Foreign-accented speech elicits a late N400-effect during semantic processing
SUPPLEMENTARY ANALYSIS

Factors:
- Accent (foreign, native)
- Correctness (correct, incorrect)
- Phoneme (/l/, /s/)

- Longitude (frontal, central, parietal)
- Latitude (left, medial, right)

Regions of interest (9):
- Frontal left (FL): F7, F3, FC5
- Frontal medial (FM): Fp1, Fz, Fp2
- Frontal right (FR): F8, F4, FC6
- Central left (CL): T7, C3, CP5
- Central medial (CM): FC1, Cz, FC2

- Central right (CR): T8, C4, CP6
- Parietal left (PL): P7, P3, O1
- Parietal medial (PM): CP1, CP2, Pz
- Parietal right (PR): P8, P4, O2

Repeated Measures ANOVA

	Sum of Squares	df	Mean Square	F	p
Accent	6.816	1	6.816	0.482	0.492
Residual	495.392	35	14.154		
Correctness	209.661	1	209.661	8.666	0.006
Residual	846.778	35	24.194		
Phoneme	111.266	1	111.266	10.314	0.003
Residual	377.587	35	10.788		
Longitude	72.280[a]	2[a]	36.140[a]	10.838[a]	< .001[a]
Residual	233.410	70	3.334		
Latitude	71.621	2	35.811	16.267	< .001
Residual	154.097	70	2.201		
Accent ✻ Correctness	2.059	1	2.059	0.147	0.703
Residual	489.129	35	13.975		
Accent ✻ Phoneme	21.865	1	21.865	2.385	0.131
Residual	320.861	35	9.167		
Accent ✻ Longitude	1.645[a]	2[a]	0.822[a]	0.571[a]	0.567[a]
Residual	100.733	70	1.439		
Accent ✻ Latitude	1.554	2	0.777	0.906	0.409
Residual	60.043	70	0.858		
Correctness ✻ Phoneme	0.339	1	0.339	0.028	0.867
Residual	416.124	35	11.889		
Correctness ✻ Longitude	1.293[a]	2[a]	0.647[a]	0.681[a]	0.510[a]
Residual	66.470	70	0.950		
Correctness ✻ Latitude	3.636	2	1.818	2.395	0.099
Residual	53.129	70	0.759		
Phoneme ✻ Longitude	0.837[a]	2[a]	0.419[a]	0.291[a]	0.748[a]

	Sum of Squares	df	Mean Square	F	p
Residual	100.581	70	1.437		
Phoneme ✻ Latitude	1.371 [a]	2 [a]	0.686 [a]	1.069 [a]	0.349 [a]
Residual	44.874	70	0.641		
Accent ✻ Correctness ✻ Phoneme	1.140	1	1.140	0.107	0.746
Residual	373.631	35	10.675		
Accent ✻ Correctness ✻ Longitude	2.487 [a]	2 [a]	1.244 [a]	1.025 [a]	0.364 [a]
Residual	84.951	70	1.214		
Accent ✻ Correctness ✻ Latitude	0.597	2	0.298	0.516	0.599
Residual	40.428	70	0.578		
Accent ✻ Phoneme ✻ Longitude	7.982 [a]	2 [a]	3.991 [a]	3.972 [a]	0.023 [a]
Residual	70.339	70	1.005		
Accent ✻ Phoneme ✻ Latitude	0.386	2	0.193	0.245	0.783
Residual	55.122	70	0.787		
Accent ✻ Longitude ✻ Latitude	0.536 [a]	4 [a]	0.134 [a]	0.787 [a]	0.536 [a]
Residual	23.843	140	0.170		
Correctness ✻ Phoneme ✻ Longitude	0.521 [a]	2 [a]	0.261 [a]	0.335 [a]	0.716 [a]
Residual	54.402	70	0.777		
Correctness ✻ Phoneme ✻ Latitude	0.066	2	0.033	0.050	0.951
Residual	45.668	70	0.652		
Correctness ✻ Longitude ✻ Latitude	0.952	4	0.238	1.495	0.207
Residual	22.279	140	0.159		
Phoneme ✻ Longitude ✻ Latitude	1.787 [a]	4 [a]	0.447 [a]	3.059 [a]	0.019 [a]
Residual	20.445	140	0.146		
Accent ✻ Correctness ✻ Phoneme ✻ Longitude	0.426 [a]	2 [a]	0.213 [a]	0.132 [a]	0.877 [a]
Residual	112.992	70	1.614		
Accent ✻ Correctness ✻ Phoneme ✻ Latitude	3.732	2	1.866	2.327	0.105
Residual	56.144	70	0.802		
Accent ✻ Correctness ✻ Longitude ✻ Latitude	0.286 [a]	4 [a]	0.071 [a]	0.438 [a]	0.781 [a]
Residual	22.875	140	0.163		
Accent ✻ Phoneme ✻ Longitude ✻ Latitude	0.942	4	0.235	1.661	0.162
Residual	19.836	140	0.142		
Correctness ✻ Phoneme ✻ Longitude ✻ Latitude	0.569 [a]	4 [a]	0.142 [a]	0.773 [a]	0.544 [a]
Residual	25.768	140	0.184		
Accent ✻ Correctness ✻ Phoneme ✻ Long ✻ Lat	0.576 [a]	4 [a]	0.144 [a]	0.750 [a]	0.560 [a]
Residual	26.896	140	0.192		

Note. Type III Sum of Squares

[a] Mauchly's test of sphericity indicates that the assumption of sphericity is violated (p < .05).

Between Subjects Effects

	Sum of Squares	df	Mean Square	F	p
Residual	1251.979	35	35.771		

Note. Type III Sum of Squares

Repeated Measures ANOVA

	Sum of Squares	df	Mean Square	F	p
Accent	6.583	1	6.583	0.249	0.621
Residual	924.965	35	26.428		
Correctness	41.107	1	41.107	1.817	0.186
Residual	791.709	35	22.620		
Phoneme	8.668	1	8.668	0.653	0.424
Residual	464.280	35	13.265		
Longitude	9.208 [a]	2 [a]	4.604 [a]	1.144 [a]	0.324 [a]
Residual	281.701	70	4.024		
Latitude	62.607	2	31.304	10.543	< .001
Residual	207.830	70	2.969		
Accent ✼ Correctness	16.552	1	16.552	0.782	0.383
Residual	740.837	35	21.167		
Accent ✼ Phoneme	5.738	1	5.738	0.485	0.491
Residual	413.749	35	11.821		
Accent ✼ Longitude	0.434 [a]	2 [a]	0.217 [a]	0.125 [a]	0.883 [a]
Residual	121.920	70	1.742		
Accent ✼ Latitude	2.809	2	1.404	1.309	0.276
Residual	75.074	70	1.072		
Correctness ✼ Phoneme	4.931	1	4.931	0.226	0.637
Residual	763.311	35	21.809		
Correctness ✼ Longitude	0.481 [a]	2 [a]	0.240 [a]	0.170 [a]	0.844 [a]
Residual	98.761	70	1.411		
Correctness ✼ Latitude	1.405	2	0.703	0.731	0.485
Residual	67.314	70	0.962		
Phoneme ✼ Longitude	1.390 [a]	2 [a]	0.695 [a]	0.673 [a]	0.513 [a]
Residual	72.220	70	1.032		
Phoneme ✼ Latitude	2.109	2	1.055	1.139	0.326
Residual	64.789	70	0.926		
Longitude ✼ Latitude	39.804 [a]	4 [a]	9.951 [a]	18.536 [a]	< .001 [a]
Residual	75.159	140	0.537		
Accent ✼ Correctness ✼ Phoneme	0.048	1	0.048	0.004	0.953
Residual	477.217	35	13.635		
Accent ✼ Correctness ✼ Longitude	7.345 [a]	2 [a]	3.672 [a]	3.695 [a]	0.030 [a]
Residual	69.576	70	0.994		
Accent ✼ Correctness ✼ Latitude	0.152	2	0.076	0.106	0.900
Residual	50.478	70	0.721		
Accent ✼ Phoneme ✼ Longitude	2.074 [a]	2 [a]	1.037 [a]	0.772 [a]	0.466 [a]
Residual	94.036	70	1.343		
Accent ✼ Phoneme ✼ Latitude	0.678	2	0.339	0.457	0.635
Residual	51.956	70	0.742		
Accent ✼ Longitude ✼ Latitude	0.565 [a]	4 [a]	0.141 [a]	0.649 [a]	0.628 [a]
Residual	30.427	140	0.217		

	Sum of Squares	df	Mean Square	F	p
Correctness ✳ Phoneme ✳ Longitude	0.508 [a]	2 [a]	0.254 [a]	0.215 [a]	0.807 [a]
Residual	82.640	70	1.181		
Correctness ✳ Phoneme ✳ Latitude	0.924	2	0.462	0.553	0.578
Residual	58.504	70	0.836		
Correctness ✳ Longitude ✳ Latitude	1.028 [a]	4 [a]	0.257 [a]	1.100 [a]	0.359 [a]
Residual	32.695	140	0.234		
Phoneme ✳ Longitude ✳ Latitude	0.134 [a]	4 [a]	0.034 [a]	0.164 [a]	0.956 [a]
Residual	28.559	140	0.204		
Accent ✳ Correctness ✳ Phoneme ✳ Longitude	0.054 [a]	2 [a]	0.027 [a]	0.016 [a]	0.984 [a]
Residual	116.460	70	1.664		
Accent ✳ Correctness ✳ Phoneme ✳ Latitude	2.534	2	1.267	1.303	0.278
Residual	68.057	70	0.972		
Accent ✳ Correctness ✳ Longitude ✳ Latitude	0.342 [a]	4 [a]	0.085 [a]	0.476 [a]	0.753 [a]
Residual	25.130	140	0.180		
Accent ✳ Phoneme ✳ Longitude ✳ Latitude	1.729	4	0.432	2.184	0.074
Residual	27.706	140	0.198		
Correctness ✳ Phoneme ✳ Longitude ✳ Latitude	0.686	4	0.171	0.839	0.503
Residual	28.602	140	0.204		
Accent ✳ Correctness ✳ Phoneme ✳ Longitude ✳ Latitude	0.709 [a]	4 [a]	0.177 [a]	0.698 [a]	0.595 [a]
Residual	35.564	140	0.254		

Note. Type III Sum of Squares

[a] Mauchly's test of sphericity indicates that the assumption of sphericity is violated (p < .05).

Between Subjects Effects

	Sum of Squares	df	Mean Square	F	p
Residual	1358.543	35	38.816		

Note. Type III Sum of Squares

Figure A: Average ERP responses observed across all conditions for both accents in the three ROIs: parietal left (PL), parietal medial (PM) and parietal right (PR). Shaded areas represent the standard error across participants for each condition. The time-window with significant Accent * Correctness effect (600-900 ms) is highlighted in yellow.
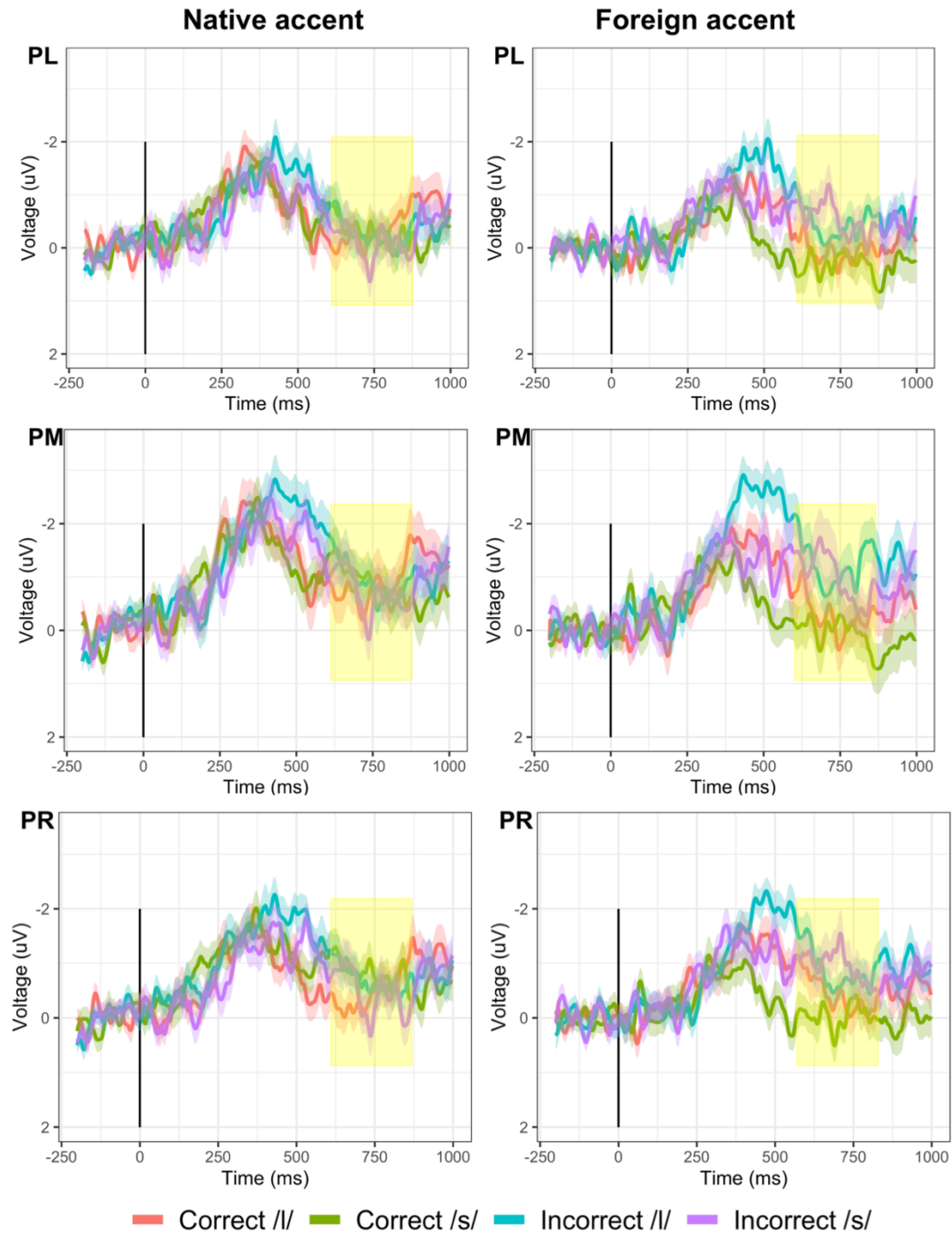
Figure B: *Left:* Difference waves from the main analysis across the three ROIs. Shaded areas represent the standard error across participants for each condition. The time-window with the significant Accent * Correctness effect (600-900 ms) is highlighted in yellow. *Right*: Individual variation in the N400 effect in both time windows. *Note*: For all figures, the voltage value for N400 effect was obtained by subtracting the correct from the incorrect conditions, collapsed across phoneme types (/l/ or /s/), as the factor of error typicality did not interact with the Accent * Correctness interaction.
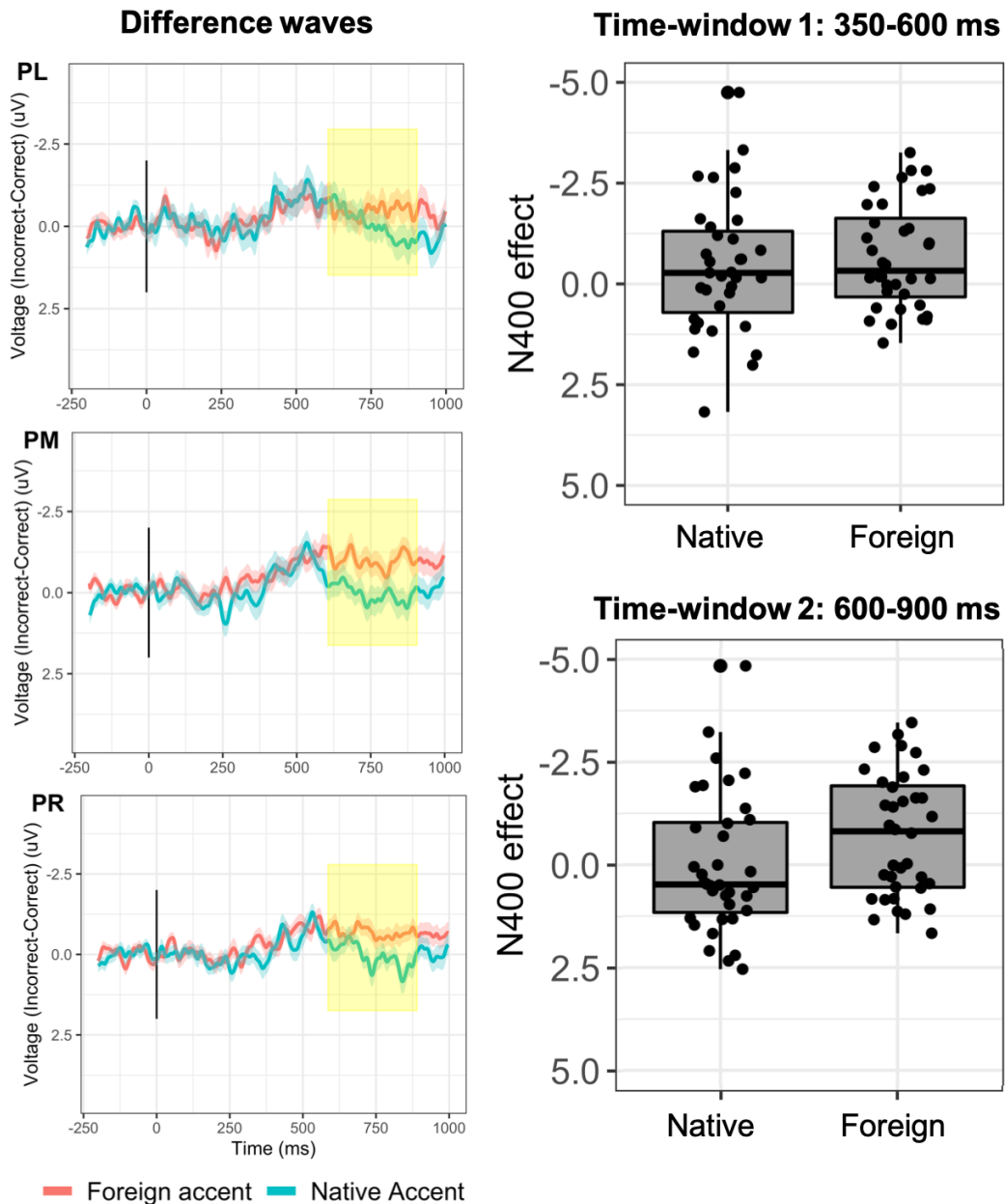
Figure C: *Left*: Average ERP responses observed across all conditions for both accents in Block 1 (top) and Block 2 (bottom). *Right*: Difference waves in both blocks. The voltage value for N400 effect was obtained by subtracting the correct from the incorrect conditions, collapsed across phoneme types (/l/ or /s/). The time-window with significant effect of Accent by Block (350-600 ms) is highlighted in yellow. *Note*: For all figures, the ERP response corresponds to an average across the three ROIs, as the topographic factor of Latitude was not included in the Block analysis. Shaded areas represent the standard error across participants for each condition.