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

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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]	leɿ	lejɿ	打雷 ‘thunder strikes’ (v.)	high
垒	MN-[ej]	leɿ	lejɿ	堡垒 ‘fortress’ (n.)	low
缆	MN-[an]	leɿ	lanɿ	光缆 ‘optical fiber’ (n.)	high
澜	MN-[an]	leɿ	lanɿ	狂澜 ‘huge wave’ (n.)	low
来	MN-[aj]	leɿ	lajɿ	上来 ‘to come up’ (v.)	high
睐	MN-[aj]	leɿ	lajɿ	青睐 ‘to favor’ (v.)	low
配	MN-[ej]	p ^h eɿ	p ^h ejɿ	搭配 ‘to match with’ (v.)	high
沛	MN-[ej]	p ^h eɿ	p ^h ejɿ	充沛 ‘abundant’ (adj.)	low
滩	MN-[an]	t ^h eɿ	t ^h anɿ	外滩 ‘the Bund’ (n.)	high
坍	MN-[an]	t ^h eɿ	t ^h anɿ	压坍 ‘to crash’ (v.)	low
态	MN-[aj]	t ^h eɿ	t ^h ajɿ	状态 ‘status’ (n.)	high
胎	MN-[aj]	t ^h eɿ	t ^h ajɿ	保胎 ‘to protect the fetus’ (v.)	low
贝	MN-[ej]	peɿ	pejɿ	宝贝 ‘treasure’ (n.)	high
狈	MN-[ej]	peɿ	pejɿ	狼狈 ‘in an extremely embarrassing state’ (adj.)	low
班	MN-[an]	peɿ	panɿ	上班 ‘to go to work’ (v.)	high
阪	MN-[an]	peɿ	panɿ	大阪 ‘Osaka (Japanese city)’ (n.)	low
呆	MN-[aj]	teɿ	tajɿ	痴呆 ‘retarded’ (adj.)	high
歹	MN-[aj]	teɿ	tajɿ	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>z</i>	$p(z)$
(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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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 = $p_{\text{MCMC}} < 0.05$.

	β	<i>SE</i>	<i>z</i>	$p(z)$
(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 ^h e1	t ^h wej ¹	辞退 ‘to lay off’ (v.)	high
腿	Structure-mismatched MN-[ej]	t ^h e1	t ^h wej ⁴	方腿 ‘Spam (meat)’ (n.)	high
对	Structure-mismatched MN-[ej]	te1	twej ¹	不对 ‘not correct’ (adj.)	high
碎	Structure-mismatched MN-[ej]	se1	swej ¹	打碎 ‘to break something’ (v.)	high
配	Regular MN-[ej]	p ^h e1	p ^h ej ¹	搭配 ‘to match with’ (v.)	high
贝	Regular MN-[ej]	pe1	pej ¹	宝贝 ‘treasure’ (n.)	high
态	MN-[aj]	t ^h e1	t ^h aj ¹	状态 ‘status’ (n.)	high
呆	MN-[aj]	tɛ1	taj ¹	痴呆 ‘retarded’ (adj.)	high
赛	MN-[aj]	sɛ1	saj ¹	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>z</i>	$p(z)$
(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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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 = $p_{\text{MCMC}} < 0.05$.

	β	<i>SE</i>	<i>z</i>	$p(z)$
(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]	beɿ	p ^h ejɿ	索赔 ‘to ask for indemnification’ (v.)	low
陪	Onset-mismatched MN-[ej]	beɿ	p ^h ejɿ	不陪 ‘not to accompany’ (v.)	low
备	Onset-mismatched MN-[ej]	beɿ	pejɿ	准备 ‘to prepare’ (v.)	high
倍	Onset-mismatched MN-[ej]	beɿ	pejɿ	两倍 ‘twice’ (adj.)	high
配	Regular MN-[ej]	p ^h eɿ	p ^h ejɿ	搭配 ‘to match with’ (v.)	high
沛	Regular MN-[ej]	p ^h eɿ	p ^h ejɿ	充沛 ‘abundant’ (adj.)	low
贝	Regular MN-[ej]	peɿ	pejɿ	宝贝 ‘treasure’ (n.)	high
狈	Regular MN-[ej]	peɿ	pejɿ	狼狈 ‘in an extremely embarrassing state’ (adj.)	low
态	MN-[aj]	t ^h eɿ	t ^h ajɿ	状态 ‘status’ (n.)	high
胎	MN-[aj]	t ^h eɿ	t ^h ajɿ	保胎 ‘to protect the fetus’ (v.)	low
呆	MN-[aj]	teɿ	tajɿ	痴呆 ‘retarded’ (adj.)	high
歹	MN-[aj]	teɿ	tajɿ	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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	<i>SE</i>	<i>t</i>	p_{MCMC}	β	<i>SE</i>	<i>t</i>	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 = $p_{\text{MCMC}} < 0.05$.

	β	<i>SE</i>	<i>z</i>	$p(z)$
(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	<i>SE</i>	<i>t</i>	<i>p</i> _{MCMC}	β	<i>SE</i>	<i>t</i>	<i>p</i> _{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	<i>SE</i>	<i>t</i>	<i>p</i> _{MCMC}	β	<i>SE</i>	<i>t</i>	<i>p</i> _{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 = $p_{\text{MCMC}} < 0.05$.

	β	<i>SE</i>	<i>z</i>	$p(z)$
(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 = $p(|z|) < 0.05$.

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