

Supplementary materials to 'Phonetic and phonological aspects of prosodic focus marking in Canadian English'

Jiseung Kim and Anja Arnhold

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These supplementary materials are the results of statistical analysis described in the following article:

Jiseung, K., & Arnhold, A. (to appear). Phonetic and phonological aspects of prosodic focus marking in Canadian English.

The document consists of three sections: Section 1 presents the fixed effects tables of the Linear Mixed-effects Models for the acoustic measurements, section 2 presents the estimated marginal means and compact letter labels as part of the ad hoc analysis for the same acoustic measurements, and finally section 3 presents model summaries of the fixed effects tables and the multiple comparison tables of the binomial Generalized Linear Mixed-effects Models used in the pitch accent analysis. For sections 1 and 3, the intercept is BF for focus and S for constituent.

Section 1. Fixed effects summaries of the Linear Mixed-Effect Regression (LMER) Models

Table 1. Fixed effect summary for LMER that examined constituent duration (ms) based on 2,445 constituents. Participant and Item were included as random intercepts with additional by-participant and by-item slopes for constituent.

	Estimate	Std.Error	df	t value	p value
(Intercept)	438.722	12.408	62.142	35.359	< .001
Focus = SF	57.822	6.018	2225.896	9.608	< .001

Focus = VF	12.467	6.089	2224.625	2.047	< .05
Focus = OF	11.224	6.08	2220.399	1.846	= .07
Constituent = V	77.083	14.095	33.334	5.469	< .001
Constituent = O	129.534	20.512	30.489	6.315	< .001
SF:V	-81.193	8.564	2229.778	-9.481	< .001
VF:V	39.553	8.716	2228.3	4.538	< .001
OF:V	-35.492	8.686	2225.014	-4.086	< .001
SF:O	-88.205	8.526	2223.119	-10.346	< .001
VF:O	-53.461	8.605	2221.967	-6.213	< .001
OF:O	12.519	8.598	2218.991	1.456	= .15

Table 2. Fixed effect summary for LMER that examined relative intensity (dB) based on 2,361 constituents. Participant and Item were included as random intercepts, with additional by-participant and by-item slopes for constituent.

	Estimate	Std.Error	df	t value	p value
(Intercept)	1.920	0.385	51.983	4.986	< .001
Focus = SF	0.809	0.248	2192.736	3.259	< .01
Focus = VF	-0.196	0.251	2188.725	-0.782	0.434
Focus = OF	-0.032	0.251	2186.944	-0.127	0.899
Constituent = V	-1.256	0.443	42.647	-2.831	< .01
Constituent = O	1.607	0.416	63.908	3.861	< .001
SF:V	-0.860	0.345	2203.418	-2.493	< .05
VF:V	1.550	0.348	2196.355	4.454	< .001

OF:V	0.315	0.349	2192.734	0.901	0.368
SF:O	-2.286	0.347	2193.965	-6.586	< .001
VF:O	1.713	0.350	2190.162	-4.886	< .001
OF:O	0.613	0.351	2187.449	1.747	0.081

Table 3. Fixed effect summary for LMER that examined mean intensity in the middle 50% of the stressed vowel (dB, scaled to 70dB) based on 2,445 constituents. Participant and Item were included as random intercepts with additional by-participant and by-item slopes for constituent.

	Estimate	Std.Error	df	t value	p value
(Intercept)	71.6926	0.255	37.7632	281.166	< .001
Focus = SF	-1.043	0.1583	2228.4611	-6.587	< .001
Focus = VF	-1.28	0.1602	2226.601	-7.989	< .001
Focus = OF	-1.4897	0.16	2221.8946	-9.311	< .001
Constituent = V	-3.9351	0.4111	42.7691	-9.573	< .001
Constituent = O	-7.2985	0.5815	41.0475	-12.551	< .001
SF:V	-1.469	0.2255	2225.8748	-6.514	< .001
VF:V	0.7005	0.2295	2224.9373	3.052	< .01
OF:V	1.088	0.2287	2222.5851	4.758	< .001
SF:O	-0.6671	0.2244	2221.3104	-2.973	< .01
VF:O	-0.7611	0.2265	2220.4965	-3.36	< .001
OF:O	1.3376	0.2263	2217.9551	5.91	< .001

Figure 1. Mean intensity values for stressed syllable vowels of subjects, verbs and objects in the four focus conditions; letters reflect results of pairwise comparisons.

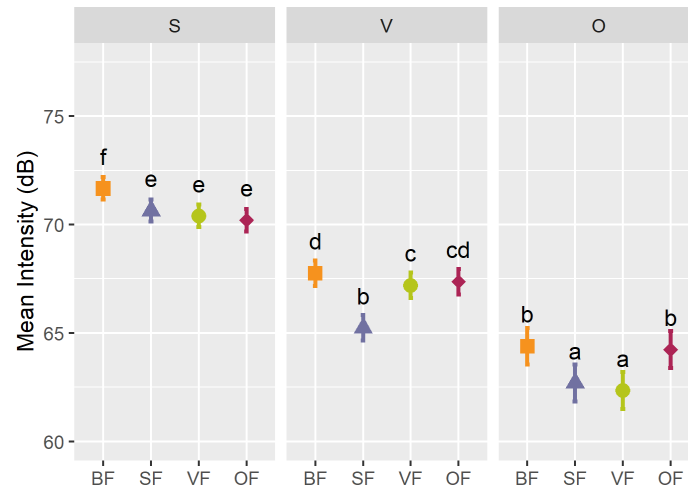


Table 4. Fixed effect summary for LMER that examined f0 range (st) based on 2,256 constituents. Participant was included as random intercepts by-Participant slopes for constituents, and Item was included as a random intercept.

	Estimate	Std.Error	df	t value	p value
(Intercept)	2.9681	0.2014	81.6193	14.74	< .001
Focus = SF	0.4247	0.1798	2084.892	2.362	< .05
Focus = VF	-0.4773	0.1818	2082.6008	-2.626	< .01
Focus = OF	-0.3074	0.1818	2078.2706	-1.691	= .09
Constituent = V	0.3211	0.1976	249.351	1.625	= .11
Constituent = O	0.2666	0.1938	277.4419	1.375	= .17
SF:V	-0.8762	0.258	2087.5385	-3.396	< .001
VF:V	0.8999	0.2599	2081.6554	3.463	< .001
OF:V	-0.196	0.2594	2078.7208	-0.756	= .44
SF:O	-1.5701	0.2718	2103.123	-5.778	< .001

VF:O	-0.2448	0.2742	2106.5317	-0.893	= .37
OF:O	0.3089	0.262	2084.0553	1.179	= .23

Table 5. Fixed effect summary for LMER that examined f0 maximum (st) based on 2,256 constituents. Participant and Item were included as random intercepts.

	Estimate	Std.Error	df	t value	p value
(Intercept)	12.567	0.9089	37.4796	13.826	< .001
Focus = SF	-1.2556	0.1693	2146.6033	-7.416	< .001
Focus = VF	-0.948	0.1711	2145.284	-5.54	< .001
Focus = OF	-0.7748	0.1712	2144.6524	-4.525	< .001
Constituent = V	-1.2664	0.1713	2141.3297	-7.394	< .001
Constituent = O	-3.1553	0.1718	2141.6558	-18.371	< .001
SF:V	-0.5794	0.2428	2141.153	-2.387	< .05
VF:V	0.9822	0.2446	2141.5197	4.016	< .001
OF:V	0.4856	0.2442	2141.4793	1.989	< .05
SF:O	0.4581	0.2557	2142.6294	1.791	= .07
VF:O	0.2249	0.2579	2142.3881	0.872	= .38
OF:O	1.0076	0.2467	2141.771	4.085	< .001

Table 6. Fixed effect summary for LMER that examined f0 mean (st) based on 2,256 constituents. Participant was included as random intercepts with by-Participant slopes for constituents, and Item was included as a random intercept.

	Estimate	Std.Error	df	t value	p value
(Intercept)	11.0437	0.9312	36.8537	11.859	< .001

Focus = SF	-1.327	0.1477	2066.323	-8.982	< .001
Focus = VF	-0.5992	0.1493	2064.7026	-4.013	< .001
Focus = OF	-0.5398	0.1494	2060.7166	-3.614	< .001
Constituent = V	-1.5274	0.1582	292.103	-9.658	< .001
Constituent = O	-3.248	0.2252	76.6425	-14.423	< .001
SF:V	-0.2602	0.2125	2072.1328	-1.225	= .22
VF:V	0.5343	0.2134	2066.99	2.504	< .05
OF:V	0.5481	0.2132	2064.1878	2.571	< .05
SF:O	0.894	0.2256	2070.4674	3.963	< .001
VF:O	0.2611	0.2271	2070.3882	1.15	= .25
OF:O	0.7534	0.2161	2059.1305	3.486	< .001

Table 7. Fixed effect summary for LMER that examined f0 minimum (st) based on 2,256 constituents. Participant was included as random intercepts with by-Participant slopes for constituent, and Item was included as a random intercept.

	Estimate	Std.Error	df	t value	p value
(Intercept)	9.59985	0.97938	37.11552	9.802	< .001
Focus = SF	-1.67889	0.1859	2083.67151	-9.031	< .001
Focus = VF	-0.46797	0.18792	2081.4111	-2.49	< .05
Focus = OF	-0.47661	0.18798	2077.44733	-2.535	< .05
Constituent = V	-1.58225	0.20771	226.47934	-7.617	< .001
Constituent = O	-3.39629	0.24696	103.14141	-13.752	< .001
SF:V	0.28633	0.26675	2086.37307	1.073	= .28

VF:V	0.06878	0.26864	2081.04362	0.256	= .79
OF:V	0.69257	0.26815	2078.05248	2.583	< .01
SF:O	1.99785	0.28184	2090.20524	7.088	< .001
VF:O	0.49926	0.28455	2091.67018	1.755	= .08
OF:O	0.70262	0.2712	2076.68897	2.591	< .01

Section 2. Estimated Marginal Means and compact letter labels for the LMERs

Table 8. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 1) testing constituent duration (ms).

Focus	Constituent	Estimated Marginal Mean	Std.Error	df	lower.CL	upper.CL	cld label
BF	S	438.87	12.41	62.86	414.08	463.67	a
SF	S	496.49	12.41	62.87	471.69	521.28	cd
VF	S	451.76	12.44	63.44	426.91	476.61	ab
OF	S	450.86	12.44	63.49	426.00	475.71	ab
BF	V	515.90	13.51	61.22	488.89	542.92	de
SF	V	492.39	13.51	61.10	465.39	519.40	bc
VF	V	566.28	13.53	61.57	539.23	593.33	fgh
OF	V	492.18	13.54	61.73	465.11	519.26	bc
BF	O	570.33	18.46	39.30	533.00	607.65	e g
SF	O	537.84	18.46	39.31	500.51	575.16	cd f
VF	O	527.49	18.47	39.45	490.13	564.84	cd f
OF	O	592.14	18.48	39.48	554.78	629.50	h

Table 9. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 2) testing relative intensity (dB).

Focus	Constituent	Estimated Marginal	Std.Error	df	lower.CL	upper.CL	cld label
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		Mean					
BF	S	0.61	0.27	68.3	0.080	1.15	a
SF	S	0.67	0.27	69.1	0.130	1.20	ab
VF	S	0.95	0.27	71.4	0.409	1.49	ab
OF	S	1.62	0.35	71.4	0.924	2.31	abcd
BF	V	1.72	0.38	49.8	0.958	2.49	abc
SF	V	1.89	0.38	50.1	1.121	2.66	abc
VF	V	1.92	0.39	51.8	1.147	2.69	abcd
OF	V	2.02	0.27	70.4	1.482	2.56	cd
BF	O	2.05	0.35	70.0	1.358	2.74	bcd
SF	O	2.73	0.38	48.8	1.967	3.49	de
VF	O	3.53	0.35	69.3	2.837	4.22	e
OF	O	4.11	0.35	71.6	3.413	4.80	e

Table 10. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 3) testing mean intensity in the middle 50% of the stressed vowel (dB, scaled to 70dB).

Focus	Constituent	Estimated	Std.Error	df	lower.CL	upper.CL	cld label
		Marginal Mean					
BF	S	71.68	0.26	37.73	71.16	72.20	f
SF	S	70.65	0.26	37.74	70.13	71.17	e
VF	S	70.40	0.26	38.29	69.88	70.92	e
OF	S	70.21	0.26	38.34	69.69	70.73	e
BF	V	67.78	0.29	45.70	67.19	68.37	d
SF	V	65.24	0.29	45.57	64.66	65.83	b
VF	V	67.20	0.29	46.07	66.61	67.79	c
OF	V	67.38	0.29	46.25	66.79	67.97	cd
BF	O	64.38	0.42	50.09	63.53	65.23	b
SF	O	62.69	0.42	50.09	61.84	63.55	a
VF	O	62.35	0.42	50.32	61.49	63.20	a
OF	O	64.23	0.43	50.38	63.38	65.09	b

Table 11. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 3) testing f0 range (st).

Focus	Constituent	Estimated Marginal Mean	Std.Error	df	lower.CL	upper.CL	cld label
BF	S	2.96	0.20	80.10	2.57	3.36	bcd
SF	S	3.39	0.20	80.66	2.99	3.79	de
VF	S	2.50	0.20	82.60	2.10	2.90	ab
OF	S	2.66	0.20	82.98	2.26	3.06	abc
BF	V	3.26	0.17	121.02	2.92	3.59	cde
SF	V	2.84	0.17	131.54	2.50	3.18	bcd
VF	V	3.68	0.17	125.01	3.34	4.01	e
OF	V	2.76	0.17	127.88	2.43	3.10	abcd
BF	O	3.26	0.18	98.60	2.91	3.62	cde
SF	O	2.09	0.20	144.51	1.69	2.48	a
VF	O	2.51	0.20	147.70	2.11	2.91	ab
OF	O	3.23	0.18	108.31	2.87	3.60	cde

Table 12. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 4) testing f0 maximum (st).

Focus	Constituent	Estimated Marginal Mean	Std.Error	df	lower.CL	upper.CL	cld label
BF	S	12.56	0.91	37.49	10.72	14.40	e
SF	S	11.31	0.91	37.50	9.47	13.16	cd
VF	S	11.62	0.91	37.54	9.78	13.47	d
OF	S	11.75	0.91	37.54	9.91	13.60	d
BF	V	11.34	0.91	37.50	9.49	13.18	cd
SF	V	9.47	0.91	37.60	7.62	11.31	b
VF	V	11.33	0.91	37.54	9.48	13.17	cd
OF	V	11.00	0.91	37.56	9.16	12.85	c
BF	O	9.46	0.91	37.56	7.61	11.30	b
SF	O	8.62	0.91	38.16	6.77	10.47	a

VF	O	8.69	0.91	38.21	6.84	10.54	a
OF	O	9.64	0.91	37.69	7.79	11.48	b

Table 13. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 5) testing f0 mean (st).

Focus	Constituent	Estimated Marginal Mean	Std.Error	df	lower.CL	upper.CL	cld label
BF	S	9.60	0.98	37.10	7.61	11.59	c
SF	S	7.92	0.98	37.11	5.93	9.91	b
VF	S	9.13	0.98	37.15	7.14	11.12	c
OF	S	9.09	0.98	37.15	7.10	11.08	c
BF	V	8.09	0.93	37.23	6.21	9.96	b
SF	V	6.63	0.93	37.36	4.75	8.51	a
VF	V	7.65	0.93	37.28	5.77	9.53	b
OF	V	8.24	0.93	37.31	6.37	10.12	b
BF	O	6.22	0.94	37.18	4.32	8.12	a
SF	O	6.53	0.94	37.89	4.62	8.43	a
VF	O	6.24	0.94	37.96	4.34	8.15	a
OF	O	6.43	0.94	37.32	4.53	8.33	a

Table 14. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the LMER (section 1, Table 6) testing f0 minimum (st).

Focus	Constituent	Estimated Marginal Mean	Std.Error	df	lower.CL	upper.CL	cld label
BF	S	11.04	0.93	36.86	9.15	12.93	e
SF	S	9.72	0.93	36.87	7.83	11.61	c
VF	S	10.44	0.93	36.90	8.55	12.33	d
OF	S	10.47	0.93	36.90	8.58	12.36	d
BF	V	9.56	0.92	36.89	7.70	11.42	c
SF	V	7.93	0.92	36.99	6.07	9.79	ab

VF	V	9.46	0.92	36.92	7.61	11.32	c
OF	V	9.52	0.92	36.95	7.67	11.38	c
BF	O	7.81	0.91	36.90	5.98	9.65	ab
SF	O	7.37	0.91	37.42	5.52	9.21	a
VF	O	7.47	0.91	37.45	5.63	9.32	ab
OF	O	8.01	0.91	37.00	6.17	9.85	b

Section 3. Fixed effects summaries and the multiple comparisons of the Generalized Linear Mixed-Effect Models (GLMM)

Table 15. Fixed effect summary for GLMM that examined the probability of presence and absence of pitch accent annotation based on 2,445 constituents. The model failed to converge when the interaction between Information Structure (IS) and Constituent was included. Therefore, this interaction was excluded from the final model. BG stands for Background, meaning constituents preceding or following constituents with narrow focus. NF stands for Narrow Focus, meaning constituents with narrow contrastive focus on the constituent itself (i.e., subject in SF, verb in VF, object in OF).

	Estimate	Ste.Error	z value	p value
(Intercept)	3.6029	0.2027	17.777	< 0.001
IS = BG	-2.135	0.1363	-15.66	< 0.001
IS = NF	1.6933	0.2145	7.895	< 0.001
Constituent = V	-2.5057	0.158	-15.862	< 0.001
Constituent = O	-2.8794	0.1617	-17.803	< 0.001

Table 16. Output of the multiple comparison test for the GLMM (section 3, Table 14) testing the probability of presence and absence of pitch accent annotation using the `glht` function in the `multcomp` package for R.

Comparison	Estimate	Std.Error	z value	p value
BG – BF	-2.126	0.138	-15.292	< 0.001
NF – BF	1.729	0.220	7.850	< 0.001
NF – BG	3.845	0.213	18.061	< 0.001
S – O	2.833	0.164	17.255	< 0.001

V – O	0.363	0.129	2.827	< 0.05
V – S	-2.470	0.160	-15.478	< 0.001

Table 17. Fixed effect summary for GLMM that examined the probability of H* pitch accent annotation against any non-H* annotation based on 1,587 constituents after excluding constituents with no accent.

	Estimate	Ste.Error	z value	p value
(Intercept)	0.72784	0.18372	3.962	< 0.001
IS = BG	0.0562	0.19745	0.285	0.77591
IS = NF	0.30721	0.22193	1.384	0.16627
Constituent = V	0.39927	0.24366	1.639	0.10129
Constituent = O	0.90572	0.27723	3.267	< 0.01
BG: V	0.25078	0.36378	0.689	0.49059
NF: V	-0.95277	0.33029	-2.885	< 0.01
BG: O	0.39029	0.43813	0.891	0.37304
NF: O	0.04671	0.39054	0.12	0.90479

Table 18. Estimated Marginal Means and the corresponding labels from compact letter display (cld) function for the GLMM (section 3, Table 16) testing the probability of H* pitch accent annotation against any non-H* annotation.

Focus	Constituent	Probability	Std.Error	df	asympt.LCL	asympt.UCL	cld label
GV	S	0.6893392	0.03384012	Inf	0.6194744	0.7515219	abc
NF	S	0.7347920	0.03625178	Inf	0.6580159	0.7995815	abcd
BF	S	0.6685030	0.04185166	Inf	0.5820689	0.7448958	ab
GV	V	0.8040964	0.04098954	Inf	0.7113800	0.8723721	bcde
NF	V	0.6234788	0.04253087	Inf	0.5372429	0.7025421	a
BF	V	0.7564822	0.03952974	Inf	0.6710449	0.8254998	abcde
GV	O	0.8840491	0.03398144	Inf	0.7992488	0.9359013	de
NF	O	0.8752372	0.02709707	Inf	0.8117954	0.9194163	e
BF	O	0.8346424	0.03504996	Inf	0.7542007	0.8925103	cde