERSAL IN SHANGHAINESE: ONLINE APPENDICES

YAO YAO
The Hong Kong Polytechnic University

CHARLES B. CHANG
Boston University

APPENDIX A: MATERIALS AND MODELS IN STUDY 1

ITEM	LEXICAL SET	SHANGHAINESE CITATION FORM* (IN STAGE II)	MANDARIN FORM	EMBEDDING COMPOUND (AND PART OF SPEECH)	EMBEDDING COMPOUND FREQUENCY
雷	MN-[ej]	leˊ	lejˊ	打雷 ‘thunder strikes’ (v.)	high
垒	MN-[ej]	leˊ	lejˊ	堡垒 ‘fortress’ (n.)	low
缆	MN-[an]	lɛˊ	lanˊ	光缆 ‘optical fiber’ (n.)	high
澜	MN-[an]	lɛˊ	lanˊ	狂澜 ‘huge wave’ (n.)	low
来	MN-[aj]	lɛˊ	lajˊ	上来 ‘to come up’ (v.)	high
睐	MN-[aj]	lɛˊ	lajˇ	青睐 ‘to favor’ (v.)	low
配	MN-[ej]	pʰeˊ	pʰejˇ	搭配 ‘to match with’ (v.)	high
沛	MN-[ej]	pʰeˇ	pʰejˇ	充沛 ‘abundant’ (adj.)	low
滩	MN-[an]	tʰɛˇ	tʰanˉ	外滩 ‘the Bund’ (n.)	high
坍	MN-[an]	tʰɛˇ	tʰanˉ	压坍 ‘to crash’ (v.)	low
态	MN-[aj]	tʰɛˊ	tʰajˇ	状态 ‘status’ (n.)	high
胎	MN-[aj]	tʰɛˇ	tʰajˉ	保胎 ‘to protect the fetus’ (v.)	low
贝	MN-[ej]	peˊ	pejˇ	宝贝 ‘treasure’ (n.)	high
狽	MN-[ej]	peˊ	pejˇ	狼狽 ‘in an extremely embarrassing state’ (adj.)	low
班	MN-[an]	pɛˇ	panˉ	上班 ‘to go to work’ (v.)	high
阪	MN-[an]	pɛˊ	panˊ	大阪 ‘Osaka (Japanese city)’ (n.)	low
呆	MN-[aj]	tɛˇ	tajˉ	痴呆 ‘retarded’ (adj.)	high
歹	MN-[aj]	tɛˇ	tajˊ	为非作歹 ‘to do bad things’ (v.)	low

* The tone of the test items will change when embedded in a compound due to tone sandhi.

TABLE A1. Critical items in study 1.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	634.01	8.58	73.91	< **0.001**	1530.92	13.05	117.33	< **0.001**
Age = Old	−54.20	3.49	−15.55	< **0.001**	26.13	3.07	8.52	< **0.001**
Sex = F	37.90	2.58	14.70	< **0.001**	91.72	2.35	39.12	< **0.001**
Onset = L	46.90	8.01	5.86	< **0.001**	−47.57	7.34	−6.48	< **0.001**
Onset = PHTH	−13.86	8.01	−1.73	0.097	44.53	7.34	6.07	< **0.001**
	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	634.72	14.88	43.26	< **0.001**	1530.40	15.62	98.05	< **0.001**
LexSet = MN-[an]	−5.65	15.24	−0.37	0.72	21.87	15.89	1.38	0.15
LexSet = MN-[ej]	−74.17	15.23	−4.87	< **0.001**	66.74	15.88	4.20	< **0.001**
Age = Old	−31.73	4.18	−7.59	< **0.001**	29.09	5.58	5.21	< **0.001**
LexSet = MN-[an]: Age = Old	—	—	—	—	−18.20	7.83	−2.32	**0.020**
LexSet = MN-[ej]: Age = Old	—	—	—	—	−24.95	7.79	−3.21	**0.002**
Sex = F	28.12	3.15	8.93	< **0.001**	91.00	2.44	37.26	< **0.001**
Onset = L	28.87	8.80	3.28	**0.0042**	—	—	—	—
Onset = PHTH	−11.76	8.80	−1.34	0.18	—	—	—	—

TABLE A2. Fixed-effect terms in the LM models on formant measures in the reading experiment, study 1. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	*p*(|*z*|)
(intercept)	−1.63	0.25	−6.42	< **0.001**
LexSet = MN-[an]	0.50	0.25	2.00	**0.045**
LexSet = MN-[ej]	2.42	0.25	9.75	< **0.001**
Age = Old	−0.52	0.14	−3.63	< **0.001**
Frq = H	0.33	0.10	3.38	< **0.001**
Onset = L	1.14	0.14	8.38	< **0.001**
Onset = PHTH	−0.94	0.15	−6.35	< **0.001**

TABLE A3. Fixed-effect terms in the GLM model on Diphthong in the reading experiment, study 1. **Bold** = $p(|z|) < 0.05$.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	663.30	9.37	70.75	< **0.001**	1550.92	13.11	118.28	< **0.001**
Age = Old	−53.74	3.71	−14.50	< **0.001**	—	—	—	—
Sex = F	41.50	2.78	14.94	< **0.001**	90.87	2.18	41.70	< **0.001**
Onset = L	38.96	7.52	5.18	< **0.001**	−37.91	6.47	−5.86	< **0.001**
Onset = PHTH	−1.50	7.52	−0.20	0.84	35.19	6.47	5.44	< **0.001**
Block.L	7.91	3.19	2.48	**0.014**	−6.78	2.45	−2.76	**0.006**
Block.Q	−0.96	3.19	−0.30	0.77	−1.01	2.45	−0.41	0.70
	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	675.13	18.33	36.84	< **0.001**	1566.59	15.70	99.81	< **0.001**
LexSet = MN-[an]	−5.66	19.73	−0.29	0.77	1.39	11.38	0.12	0.89
LexSet = MN-[ej]	−130.14	19.73	−6.60	< **0.001**	86.36	11.38	7.79	**0.001**
Age = Old	−37.73	7.92	−4.76	< **0.001**	7.51	5.59	1.34	0.18
LexSet = MN-[an]: Age = Old	9.34	11.14	−0.84	0.40	−0.95	7.86	−0.12	0.89
LexSet = MN-[ej]: Age = Old	34.99	11.14	3.14	**0.002**	−43.24	7.86	−5.50	< **0.001**
Sex = F	39.33	3.47	11.32	< **0.001**	92.08	2.48	37.07	< **0.001**

TABLE A4. Fixed-effect terms in the LM models on formant measures in the translation experiment, study 1. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	*p*(|*z*|)
(intercept)	−1.38	0.26	−5.37	< **0.001**
LexSet = MN-[an]	0.35	0.24	1.44	0.15
LexSet = MN-[ej]	3.12	0.27	11.60	< **0.001**
Age = Old	0.10	0.24	0.42	0.68
LexSet = MN-[an]: Age = Old	−0.53	0.34	−1.55	0.12
LexSet = MN-[ej]: Age = Old	−0.91	0.34	−2.64	**0.008**
Frq = H	0.17	0.07	2.35	**0.019**
Onset = L	0.97	0.11	9.20	< **0.001**
Onset = PHTH	−0.56	0.11	−5.22	< **0.001**

TABLE A5. Fixed-effect terms in the GLM model on Diphthong in the translation experiment, study 1. **Bold** = $p(|z|) < 0.05$.

APPENDIX B: MATERIALS AND MODELS IN STUDY 2

ITEM	LEXICAL SET	SHANGHAINESE CITATION FORM* (IN STAGE II)	MANDARIN FORM	EMBEDDING COMPOUND (AND PART OF SPEECH)	EMBEDDING COMPOUND FREQUENCY
退	Structure-mismatched MN-[ej]	t^he˧˥	t^hwej˨˩	辞退 ‘to lay off’ (v.)	high
腿	Structure-mismatched MN-[ej]	t^he˧˥	t^hwej˧˥	方腿 ‘Spam (meat)’ (n.)	high
对	Structure-mismatched MN-[ej]	te˧˥	twej˨˩	不对 ‘not correct’ (adj.)	high
碎	Structure-mismatched MN-[ej]	se˧˥	swej˨˩	打碎 ‘to break something’ (v.)	high
配	Regular MN-[ej]	p^he˧˥	p^hej˨˩	搭配 ‘to match with’ (v.)	high
贝	Regular MN-[ej]	pe˧˥	pej˨˩	宝贝 ‘treasure’ (n.)	high
态	MN-[aj]	$t^h\varepsilon$˧˥	t^haj˨˩	状态 ‘status’ (n.)	high
呆	MN-[aj]	tɛ˩˧	taj˥˧	痴呆 ‘retarded’ (adj.)	high
赛	MN-[aj]	sɛ˧˥	saj˨˩	决赛 ‘final competition’ (n.)	high

*The tone of the test items will change when embedded in a compound due to tone sandhi.

TABLE B1. Critical items in study 2.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	583.56	8.72	66.91	< **0.001**	1582.71	19.57	80.88	< **0.001**
LexSet = MN-[aj]	—	—	—	—	−21.87	21.65	−1.01	0.39
LexSet = MN-[ej] (regular)	—	—	—	—	−31.14	24.54	−1.27	0.19
Age = Old	−50.66	4.83	−10.50	< **0.001**	13.82	4.02	3.44	< **0.001**
Sex = F	36.37	3.49	10.44	< **0.001**	82.82	3.82	21.71	< **0.001**
Onset = PHTH	26.46	6.54	4.05	**0.006**	—	—	—	—
Onset = PT	−2.17	6.95	−0.31	0.76	—	—	—	—
LexSet = MN-[aj]: Sex = F	—	—	—	—	12.75	4.74	2.69	**0.007**
LexSet = MN-[ej] (regular): Sex = F	—	—	—	—	11.64	5.33	2.18	**0.029**

	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	547.98	13.60	40.29	< **0.001**	1594.90	20.73	76.93	< **0.001**
LexSet = MN-[aj]	78.16	10.53	7.42	< **0.001**	−52.35	25.90	−2.02	**0.042**
LexSet = MN-[ej] (regular)	−31.82	12.02	−2.65	**0.036**	37.35	29.36	1.27	0.17
Age = Old	−20.29	9.11	−2.23	**0.028**	−3.86	6.44	−0.60	0.54
LexSet = MN-[aj]: Age = Old	−34.64	14.08	−2.46	**0.015**	38.70	9.99	3.87	< **0.001**
LexSet = MN-[ej] (regular): Age = Old	37.65	15.77	2.39	**0.016**	−16.77	11.18	−1.50	0.14
Sex = F	31.43	4.58	6.86	< **0.001**	81.80	4.12	19.85	< **0.001**
Onset = PHTH	17.01	4.67	3.64	**0.021**	—	—	—	—
Onset = PT	−8.42	4.97	−1.69	0.16	—	—	—	—
LexSet = MN-[aj]: Sex = F	—	—	—	—	12.60	5.16	2.44	**0.015**
LexSet = MN-[ej] (regular): Sex = F	—	—	—	—	7.34	5.80	1.26	0.22

TABLE B2. Fixed-effect terms in the LM models on formant measures in the reading experiment, study 2. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	$p(\|z\|)$
(intercept)	−0.26	0.30	−0.87	0.38
LexSet = MN-[aj]	−2.53	0.44	−5.69	< **0.001**
LexSet = MN-[ej] (regular)	1.10	0.38	2.92	**0.004**
Age = Old	−0.94	0.27	−3.46	< **0.001**
LexSet = MN-[aj]: Age = Old	1.46	0.57	2.57	**0.01**
LexSet = MN-[ej] (regular): Age = Old	−0.71	0.47	−1.49	0.14
Onset = PHTH	−0.14	0.16	−0.83	0.41
Onset = PT	0.64	0.17	3.71	< **0.001**

TABLE B3. Fixed-effect terms in the GLM model on Diphthong in the reading experiment, study 2. **Bold** = $p(|z|) < 0.05$.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	622.65	8.44	73.81	< **0.001**	1574.97	14.85	106.06	< **0.001**
Age = Old	−56.69	5.69	−9.96	< **0.001**	—	—	—	—
Sex = F	47.37	4.04	11.72	< **0.001**	81.79	2.88	28.38	< **0.001**
Onset = PHTH	43.28	5.32	8.14	< **0.001**	—	—	—	—
Onset = PT	−8.60	5.67	−1.52	0.17	—	—	—	—

	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	539.38	16.43	32.82	< **0.001**	1657.96	16.46	100.76	< **0.001**
LexSet = MN-[aj]	112.90	10.70	10.55	< **0.001**	−87.78	9.15	−9.60	< **0.001**
LexSet = MN-[ej] (regular)	7.47	12.23	0.61	0.57	5.82	10.35	0.56	0.59
Age = Old	−4.37	9.83	−0.44	0.66	−33.61	6.01	−5.60	< **0.001**
LexSet = MN-[aj]: Age = Old	−41.66	15.03	−2.77	**0.007**	47.67	9.18	5.20	< **0.001**
LexSet = MN-[ej] (regular): Age = Old	1.44	16.97	0.08	0.93	−18.47	10.37	−1.78	0.079
Sex = F	42.98	4.97	8.66	< **0.001**	92.30	3.09	29.88	< **0.001**
Onset = PHTH	23.62	4.51	5.24	**0.001**	—	—	—	—
Onset = PT	−9.64	4.87	−1.98	0.10	—	—	—	—

TABLE B4. Fixed-effect terms in the LM models on formant measures in the translation experiment, study 2. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	*p*(|*z*|)
(intercept)	1.02	0.37	2.74	**0.006**
LexSet = MN-[aj]	−3.34	0.38	−8.76	< **0.001**
LexSet = MN-[ej] (regular)	0.50	0.38	1.33	0.18
Age = Old	−0.97	0.28	−3.50	< **0.001**
LexSet = MN-[aj]: Age = Old	1.36	0.50	2.73	**0.006**
LexSet = MN-[ej] (regular): Age = Old	−0.11	4.50	−0.23	0.82

TABLE B5. Fixed-effect terms in the GLM model on Diphthong in the translation experiment, study 2. **Bold** = $p(|z|) < 0.05$.

APPENDIX C: MATERIALS AND MODELS IN STUDY 3

ITEM	LEXICAL SET	SHANGHAINESE CITATION FORM* (IN STAGE II)	MANDARIN FORM	EMBEDDING COMPOUND (AND PART OF SPEECH)	EMBEDDING COMPOUND FREQUENCY
赔	Onset-mismatched MN-[ej]	beˀ	pʰejˊ	索赔 'to ask for indemnification' (v.)	low
陪	Onset-mismatched MN-[ej]	beˀ	pʰejˊ	不陪 'not to accompany' (v.)	low
备	Onset-mismatched MN-[ej]	beˀ	pejˋ	准备 'to prepare' (v.)	high
倍	Onset-mismatched MN-[ej]	beˀ	pejˋ	两倍 'twice' (adj.)	high
配	Regular MN-[ej]	pʰeˊ	pʰejˋ	搭配 'to match with' (v.)	high
沛	Regular MN-[ej]	pʰeˋ	pʰejˋ	充沛 'abundant' (adj.)	low
贝	Regular MN-[ej]	peˊ	pejˋ	宝贝 'treasure' (n.)	high
狈	Regular MN-[ej]	peˊ	pejˋ	狼狈 'in an extremely embarrassing state' (adj.)	low
态	MN-[aj]	tʰɛˊ	tʰajˋ	状态 'status' (n.)	high
胎	MN-[aj]	tʰɛˋ	tʰaj˥	保胎 'to protect the fetus' (v.)	low
呆	MN-[aj]	tɛˋ	taj˥	痴呆 'retarded' (adj.)	high
歹	MN-[aj]	tɛˋ	tajˊ	为非作歹 'to do bad things' (v.)	low

* The tone of the test items will change when embedded in a compound due to tone sandhi.

TABLE C1. Critical items in study 3.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	630.99	10.75	58.70	< **0.001**	1512.92	21.08	71.76	< **0.001**
LexSet = MN-[aj]	−21.17	11.10	−1.91	0.11	50.17	19.80	2.53	**0.021**
LexSet = MN-[ej] (regular)	−20.86	11.10	−1.88	0.11	22.45	19.80	1.13	0.26
Age = Old	−56.82	4.00	−14.19	< **0.001**	23.93	4.01	5.97	< **0.001**
Sex = F	36.15	2.93	12.33	< **0.001**	82.42	4.20	19.62	< **0.001**
Onset = PHTH	13.74	4.97	2.76	**0.030**	17.66	8.84	2.00	0.057
Frq = H	14.90	7.01	2.12	0.075	—	—	—	—
LexSet = MN-[aj]: Frq = H	−18.25	9.95	−1.83	0.11	—	—	—	—
LexSet = MN-[ej] (regular): Frq = H	−27.66	9.92	−2.79	**0.028**	—	—	—	—
LexSet = MN-[aj]: Sex = F	—	—	—	—	12.08	5.04	2.40	**0.018**
LexSet = MN-[ej] (regular): Sex = F	—	—	—	—	9.94	5.01	1.98	0.053

	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	583.97	16.77	34.82	< **0.001**	1572.45	23.71	66.31	< **0.001**
LexSet = MN-[aj]	37.12	17.03	2.18	0.055	−33.39	29.72	−1.12	0.20
LexSet = MN-[ej] (regular)	−18.35	17.01	−1.08	0.31	14.88	29.71	0.50	0.56
Age = Old	−24.13	5.52	−4.37	< **0.001**	−0.43	7.01	−0.06	0.97
Sex = F	27.22	4.14	6.58	< **0.001**	88.05	3.14	28.03	< **0.001**
LexSet = MN-[aj]: Age = Old	—	—	—	—	31.57	10.09	3.13	**0.002**
LexSet = MN-[ej] (regular): Age = Old	—	—	—	—	12.33	9.99	1.23	0.22

TABLE C2. Fixed-effect terms in the LM models on formant measures in the reading experiment, study 3. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	$p(\|z\|)$
(intercept)	−0.44	0.45	−0.96	0.33
LexSet = MN-[aj]	−2.23	0.50	−4.49	< **0.001**
LexSet = MN-[ej] (regular)	0.85	0.47	1.82	0.069
Age = Old	−0.79	0.18	−4.45	< **0.001**
Sex = F	0.29	0.13	2.21	**0.027**
Onset = PHTH	−0.45	0.23	−2.00	**0.046**

TABLE C3. Fixed-effect terms in the GLM model on Diphthong in the reading experiment, study 3. **Bold** = $p(|z|) < 0.05$.

	LM MODEL ON F1START				LM MODEL ON F2START			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	665.84	8.22	81.00	< **0.001**	1538.19	18.06	85.20	< **0.001**
LexSet = MN-[aj]	−32.66	6.50	−5.03	**0.002**	44.37	15.41	2.88	**0.004**
LexSet = MN-[ej] (regular)	-8.00	6.47	−1.24	0.29	12.52	15.40	0.81	0.42
Age = Old	−60.63	4.76	−12.73	< **0.001**	—	—	—	—
Sex = F	46.89	3.41	13.75	< **0.001**	83.42	2.69	31.01	< **0.001**
Onset = PHTH	22.56	2.89	7.79	< **0.001**	13.45	6.89	1.95	0.051
Frq = H	−0.57	4.10	−0.14	0.91	—	—	—	—
LexSet = MN-[aj]: Frq = H	4.04	5.81	0.69	0.54	—	—	—	—
LexSet = MN-[ej] (regular): Frq = H	−11.98	5.78	−2.07	0.077	—	—	—	—

	LM MODEL ON F1END				LM MODEL ON F2END			
	β	*SE*	*t*	p_{MCMC}	β	*SE*	*t*	p_{MCMC}
(intercept)	574.42	17.45	32.91	< **0.001**	1648.40	16.46	100.15	< **0.001**
LexSet = MN-[aj]	77.97	11.79	6.61	< **0.001**	−69.39	10.77	−6.44	< **0.001**
LexSet = MN-[ej] (regular)	−8.96	11.76	−0.76	0.45	−3.11	10.75	−0.29	0.79
Age = Old	2.44	9.83	0.25	0.82	−40.42	7.04	−5.74	< **0.001**
Sex = F	39.10	4.31	9.07	< **0.001**	92.10	3.12	29.56	< **0.001**
Onset = PHTH	15.80	4.28	3.69	**0.005**	—	—	—	—
LexSet = MN-[aj]: Age = Old	−44.27	13.87	−3.19	**0.001**	48.08	9.93	4.84	< **0.001**
LexSet = MN-[ej] (regular): Age = Old	−22.81	13.81	−1.65	0.10	8.86	9.89	0.90	0.38

TABLE C4. Fixed-effect terms in the LM models on formant measures in the translation experiment, study 3. **Bold** = $p_{MCMC} < 0.05$.

	β	*SE*	*z*	*p*(|*z*|)
(intercept)	1.33	0.38	3.53	< **0.001**
LexSet = MN-[aj]	−3.61	0.35	−10.26	< **0.001**
LexSet = MN-[ej] (regular)	0.14	0.31	0.46	0.64
Age = Old	−1.56	0.29	−5.40	< **0.001**
LexSet = MN-[aj]: Age = Old	1.99	0.46	4.36	< **0.001**
LexSet = MN-[ej] (regular): Age = Old	0.68	0.41	1.66	0.096

TABLE C5. Fixed-effect terms in the GLM model on Diphthong in the translation experiment, study 3. **Bold** = $p(|z|) < 0.05$.

[ctyaoyao@polyu.edu.hk] (Yao)

[cc@bu.edu] (Chang)