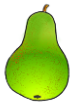
Supporting Information for: Bowles, A. R., Chang, C. B, & Karuzis, V. P. Pitch ability as an aptitude for tone learning. Article accepted in *Language Learning* on 24 July 2015.

Appendix S1: Target Lexicon in the Tonal Word Learning Task

Item type	Meaning	Image[1]	Audio (in *pinyin*)
Monosyllabic	'balloon'		lou1
	'window'		lou2
	'apple'		lou3
	'horse'		lou4
	'banana'		ma1
	'pencil'		ma2
	'cake'		ma3
	'ring'		ma4

[1]All images obtained from Rossion, B., & Pourtois, G. (2004). Revisiting Snodgrass and Vanderwart's object set: The role of surface detail in basic-level object recognition. *Perception*, *33*, 217–236.

Disyllabic (1st-syllable tonal contrast)	‘hand’		bao1mi1
	‘button’		bao2mi1
	‘desk’		bao3mi1
	‘fork’		bao4mi1
	‘key’		da1li2
	‘foot’		da2li2
	‘eye’		da3li2
	‘dog’		da4li2
Disyllabic (2nd-syllable tonal contrast)	‘book’		di4wa1
	‘pear’		di4wa2
	‘car’		di4wa3

‘hat’		di4wa4
‘chair’		ji2nan1
‘ear’		ji2nan2
‘door’		ji2nan3
‘box’		ji2nan4

Appendix S2: PCA Component Loadings

Variable	Component							
	I	II	III	IV	V	VI	VII	VIII
AMMA – Pitch	.327	–.105	.061	.282	–.851	–.286	.126	.083
AMMA – Rhythm	.355	–.077	.081	.314	–.819	–.280	.098	.272
Antisaccade analogue (acc.)	.115	–.156	–.016	.212	–.183	–.266	.624	.148
Antisaccade analogue (RT)	–.098	.460	–.034	–.213	.100	.039	–.772	–.161
Consonant discrimination	.007	–.003	–.029	.017	–.363	–.042	.069	–.039
FL listening/speaking	.188	–.094	.895	.178	.038	–.078	.058	.214
FL reading/writing	.074	–.025	.869	.179	.013	–.058	.051	.277
Heritage language exposure	–.020	.050	.377	–.005	–.080	–.016	–.131	–.242
Letter sets	.156	–.193	.141	.406	–.096	–.241	.430	.485
Months of music lessons	.754	–.054	.140	.109	–.269	–.474	.042	.250
Music major	.841	–.177	.089	.185	–.042	–.317	–.012	.187
Nonword span	.174	.008	.149	.840	–.278	–.263	.257	.141
Number of FLs	.180	–.016	.185	.120	–.109	–.103	.024	.331
OMSI score	.794	–.183	.134	.173	–.194	–.404	.015	.224
Paired associates	.100	–.152	.113	.669	–.144	–.180	.265	.215
Pitch contour identification (acc.)	.359	–.162	.005	.203	–.067	–.649	.267	.331
Pitch contour identification (RT)	–.187	.663	.074	–.154	.116	.060	–.450	–.102
Pitch STM – Control	.394	–.184	.109	.134	–.297	–.852	.178	–.095
Pitch STM – Interference	.582	.028	.018	.278	–.361	–.247	.145	.150
Running memory span	.335	–.169	.020	.424	–.334	–.225	.179	.288
Serial reaction time	.176	–.166	.078	.384	–.058	–.029	–.033	.158

Tone discrimination (d')	.416	–.020	–.015	.423	–.281	–.627	.045	.312
Tone discrimination (RT)	.018	.682	.010	–.211	.023	.060	–.285	–.048
Tone identification (acc.)	.451	–.129	.116	.377	–.330	–.602	.112	.525
Tone identification (RT)	–.227	.765	–.080	–.076	.099	.217	–.131	–.172
WMAT, Part I	.608	–.137	.070	.218	–.360	–.500	.241	.185
WMAT, Part III	.639	–.227	.222	.232	–.396	–.758	.145	.034
Wonderlic	.148	–.284	.071	.276	–.096	–.082	.235	.451

Extraction method: Principal axis factoring.

Rotation method: Oblimin with Kaiser normalization.

Appendix S3: Descriptive Statistics for Predictor and Dependent Measures

Task/measure	Data type	*n*	*M*	*Min*	*Max*	*SD*
Pitch ability						
Pitch contour identification	arcsine accuracy	160	0.74	0.38	1.02	0.13
Pitch contour identification	log mean RT	160	3.03	2.71	3.30	0.08
Pitch STM – Control	proportion accuracy	158	0.86	0.00	1.00	0.14
Pitch STM – Interference	proportion accuracy	158	0.54	0.00	1.00	0.11
Tone discrimination	*d′*	159	1.15	0.00	3.00	0.70
Tone discrimination	log mean RT	158	2.81	2.00	3.00	0.21
Tone identification	arcsine accuracy	160	0.75	0.27	1.20	0.28
Tone identification	log mean RT	159	3.25	3.00	4.00	0.10
Musicality						
AMMA – Pitch	percent accuracy	160	56.90	5.00	94.00	21.78
AMMA – Rhythm	percent accuracy	160	52.69	4.00	93.00	18.98
Months of music lessons[2]	sum	160	59.33	0.00	387.00	82.52
Music major	binary (Y=1/N=0)	160	0.13	0.00	1.00	0.33
OMSI score	prob. mus. soph.	160	254.52	15.00	997.00	249.65
WMAT, Part I (chord)	proportion accuracy	160	0.53	0.15	1.00	0.18
WMAT, Part III (melody)	proportion accuracy	160	0.55	0.13	0.97	0.19
General L2 aptitude						
Antisaccade analogue	log odds prop. corr.	150	1.16	–1.00	4.00	0.92
Antisaccade analogue	RT (ms)	150	633.15	380.00	1446	171.38

[2]For participants who studied multiple instruments, a total figure was summed over all of their instruments.

Consonant discrimination	*d′*	158	0.31	–2.00	2.00	0.64
Nonword span	sum	159	171.57	121.00	202.00	17.86
Paired associates	% correct recall	158	12.37	0.00	20.00	6.01
Running memory span	mean # recalled	160	3.02	1.00	5.65	0.70
Serial reaction time	RT difference (ms)	157	24.03	–80.00	149.00	34.89
General cognitive ability						
Letter sets	sum (# correct)	159	11.46	3.00	15.00	2.50
Wonderlic	sum (# correct)	159	29.60	14.00	44.00	5.41
Learning outcomes (Tonal Word Learning)						
Penultimate accuracy	proportion accuracy	160	0.53	0.04	1.00	0.25
Final accuracy	proportion accuracy	160	0.52	0.04	0.99	0.25

Appendix S4: Correlation Matrix of Predictor Measures

Measure	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1 Tone discrimination (*d'*)	-.06	.61**	.52**	.44**	.48**	.33**	.36**	.47**	.54**	.37***	.26**	.40***	.04	.44**	.39**	.14†	.02	.14†	.29**	.29**	.13
2 Tone discrimination (RT)		-.08	-.22**	.03	-.12	-.10	-.14†	-.09	-.15†	-.07	-.05	.02	-.01	-.13*	-.17*	-.18*	-.02	-.28**	-.23**	-.26**	-.21**
3 Tone identification (acc.)			.48**	.39**	.55**	.34**	.45**	.49**	.55**	.46***	.41***	.46***	.06	.39**	.41**	.24**	.17*	.19*	.34**	.40**	.33**
4 Pitch STM – Control				.29**	.62**	.36**	.32**	.44**	.75**	.36***	.33***	.41***	.01	.32**	.28**	.27**	.08	.09	.19*	.25**	.09
5 Pitch STM – Interference					.29**	.40**	.37**	.48**	.45**	.42***	.40***	.43***	.15†	.30**	.38**	.19*	.05	.21*	.18*	.21**	.12
6 Pitch contour identification						.24**	.26**	.39**	.52**	.36***	.33***	.38***	-.01	.32**	.23**	.30**	.12	.11	.24**	.37**	.30**
7 AMMA – Pitch							.77**	.41**	.45**	.27**	.14†	.26**	.24**	.34**	.30**	.18*	.04	.09	.16*	.22**	.17*
8 AMMA – Rhythm								.37**	.41**	.31***	.22**	.34***	.20*	.33**	.35**	.17*	.04	.17*	.21**	.32**	.19*
9 WMAT, Part I (chords)									.64**	.57***	.46***	.58***	.07	.35**	.31**	.27**	.16*	.09	.22**	.32**	.24**
10 WMAT, Part III (melodies)										.60***	.47***	.60***	.12	.33**	.36**	.24**	.23**	.14†	.19*	.30**	.21**
11 OMSI score											.73**	.66**	.09	.20*	.22**	.13	.23**	.18*	.08	.21**	.14†
12 Music major (yes/no)												.61**	-.08	.17*	.20*	.09	.17*	.20*	.09	.13	.16*

Measure	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
13 Private music lessons (months)													.05	.18*	.21**	.11	.21**	.07	.14†	.26**	.16*
14 Consonant discrimination														.06	.05	.16†	-.01	-.05	-.08	-.03	-.08
15 Nonword span															.37**	.26**	.15	.30**	.55**	.39**	.27**
16 Running memory span																.19*	.06	.17*	.37**	.29**	.36**
17 Antisaccade analogue																	.07	-.04	.30**	.27**	.19*
18 L2 listening/speaking																		.05	.11	.14	.12
19 Serial reaction time																			.22**	.21**	.13
20 Paired associates																				.35**	.34**
21 Letter sets																					.39**
22 Wonderlic																					

Note. †$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

Appendix S5: Reliability of Predictor Measures

Predictor	Reliability	Measure
Tone discrimination (*d'*)	.91[a]	alpha
Tone discrimination (RT)	—*	na
Tone identification	.94[a]	alpha
Pitch STM – Control	.89[a]	alpha
Pitch STM – Interference	.60[a]	alpha
Pitch contour identification	.93[a]	alpha
AMMA – Pitch	.80–.84[b]	split-half
AMMA – Rhythm	.80–.85[b]	split-half
WMAT, Part I (chords)	—**	na
WMAT, Part III (melodies)	—**	na
OMSI score	.90[c]	alpha
Music major (yes/no)	na	na
Months of private music lessons	na	na
Consonant discrimination	.89[d]	alpha
Nonword span	.87[d]	alpha
Running memory span	.89[e]	alpha
Antisaccade analogue	.92[e]	split-half
L2 listening/speaking	na	na
Serial reaction time	.79[e]	alpha
Paired associates	.88[e]	alpha
Letter sets	.65[d]	alpha
Wonderlic	~.90[f]	unspecified

Notes. [a]Calculated from data in this study. [b]From Sherbon, J. W. (1995). Review of the Advanced Measures of Music Audiation. In J. C. Conoley & J. C. Impara (Eds.), *The twelfth mental measurements yearbook*. Available from http://buros.org; lower values are for non-music majors and higher values are for music majors. [c]From Ollen, J. E. (2006). *A criterion-related validity test of selected indicators of musical sophistication using expert ratings*. Doctoral dissertation, Ohio State University; this measure represents "standardized item alpha." [d]From Bunting, M. F., Bowles, A. R., Campbell, S. G., Linck, J. A., Mislevy, M. A., Jackson, S. R., …Doughty, C. J. (2011). *Reinventing DLAB: Potential new predictors of success at DLIFLC*. Technical Report. University of Maryland Center for Advanced Study of Language. [e]From Linck, J. A., Hughes, M. M., Campbell, S. G., Silbert, N. H., Tare, M., Jackson, S. R., Smith, B. K., Bunting, M. F., & Doughty, C. J. (2013). Hi-LAB: A new measure of aptitude for high-level language proficiency. *Language Learning*, *63*, 530–566. [f]From Schraw, G. (2001). Review of the Wonderlic Personnel Test and Scholastic Level Exam. In B. S. Blake & J. C. Impara (Eds.), *The fourteenth mental measurements yearbook*. Available from http://buros.org. *Not calculated (as trial-level data were not available). **For the full Wing Musical Aptitude Test, Wing reports internal consistency of .91 in Wing, H. D. (1962). A revision of the "Wing Musical Aptitude Test." *Journal of Research in Music Education, 10,* 39–46. In this study, we used only two parts of this test.