

Supplementary Material

Table S1. Experiment 1 (Perceptual Assimilation). Summary of mixed effects logistic regression analyses for perceptual assimilation patterns in EB (early bilingual) and LB (late bilingual) listeners.

AE Vowel	Spanish Response Vowel	EB (%)	LB (%)	Odds Ratio	Std. Err.	z	p	95% CI
/i/	/a/	0	0.2	—				
	/e/	4.1	3.3	1.286	0.978	0.33	.741	[0.29; 5.707]
	/i/	95.4	96.3	0.820	0.545	-0.3	.766	[0.223; 3.02]
	/o/	0.4	0	—				
	/u/	0.2	0.2	1.000	1.416	0	1	[0.062; 16.03]
/ɪ/	/a/	0.6	0.2	0.332	0.384	-0.95	.34	[0.034; 3.203]
	/e/	48.5	48.9	0.625	0.691	-0.42	.671	[0.072; 5.459]
	/i/	50	50	1.857	2.058	0.56	.577	[0.212; 16.301]
	/o/	0.2	0.9	5.019	6.443	1.26	.209	[0.405; 62.135]
	/u/	0.7	0	—				
/ɛ/	/a/	4.6	11.3	3.393	1.748	2.37	.018	[1.236; 9.312]
	/e/	93.5	86.7	0.380	0.173	-2.12	.034	[0.156; 0.929]
	/i/	0.7	0.6	0.749	0.574	-0.38	.706	[0.167; 3.361]
	/o/	0.2	1.5	8.167	9.076	1.89	.059	[0.925; 72.11]
	/u/	0.9	0	—				
/æ/	/a/	91.7	82	0.390	0.141	-2.6	.009	[0.192; 0.794]
	/e/	7	13.5	2.197	0.888	1.95	.051	[0.995; 4.851]
	/i/	0.2	0.6	2.989	3.864	0.85	.397	[0.237; 37.654]
	/o/	0.9	3.5	3.839	2.683	1.92	.054	[0.976; 15.107]
	/u/	0.2	0.4	2.004	2.457	0.57	.571	[0.181; 22.163]
/ɑ/	/a/	82.6	75	0.679	0.482	-0.54	.586	[0.169; 2.733]
	/e/	0.4	1.3	4.407	5.537	1.18	.238	[0.375; 51.721]
	/i/	0	0.2	—				
	/o/	10.9	22.8	1.834	1.274	0.87	.383	[0.47; 7.156]
	/u/	6.1	0.7	0.174	0.223	-1.37	.172	[0.014; 2.141]
/Δ/	/a/	29.4	53.1	9.729	9.122	2.43	.015	[1.549; 61.119]
	/e/	4.3	6.7	1.675	1.171	0.74	.461	[0.426; 6.59]
	/i/	0.2	0.7	4.022	4.504	1.24	.214	[0.448; 36.105]
	/o/	24.4	38.5	2.545	1.837	1.29	.196	[0.618; 10.477]
	/u/	41.7	0.9	0.001	0.001	-3.66	<.001	[0; 0.035]
/o/	/a/	0.9	0.3	0.332	0.384	-0.95	.34	[0.034; 3.2]
	/e/	0	1.5	—				
	/i/	0	0	—				
	/o/	96	97.8	0.972	1.304	-0.02	.983	[0.07; 13.485]
	/u/	3.1	0.3	0.415	1.190	-0.31	.759	[0.002; 114.374]

Table S2. Experiment 2 (Categorical Discrimination). Summary of mixed effects logistic regression analysis for the effects of Group and Vowel contrast on response accuracy.

Fixed Effect	Estimate(SE)	<i>z</i>	<i>p</i>	95% CI
/ɪ-i/	1.056(0.534)	1.98	.048	[0.01; 2.103]
/æ-ɑ/	-0.541(0.359)	-1.51	.131	[-1.244; 0.162]
/ʌ-æ/	0.574(0.458)	1.25	.21	[-0.324; 1.473]
/ʌ-ɑ/	-0.082(0.39)	-0.21	.834	[-0.845; 0.682]
group-EB	-0.892(0.433)	-2.06	.04	[-1.742; -0.043]
group-LB	-2.098(0.415)	-5.06	<.001	[-2.911; -1.285]
/ɪ-i/ ×EB	-1.55(0.579)	-2.68	.007	[-2.684; -0.415]
/ɪ-i/ ×LB	-1.28(0.559)	-2.29	.022	[-2.374; -0.185]
/æ-ɑ/ ×EB	-0.898(0.414)	-2.17	.03	[-1.71; -0.087]
/æ-ɑ/ ×LB	-0.344(0.391)	-0.88	.379	[-1.111; 0.423]
/ʌ-æ/ ×EB	-1.681(0.504)	-3.33	.001	[-2.67; -0.692]
/ʌ-æ/ ×LB	-1.564(0.484)	-3.23	.001	[-2.513; -0.615]
/ʌ-ɑ/ ×EB	-1.269(0.441)	-2.87	.004	[-2.134; -0.403]
/ʌ-ɑ/ ×LB	-0.839(0.42)	-2	.046	[-1.662; -0.016]
Intercept	3.395(0.353)	9.61	<.001	[2.703; 4.088]
<i>Random Effect</i>				
Intercept	0.393(0.123)			[0.212; 0.727]

Note. EB = early bilingual; LB = late bilingual. Monolingual AE listeners are the reference group.

Table S3. Experiment 2 (Categorical Discrimination). Pairwise comparisons for the effect of Group on discrimination accuracy. P values are corrected for multiple comparisons using the Bonferroni method.

Comparison	Estimate(SE)	<i>z</i>	<i>p</i>	95% CI
EB vs MO	-1.985(0.318)	-6.24	<.001	[-2.609; -1.361]
LB vs MO	-2.913(0.316)	-9.21	<.001	[-3.533; -2.293]
LB vs EB	-0.928(0.269)	-3.45	.002	[-1.455; -0.401]

Note. EB = early bilingual; LB = late bilingual; MO = monolingual.

Table S4. Experiment 2 (Categorical Discrimination). Pairwise comparisons for the effect of Vowel contrast on discrimination accuracy. P-values are corrected for multiple comparisons using the Bonferroni method.

Comparison	Estimate(SE)	<i>z</i>	<i>p</i>	95% CI
/I-ɛ/ vs /I-i/	-0.058(0.185)	-0.31	1	[-0.577; 0.462]
/æ-ɑ/ vs /I-i/	-1.037(0.169)	-6.13	<.001	[-1.512; -0.563]
/Λ-æ/ vs /I-i/	-0.628(0.189)	-3.32	.009	[-1.16; -0.097]
/Λ-ɑ/ vs /I-i/	-0.883(0.175)	-5.05	<.001	[-1.375; -0.392]
/æ-ɑ/ vs /I-ɛ/	-0.98(0.14)	-7.01	<.001	[-1.372; -0.587]
/Λ-æ/ vs /I-ɛ/	-0.571(0.164)	-3.49	.005	[-1.03; -0.112]
/Λ-ɑ/ vs /I-ɛ/	-0.826(0.147)	-5.62	<.001	[-1.238; -0.414]
/Λ-æ/ vs /æ-ɑ/	0.409(0.145)	2.82	.048	[0.002; 0.816]
/Λ-ɑ/ vs /æ-ɑ/	0.154(0.126)	1.22	<.001	[-0.199; 0.507]
/Λ-ɑ/ vs /Λ-æ/	-0.255(0.152)	-1.68	.933	[-0.682; 0.171]

Table S5. Experiment 2 (Categorical Discrimination). Pairwise comparisons for the Group $\times$ Vowel contrast interaction on discrimination accuracy. P values are corrected for multiple comparisons using the Bonferroni method.

Comparison	Estimate(SE)	<i>z</i>	<i>p</i>	95% CI
<i>/I-i/</i>				
EB vs MO	-2.442(0.549)	-4.45	<.001	[-3.517; -1.367]
LB vs MO	-3.377(0.541)	-6.24	<.001	[-4.438; -2.317]
LB vs EB	-0.936(0.315)	-2.97	.009	[-1.553; -0.318]
<i>/I-ε/</i>				
EB vs MO	-0.892(0.433)	-2.06	.119	[-1.742; -0.043]
LB vs MO	-2.098(0.415)	-5.06	<.001	[-2.911; -1.285]
LB vs EB	-1.205(0.334)	-3.61	.001	[-1.861; -0.55]
<i>/æ-ɑ/</i>				
EB vs MO	-1.791(0.369)	-4.86	<.001	[-2.513; -1.068]
LB vs MO	-2.442(0.365)	-6.69	<.001	[-3.157; -1.727]
LB vs EB	-0.651(0.298)	-2.19	.086	[-1.235; -0.068]
<i>/Λ-æ/</i>				
EB vs MO	-2.573(0.469)	-5.49	<.001	[-3.492; -1.654]
LB vs MO	-3.661(0.464)	-7.89	<.001	[-4.571; -2.752]
LB vs EB	-1.088(0.301)	-3.62	.001	[-1.678; -0.499]
<i>/Λ-ɑ/</i>				
EB vs MO	-2.161(0.4)	-5.41	<.001	[-2.944; -1.378]
LB vs MO	-2.937(0.396)	-7.42	<.001	[-3.713; -2.161]
LB vs EB	-0.776(0.298)	-2.6	.028	[-1.361; -0.191]

Note. EB = early bilingual; LB = late bilingual; MO = monolingual.