

Monaghan and Fletcher: Supplementary Materials

Supplementary Materials 1 (pp.2-9):

Full Models of phoneme features and phonemes for each semantic attribute.

Note that “stem” refers to the nonword template. For place, alveolar place of articulation is the reference category, with “placeb” referring to bilabial place of articulation, “placed” referring to dental place of articulation, and “placev” referring to velar place of articulation. “mannerp” refers to plosive manner of articulation, in comparison with the reference category of fricative.

For the phoneme models, “phonemeX” refers to comparison of the phoneme X to the reference phoneme /b/.

Supplementary Materials 2 (pp.10-17):

Full models of phoneme features and phonemes for each semantic attribute, omitting nonwords containing reduplication, sharing onset phoneme with attribute, or that are pseudohomophones.

Supplementary Materials 3 (pp.18-25):

Full models of phoneme features from Supplementary Materials 2, testing whether letter shape contributes additional variance. Full models of phonemes from Supplementary Materials 2 compared to model containing only random effects and letter shape.

Supplementary Materials 1

Small:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=smallness)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.7335783	0.85649	
stem	(Intercept)	0.1636593	0.40455	
	placeb	0.0135832	0.11655	-0.29
	placed	0.0358675	0.18939	0.31 0.08
	placev	0.0232206	0.15238	-0.78 -0.08 -0.81
	voice	0.0007625	0.02761	0.52 0.60 0.01 -0.48
	mannerp	0.0223974	0.14966	0.63 0.19 0.89 -0.98 0.42
Residual		1.7749615	1.33228	

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.57853	0.22756	4.20118	15.726	6.82e-05 ***
placeb	-0.01630	0.09066	4.17640	-0.180	0.8657
placed	-0.16033	0.11743	3.12367	-1.365	0.2622
placev	-0.25679	0.10309	3.76438	-2.491	0.0713 .
voice	-0.29565	0.04604	17.18986	-6.421	6.00e-06 ***
mannerp	-0.10598	0.10209	3.76386	-1.038	0.3613

Model fit:

Df	AIC	BIC	logLik
29	12894	13074	-6418.1

Phoneme model:

Syntax in R: `lmer(response ~ (1+phoneme|subject) + (1|stem) + phoneme, data=smallness)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.49817	0.7058	
	phonemed	0.04819	0.2195	0.80
	phonemef	0.32358	0.5688	0.22 0.04
	phonemeg	0.09410	0.3068	-0.20 -0.48 0.23
	phonemek	0.13574	0.3684	0.56 0.26 0.84 0.37
	phonemep	0.17434	0.4175	0.46 0.48 0.46 0.25 0.76
	phonemes	0.36007	0.6001	0.06 0.18 0.76 -0.37 0.38 0.13
	phonemet	0.12646	0.3556	0.45 0.46 0.87 -0.09 0.81 0.69 0.79
	phonemev	0.17099	0.4135	0.17 0.01 0.99 0.27 0.85 0.56 0.72 0.88
	phonemez	0.20404	0.4517	0.45 0.31 0.89 0.29 0.83 0.51 0.61 0.82 0.84
stem	(Intercept)	0.21346	0.4620	
Residual		1.69244	1.3009	

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.0082	0.2517	4.1187	11.949	0.000238 ***
phonemed	0.2011	0.0986	476.2494	2.039	0.041959 *
phonemef	0.2853	0.1128	127.2249	2.530	0.012615 *
phonemeg	-0.1060	0.1011	227.9624	-1.048	0.295624
phonemek	0.2255	0.1033	229.5123	2.183	0.030041 *
phonemep	0.6005	0.1053	111.8028	5.702	9.80e-08 ***
phonemes	0.5571	0.1145	118.4462	4.865	3.56e-06 ***
phonemet	0.4321	0.1028	232.8621	4.202	3.77e-05 ***
phonemev	0.2391	0.1051	176.3123	2.274	0.024161 *
phonemez	0.2880	0.1068	124.8626	2.696	0.007988 **

Model fit:

Df	AIC	BIC	logLik
67	12906	13322	-6386.0

Large:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=largeness)`

```
Random effects:
Groups   Name                Variance Std.Dev. Corr
subject (Intercept)      0.78667  0.8869
stem    (Intercept)      0.92854  0.9636
        placeb       0.10170  0.3189  -0.88
        placed      0.29266  0.5410  -0.91  0.92
        placev      0.05515  0.2348  -0.87  0.72  0.93
        voice       0.03383  0.1839  -0.53  0.84  0.79  0.54
        mannerp    0.12828  0.3582  -0.77  0.96  0.92  0.72  0.95
Residual 1.63095  1.2771
Number of obs: 3680, groups: subject, 92; stem, 4
```

```
Fixed effects:
              Estimate Std. Error      df t value Pr(>|t|)
(Intercept)  3.53370    0.49330   3.22755  7.163  0.00438 **
placeb      -0.10054    0.17279   3.07377  -0.582  0.60059
placed      -0.23641    0.27856   3.00924  -0.849  0.45823
placev      0.09239    0.13498   3.16657   0.685  0.54041
voice       0.32663    0.10114   3.09537   3.229  0.04615 *
mannerp    -0.23370    0.19105   3.04964  -1.223  0.30730
```

```
Model fit:
Df  AIC  BIC  logLik
29 12610 12790 -6275.8
```

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=largeness)`

```
Random effects:
Groups   Name                Variance Std.Dev.
subject (Intercept)      0.7855  0.8863
stem    (Intercept)      0.3922  0.6262
Residual 1.6778  1.2953
Number of obs: 3680, groups: subject, 92; stem, 4
```

```
Fixed effects:
              Estimate Std. Error      df t value Pr(>|t|)
(Intercept)  3.68478    0.33338   3.81866  11.053  0.000488 ***
phonemed    -0.15217    0.09549  3576.00026  -1.594  0.111113
phonemef    -0.32880    0.09549  3576.00026  -3.443  0.000581 ***
phonemeg     0.07065    0.09549  3576.00026   0.740  0.459416
phonemek    -0.32880    0.09549  3576.00026  -3.443  0.000581 ***
phonemep    -0.64402    0.09549  3576.00026  -6.744  1.79e-11 ***
phonemes    -0.10870    0.09549  3576.00026  -1.138  0.255076
phonemet    -0.29076    0.09549  3576.00026  -3.045  0.002344 **
phonemev    -0.11957    0.09549  3576.00026  -1.252  0.210608
phonemez     0.13315    0.09549  3576.00026   1.394  0.163282
```

```
Model fit:
Df  AIC  BIC  logLik
13 12656 12737 -6315.3
```

Soft:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=softness)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.853178	0.92368	
stem	(Intercept)	0.392460	0.62647	
	placeb	0.024768	0.15738	-0.49
	placed	0.023234	0.15243	0.65 -0.77
	placev	0.012381	0.11127	-0.11 0.46 0.18
	voice	0.017116	0.13083	-0.56 -0.44 0.12 -0.22
	mannerp	0.007451	0.08632	0.28 0.69 -0.40 0.26 -0.95
Residual		1.619705	1.27268	

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.27717	0.33171	3.60449	9.880	0.000974 ***
placeb	0.14130	0.10292	3.59799	1.373	0.249118
placed	0.19565	0.10104	3.59862	1.936	0.132795
placev	-0.18207	0.08658	3.63890	-2.103	0.110188
voice	-0.19293	0.07771	3.29478	-2.483	0.081499 .
mannerp	-0.06793	0.07915	5.93606	-0.858	0.423998

Model fit:

Df	AIC	BIC	logLik
29	12584	12764	-6263.1

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=softness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.8530	0.9236
stem	(Intercept)	0.3705	0.6087
Residual		1.6213	1.2733

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.27717	0.32604	3.91098	10.052	0.000617 ***
phonemed	-0.18207	0.09387	3576.00128	-1.940	0.052508 .
phonemef	0.32609	0.09387	3576.00128	3.474	0.000519 ***
phonemeg	-0.34511	0.09387	3576.00128	-3.677	0.000240 ***
phonemek	-0.34783	0.09387	3576.00128	-3.705	0.000214 ***
phonemep	-0.04620	0.09387	3576.00128	-0.492	0.622654
phonemes	0.16576	0.09387	3576.00128	1.766	0.077498 .
phonemet	-0.14674	0.09387	3576.00128	-1.563	0.118081
phonemev	-0.12772	0.09387	3576.00128	-1.361	0.173722
phonemez	-0.35870	0.09387	3576.00128	-3.821	0.000135 ***

Model fit:

Df	AIC	BIC	logLik
13	12540	12621	-6257.2

Hard:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=hardness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0620	1.0305
stem	(Intercept)	0.1683	0.4102
Residual		1.6073	1.2678

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.28451	0.23715	5.23672	13.850	2.52e-05	***
placeb	-0.08016	0.06609	3579.99984	-1.213	0.22522	
placed	-0.05571	0.06609	3579.99984	-0.843	0.39933	
placev	0.23505	0.06609	3579.99984	3.557	0.00038	***
voice	0.21087	0.04180	3579.99984	5.045	4.76e-07	***
mannerp	0.09511	0.06609	3579.99984	1.439	0.15020	

Model fit:

Df	AIC	BIC	logLik
9	12522	12578	-6251.8

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=hardness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0623	1.0307
stem	(Intercept)	0.1683	0.4103
Residual		1.5965	1.2635

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.42935	0.24076	5.56236	14.244	1.37e-05	***
phonemed	0.07065	0.09315	3576.00243	0.758	0.448203	
phonemef	-0.31250	0.09315	3576.00243	-3.355	0.000802	***
phonemeg	0.29891	0.09315	3576.00243	3.209	0.001344	**
phonemek	0.28261	0.09315	3576.00243	3.034	0.002431	**
phonemep	-0.04891	0.09315	3576.00243	-0.525	0.599537	
phonemes	-0.30163	0.09315	3576.00243	-3.238	0.001214	**
phonemet	0.04076	0.09315	3576.00243	0.438	0.661707	
phonemev	0.12228	0.09315	3576.00243	1.313	0.189340	
phonemez	0.22283	0.09315	3576.00243	2.392	0.016800	*

Model fit:

Df	AIC	BIC	logLik
13	12501	12582	-6237.7

Fast:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=fastness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9314	0.9651
stem	(Intercept)	0.2670	0.5167
Residual		1.8134	1.3466

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.85815	0.28254	4.22457	13.655	0.000118	***
placeb	0.05707	0.07020	3579.99915	0.813	0.416319	
placed	-0.08560	0.07020	3579.99914	-1.219	0.222781	
placev	0.27446	0.07020	3579.99915	3.910	9.41e-05	***
voice	0.28098	0.04440	3579.99914	6.329	2.78e-10	***
mannerp	-0.61549	0.07020	3579.99914	-8.768	< 2e-16	***

Model fit:

Df	AIC	BIC	logLik
9	12945	13001	-6463.4

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=fastness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9325	0.9657
stem	(Intercept)	0.2670	0.5167
Residual		1.7715	1.3310

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.43207	0.28584	4.42623	12.007	0.000152	***
phonemed	-0.11685	0.09812	3576.00007	-1.191	0.233793	
phonemef	0.08424	0.09812	3576.00007	0.859	0.390664	
phonemeg	0.22011	0.09812	3576.00007	2.243	0.024943	*
phonemek	0.23098	0.09812	3576.00007	2.354	0.018626	*
phonemep	0.01630	0.09812	3576.00007	0.166	0.868037	
phonemes	0.17935	0.09812	3576.00007	1.828	0.067661	.
phonemet	0.01902	0.09812	3576.00007	0.194	0.846297	
phonemev	0.87772	0.09812	3576.00007	8.945	< 2e-16	***
phonemez	0.95380	0.09812	3576.00007	9.721	< 2e-16	***

Model fit:

Df	AIC	BIC	logLik
13	12865	12946	-6419.5

Slow:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=slowness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9399	0.9695
stem	(Intercept)	0.2572	0.5072
Residual		1.7835	1.3355

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.522e+00	2.783e-01	4.280e+00	12.658	0.000149	***
placeb	1.155e-01	6.962e-02	3.580e+03	1.659	0.097213	.
placed	-1.427e-01	6.962e-02	3.580e+03	-2.049	0.040506	*
placev	2.310e-02	6.962e-02	3.580e+03	0.332	0.740067	
voice	-1.087e-03	4.403e-02	3.580e+03	-0.025	0.980306	
mannerp	-9.647e-02	6.962e-02	3.580e+03	-1.386	0.165921	

Model fit:

Df	AIC	BIC	logLik
9	12886	12942	-6433.8

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=slowness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9401	0.9696
stem	(Intercept)	0.2574	0.5073
Residual		1.7741	1.3320

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.55707	0.28174	4.49159	12.625	0.000112	***
phonemed	-0.05435	0.09819	3576.00089	-0.553	0.579973	
phonemef	-0.19293	0.09819	3576.00089	-1.965	0.049511	*
phonemeg	-0.01902	0.09819	3576.00089	-0.194	0.846409	
phonemek	-0.19837	0.09819	3576.00089	-2.020	0.043439	*
phonemep	-0.03261	0.09819	3576.00089	-0.332	0.739845	
phonemes	0.16576	0.09819	3576.00089	1.688	0.091480	.
phonemet	-0.20924	0.09819	3576.00089	-2.131	0.033167	*
phonemev	-0.16304	0.09819	3576.00089	-1.660	0.096917	.
phonemez	-0.23641	0.09819	3576.00089	-2.408	0.016108	*

Model fit:

Df	AIC	BIC	logLik
13	12871	12952	-6422.5

Femininity:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=femininityness)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	1.106377	1.05184	
stem	(Intercept)	0.276478	0.52581	
	placeb	0.033924	0.18418	-0.08
	placed	0.006291	0.07931	0.96 -0.35
	placev	0.009032	0.09504	-0.87 0.55 -0.97
	voice	0.004790	0.06921	-0.70 0.76 -0.87 0.96
	mannerp	0.027428	0.16561	-0.35 -0.91 -0.08 -0.15 -0.43
Residual		1.599476	1.26470	

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.51060	0.28940	4.10667	12.131	0.000228 ***
placeb	0.09375	0.11326	3.18966	0.828	0.465200
placed	-0.08016	0.07694	6.51553	-1.042	0.334545
placev	-0.07065	0.08127	5.32926	-0.869	0.422063
voice	-0.05924	0.05418	4.58491	-1.093	0.328357
mannerp	-0.32745	0.10585	3.33219	-3.094	0.046564 *

Model fit:

Df	AIC	BIC	logLik
29	12555	12735	-6248.3

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=femininityness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.1066	1.0520
stem	(Intercept)	0.2159	0.4646
Residual		1.6054	1.2671

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.16304	0.26525	5.00877	11.925	7.23e-05 ***
phonemed	0.04348	0.09341	3576.00005	0.465	0.64163
phonemef	0.20109	0.09341	3576.00005	2.153	0.03140 *
phonemeg	-0.11685	0.09341	3576.00005	-1.251	0.21104
phonemek	-0.04348	0.09341	3576.00005	-0.465	0.64163
phonemep	0.16848	0.09341	3576.00005	1.804	0.07137 .
phonemes	0.43478	0.09341	3576.00005	4.655	3.36e-06 ***
phonemet	-0.06250	0.09341	3576.00005	-0.669	0.50347
phonemev	0.27446	0.09341	3576.00005	2.938	0.00332 **
phonemez	0.20109	0.09341	3576.00005	2.153	0.03140 *

Model fit:

Df	AIC	BIC	logLik
13	12526	12607	-6250.0

Masculinity:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=masculinityness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.00292	1.0015
stem	(Intercept)	0.02653	0.1629
Residual		1.60788	1.2680

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.15734	0.14197	22.48197	22.240	< 2e-16	***
placeb	-0.02038	0.06610	3580.00028	-0.308	0.75785	
placed	-0.15217	0.06610	3580.00028	-2.302	0.02138	*
placev	0.22826	0.06610	3580.00028	3.453	0.00056	***
voice	0.26957	0.04181	3580.00028	6.448	1.28e-10	***
mannerp	-0.02446	0.06610	3580.00027	-0.370	0.71141	

Model fit:

Df	AIC	BIC	logLik
9	12511	12567	-6246.7

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=masculinityness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.00316	1.0016
stem	(Intercept)	0.02655	0.1629
Residual		1.59776	1.2640

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.481e+00	1.479e-01	2.646e+01	23.531	< 2e-16	***
phonemed	-1.875e-01	9.319e-02	3.576e+03	-2.012	0.0443	*
phonemef	-5.788e-01	9.319e-02	3.576e+03	-6.211	5.86e-10	***
phonemeg	-2.556e-14	9.319e-02	3.576e+03	0.000	1.0000	
phonemek	2.989e-02	9.319e-02	3.576e+03	0.321	0.7484	
phonemep	-4.674e-01	9.319e-02	3.576e+03	-5.016	5.54e-07	***
phonemes	-3.804e-01	9.319e-02	3.576e+03	-4.083	4.55e-05	***
phonemet	-2.391e-01	9.319e-02	3.576e+03	-2.566	0.0103	*
phonemev	-1.033e-01	9.319e-02	3.576e+03	-1.108	0.2679	
phonemez	2.717e-03	9.319e-02	3.576e+03	0.029	0.9767	

Model fit:

Df	AIC	BIC	logLik
13	12493	12574	-6233.4

Supplementary Materials 2

Small:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=smallness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7252	0.8516
stem	(Intercept)	0.2144	0.4630
Residual		1.7222	1.3123

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.59491	0.26192	4.80806	13.725	4.86e-05 ***
placeb	-0.00912	0.07116	3120.47398	-0.128	0.898028
placed	-0.17517	0.08734	3120.01661	-2.006	0.044985 *
placev	-0.24961	0.07116	3120.47398	-3.508	0.000459 ***
voice	-0.29872	0.04936	3120.24955	-6.052	1.60e-09 ***
mannerp	-0.12801	0.08843	3120.17484	-1.448	0.147857

Model fit:

Df	AIC	BIC	logLik
9	11170	11224	-5575.8

Phoneme model:

Syntax in R: `lmer(response ~ (1+phoneme|subject) + (1|stem) + phoneme, data=smallness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.5125	0.7159	
	phonemed	0.0326	0.1806	1.00
	phonemef	0.3579	0.5983	0.15 0.15
	phonemeg	0.1371	0.3703	-0.28 -0.28 0.39
	phonemek	0.1657	0.4070	0.42 0.42 0.86 0.53
	phonemep	0.1889	0.4347	0.39 0.39 0.50 0.43 0.80
	phonemet	0.0773	0.2780	0.42 0.42 0.67 -0.41 0.44 0.18
	phonemev	0.1985	0.4455	0.10 0.10 0.99 0.39 0.86 0.57 0.66
	phonemez	0.2262	0.4757	0.37 0.37 0.90 0.49 0.87 0.52 0.52 0.84
stem	(Intercept)	0.2114	0.4598	
Residual		1.6380	1.2798	

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.00815	0.25074	4.16084	11.997	0.000220 ***
phonemed	0.20109	0.09621	806.23304	2.090	0.036925 *
phonemef	0.28533	0.11311	161.29518	2.523	0.012616 *
phonemeg	-0.10598	0.10194	220.11389	-1.040	0.299679
phonemek	0.22554	0.10345	221.62730	2.180	0.030301 *
phonemep	0.60054	0.10467	116.26729	5.737	7.77e-08 ***
phonemet	0.40240	0.10682	446.70029	3.767	0.000187 ***
phonemev	0.23913	0.10516	210.40790	2.274	0.023982 *
phonemez	0.28804	0.10659	175.22086	2.702	0.007562 **

Model fit:

Df	AIC	BIC	logLik
56	11204	11545	-5546.2

Large:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=largeness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr				
subject	(Intercept)	0.79181	0.8898					
stem	(Intercept)	0.98755	0.9938					
	placeb	0.02663	0.1632	-0.75				
	placed	0.29132	0.5397	-0.91	0.84			
	placev	0.05442	0.2333	-0.88	0.59	0.93		
	voice	0.05524	0.2350	-0.68	0.96	0.88	0.66	
	mannerp	0.12666	0.3559	-0.77	0.97	0.93	0.74	0.99
Residual		1.62110	1.2732					

Number of obs: 3496, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.55043	0.50810	3.22603	6.988	0.00473	**
placeb	-0.01857	0.10881	3.35279	-0.171	0.87428	
placed	-0.23641	0.27791	3.03071	-0.851	0.45688	
placev	0.09153	0.13558	3.10800	0.675	0.54645	
voice	0.29315	0.12527	3.02584	2.340	0.10046	
mannerp	-0.23284	0.19090	3.13040	-1.220	0.30645	

Model fit:

Df	AIC	BIC	logLik
29	11972	12150	-5956.9

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=largeness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7906	0.8892
stem	(Intercept)	0.4045	0.6360
Residual		1.6687	1.2918

Number of obs: 3496, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.68478	0.33802	3.78951	10.901	0.000534	***
phonemed	-0.15217	0.09523	3391.99812	-1.598	0.110150	
phonemef	-0.32880	0.09523	3391.99812	-3.453	0.000562	***
phonemeg	0.07065	0.09523	3391.99812	0.742	0.458199	
phonemek	-0.32880	0.09523	3391.99812	-3.453	0.000562	***
phonemep	-0.51167	0.10368	3392.51457	-4.935	8.4e-07	***
phonemes	-0.10870	0.09523	3391.99812	-1.141	0.253790	
phonemet	-0.23066	0.10368	3392.51457	-2.225	0.026166	*
phonemev	-0.11957	0.09523	3391.99812	-1.256	0.209375	
phonemez	0.13315	0.09523	3391.99812	1.398	0.162145	

Model fit:

Df	AIC	BIC	logLik
13	12017	12097	-5995.3

Soft:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=softness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.87587	0.9359	
stem	(Intercept)	0.30132	0.5489	
	placeb	0.01695	0.1302	-0.60
	placed	0.06758	0.2600	0.44 -0.79
	placev	0.01145	0.1070	-0.06 0.68 -0.18
	voice	0.03555	0.1885	-0.47 -0.34 0.56 -0.35
	mannerp	0.01053	0.1026	0.97 -0.46 0.43 0.16 -0.50
Residual		1.55943	1.2488	

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.03238	0.30239	3.82447	10.028	0.000695 ***
placeb	0.10036	0.09390	4.23026	1.069	0.342313
placed	0.43417	0.15722	3.45554	2.762	0.059779 .
placev	-0.18207	0.08426	3.50736	-2.161	0.106400
voice	-0.11391	0.10603	2.91362	-1.074	0.363512
mannerp	0.13734	0.09786	6.39090	1.403	0.207176

Model fit:

Df	AIC	BIC	logLik
29	10624	10799	-5282.9

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=softness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.8753	0.9356
stem	(Intercept)	0.3646	0.6038
Residual		1.5678	1.2521

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.21956	0.32637	4.05246	9.865	0.000555 ***
phonemed	-0.12445	0.10060	3025.60457	-1.237	0.216156
phonemef	0.38370	0.10060	3025.60457	3.814	0.000139 ***
phonemeg	-0.28749	0.10060	3025.60457	-2.858	0.004295 **
phonemek	-0.29021	0.10060	3025.60457	-2.885	0.003944 **
phonemep	0.01142	0.10060	3025.60457	0.114	0.909607
phonemet	-0.08912	0.10060	3025.60457	-0.886	0.375735
phonemev	-0.16208	0.10887	3026.33450	-1.489	0.136650
phonemez	-0.30108	0.10060	3025.60457	-2.993	0.002786 **

Model fit:

Df	AIC	BIC	logLik
12	10592	10664	-5283.9

Hard:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=hardness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0600	1.0296
stem	(Intercept)	0.1634	0.4043
Residual		1.5915	1.2615

Number of obs: 3404, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.27572	0.23456	5.30602	13.965	2.19e-05	***
placeb	-0.03700	0.06840	3304.62319	-0.541	0.588602	
placed	-0.08102	0.06836	3304.48188	-1.185	0.236009	
placev	0.26114	0.06840	3304.62319	3.818	0.000137	***
voice	0.22844	0.04374	3304.85577	5.222	1.88e-07	***
mannerp	0.09511	0.06576	3304.00401	1.446	0.148199	

Model fit:

Df	AIC	BIC	logLik
9	11567	11622	-5774.6

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=hardness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0603	1.0297
stem	(Intercept)	0.1645	0.4056
Residual		1.5824	1.2579

Number of obs: 3404, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.494e+00	2.420e-01	5.937e+00	14.438	7.55e-06	***
phonemed	6.343e-03	1.011e-01	3.301e+03	0.063	0.949953	
phonemef	-3.768e-01	1.011e-01	3.301e+03	-3.729	0.000196	***
phonemeg	2.536e-01	1.071e-01	3.300e+03	2.369	0.017917	*
phonemek	2.183e-01	1.011e-01	3.301e+03	2.160	0.030832	*
phonemep	-1.132e-01	1.011e-01	3.301e+03	-1.120	0.262637	
phonemes	-3.659e-01	1.011e-01	3.301e+03	-3.621	0.000298	***
phonemet	-2.355e-02	1.011e-01	3.301e+03	-0.233	0.815764	
phonemev	3.815e-02	1.093e-01	3.302e+03	0.349	0.726990	
phonemez	1.585e-01	1.011e-01	3.301e+03	1.569	0.116839	

Model fit:

Df	AIC	BIC	logLik
13	11552	11632	-5763.1

Fast:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=fastness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9457	0.9725
stem	(Intercept)	0.2535	0.5035
Residual		1.7891	1.3376

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.89048	0.27735	4.33223	14.027	8.95e-05	***
placeb	0.05707	0.06973	3027.99927	0.818	0.41318	
placed	0.17344	0.10213	3029.66694	1.698	0.08958	.
placev	0.27446	0.06973	3027.99927	3.936	8.46e-05	***
voice	0.13170	0.05031	3028.22333	2.618	0.00889	**
mannerp	-0.57317	0.07254	3028.42267	-7.902	3.81e-15	***

Model fit:

Df	AIC	BIC	logLik
9	10995	11050	-5488.6

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=fastness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9465	0.9729
stem	(Intercept)	0.2768	0.5261
Residual		1.7613	1.3271

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.43207	0.29030	4.36975	11.822	0.000176	***
phonemed	-0.11685	0.09784	3024.99808	-1.194	0.232456	
phonemeg	0.22011	0.09784	3024.99808	2.250	0.024538	*
phonemek	0.23098	0.09784	3024.99808	2.361	0.018298	*
phonemep	0.01630	0.09784	3024.99808	0.167	0.867660	
phonemes	0.17935	0.09784	3024.99808	1.833	0.066885	.
phonemet	0.01902	0.09784	3024.99808	0.194	0.845860	
phonemev	0.75915	0.10662	3025.86447	7.120	1.34e-12	***
phonemez	0.97413	0.10662	3025.86447	9.136	< 2e-16	***

Model fit:

Df	AIC	BIC	logLik
12	10951	11024	-5463.5

Slow:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=slowness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9691	0.9844
stem	(Intercept)	0.2463	0.4963
Residual		1.7471	1.3218

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.211e+00	2.817e-01	4.885e+00	11.401	0.000105 ***
placeb	1.155e-01	6.890e-02	3.120e+03	1.676	0.093815 .
placed	9.225e-02	8.907e-02	3.120e+03	1.036	0.300437
placev	2.310e-02	6.890e-02	3.120e+03	0.335	0.737479
voice	1.097e-01	4.971e-02	3.120e+03	2.207	0.027413 *
mannerp	1.595e-01	8.797e-02	3.120e+03	1.813	0.069976 .

Model fit:

Df	AIC	BIC	logLik
9	11240	11295	-5611.0

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=slowness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9699	0.9849
stem	(Intercept)	0.2450	0.4949
Residual		1.7479	1.3221

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.55707	0.27665	4.60145	12.858	8.81e-05 ***
phonemed	-0.05435	0.09747	3117.03454	-0.558	0.5771
phonemef	-0.22789	0.10620	3117.99254	-2.146	0.0320 *
phonemeg	-0.01902	0.09747	3117.03454	-0.195	0.8453
phonemek	-0.19837	0.09747	3117.03454	-2.035	0.0419 *
phonemep	-0.03261	0.09747	3117.03454	-0.335	0.7380
phonemet	-0.20924	0.09747	3117.03454	-2.147	0.0319 *
phonemev	-0.16304	0.09747	3117.03454	-1.673	0.0945 .
phonemez	-0.23641	0.09747	3117.03454	-2.426	0.0153 *

Model fit:

Df	AIC	BIC	logLik
12	11244	11318	-5610.3

Femininity:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1+place+voice+manner|stem) + place + voice + manner, data=femininityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	1.107122	1.05220	
stem	(Intercept)	0.287798	0.53647	
	placeb	0.031031	0.17616	-0.10
	placed	0.022714	0.15071	1.00 -0.12
	placev	0.015078	0.12279	-0.90 0.52 -0.91
	voice	0.007007	0.08371	-0.83 0.63 -0.84 0.99
	mannerp	0.025319	0.15912	-0.34 -0.90 -0.33 -0.09 -0.24
Residual		1.579850	1.25692	

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.534085	0.294432	4.047804	12.003	0.000258 ***
placeb	0.093750	0.109777	3.128206	0.854	0.453519
placed	0.009628	0.112597	4.322681	0.086	0.935672
placev	-0.043009	0.091854	4.359725	-0.468	0.662076
voice	-0.106213	0.063181	4.356652	-1.681	0.162163
mannerp	-0.327446	0.103067	3.404070	-3.177	0.042139 *

Model fit:

Df	AIC	BIC	logLik
29	10982	11158	-5462.0

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=femininityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.1068	1.0521
stem	(Intercept)	0.2037	0.4513
Residual		1.5881	1.2602

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.163e+00	2.593e-01	5.128e+00	12.196	5.54e-05 ***
phonemed	4.348e-02	9.290e-02	3.117e+03	0.468	0.63982
phonemeg	-1.168e-01	9.290e-02	3.117e+03	-1.258	0.20858
phonemek	2.186e-03	1.012e-01	3.118e+03	0.022	0.98277
phonemep	1.685e-01	9.290e-02	3.117e+03	1.813	0.06985 .
phonemes	4.348e-01	9.290e-02	3.117e+03	4.680	2.99e-06 ***
phonemet	-6.250e-02	9.290e-02	3.117e+03	-0.673	0.50116
phonemev	2.745e-01	9.290e-02	3.117e+03	2.954	0.00316 **
phonemez	2.011e-01	9.290e-02	3.117e+03	2.164	0.03050 *

Model fit:

Df	AIC	BIC	logLik
12	10955	11028	-5465.7

Masculinity:

Phoneme feature model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner, data=masculinityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.00292	1.0015
stem	(Intercept)	0.02653	0.1629
Residual		1.60788	1.2680

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.15734	0.14197	22.48197	22.240	< 2e-16	***
placeb	-0.02038	0.06610	3580.00028	-0.308	0.75785	
placed	-0.15217	0.06610	3580.00028	-2.302	0.02138	*
placev	0.22826	0.06610	3580.00028	3.453	0.00056	***
voice	0.26957	0.04181	3580.00028	6.448	1.28e-10	***
mannerp	-0.02446	0.06610	3580.00027	-0.370	0.71141	

Model fit:

Df	AIC	BIC	logLik
9	12511	12567	-6246.7

Phoneme model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + phoneme, data=masculinityness)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.00316	1.0016
stem	(Intercept)	0.02655	0.1629
Residual		1.59776	1.2640

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.481e+00	1.479e-01	2.646e+01	23.531	< 2e-16	***
phonemed	-1.875e-01	9.319e-02	3.576e+03	-2.012	0.0443	*
phonemef	-5.788e-01	9.319e-02	3.576e+03	-6.211	5.86e-10	***
phonemeg	-2.556e-14	9.319e-02	3.576e+03	0.000	1.0000	
phonemek	2.989e-02	9.319e-02	3.576e+03	0.321	0.7484	
phonemep	-4.674e-01	9.319e-02	3.576e+03	-5.016	5.54e-07	***
phonemes	-3.804e-01	9.319e-02	3.576e+03	-4.083	4.55e-05	***
phonemet	-2.391e-01	9.319e-02	3.576e+03	-2.566	0.0103	*
phonemev	-1.033e-01	9.319e-02	3.576e+03	-1.108	0.2679	
phonemez	2.717e-03	9.319e-02	3.576e+03	0.029	0.9767	

Model fit:

Df	AIC	BIC	logLik
13	12493	12574	-6233.4

Supplementary Materials 3

Small:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=smallness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7252	0.8516
stem	(Intercept)	0.2136	0.4622
Residual		1.7226	1.3125

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.67098	0.29961	8.29323	12.253	1.34e-06 ***
placeb	-0.03271	0.08439	3119.09230	-0.388	0.698292
placed	-0.18750	0.09051	3118.99630	-2.072	0.038380 *
placev	-0.24749	0.07129	3119.51442	-3.472	0.000524 ***
voice	-0.32337	0.06842	3118.99631	-4.726	2.39e-06 ***
mannerp	-0.16816	0.11736	3119.42986	-1.433	0.152011
angular_letter	-0.05142	0.09881	3119.27212	-0.520	0.602821

Model fit:

Df	AIC	BIC	logLik
9	11170	11224	-5575.8

Improvement of fit over model with just phoneme features: $\chi^2(1) = .275$, $p = .6003$

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=smallness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7245	0.8512
stem	(Intercept)	0.2052	0.4530
Residual		1.7465	1.3216

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.1821	0.2457	4.0568	12.952	0.000188 ***
angular_letter	0.1076	0.0468	3124.1498	2.298	0.021624 *

Model fit:

Df	AIC	BIC	logLik
5	11209	11240	-5599.7

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 65.346$, $p < .0001$.

Large:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=largeness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7905	0.8891
stem	(Intercept)	0.4184	0.6468
Residual		1.6726	1.2933

Number of obs: 3496, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.549e+00	3.422e-01	3.724e+00	10.371	0.00070 ***
placeb	-2.670e-02	7.663e-02	3.395e+03	-0.348	0.72755
placed	-2.397e-01	7.341e-02	3.395e+03	-3.265	0.00110 **
placev	7.883e-02	7.018e-02	3.395e+03	1.123	0.26141
voice	2.889e-01	4.523e-02	3.395e+03	6.387	1.92e-10 ***
mannerp	-2.201e-01	7.018e-02	3.395e+03	-3.137	0.00172 **
angular_letter	6.603e-03	5.813e-02	3.395e+03	0.114	0.90956

Model fit:

Df	AIC	BIC	logLik
10	12022	12083	-6000.8

Improvement of fit over model with just phoneme features: $\chi^2(1) = .0134$, $p = .9078$

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=largeness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.7899	0.8887
stem	(Intercept)	0.4224	0.6499
Residual		1.6984	1.3032

Number of obs: 3496, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.56555	0.33935	3.53290	10.507	0.000865 ***
angular_letter	-0.05312	0.04421	3400.18915	-1.202	0.229618

Model fit:

Df	AIC	BIC	logLik
5	12069	12100	-6029.57

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 68.276$, $p < .0001$.

Soft:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1 + place + voice + manner |stem) + place + voice + manner + angular_letter, data=softness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	0.87582	0.9359	
stem	(Intercept)	0.30444	0.5518	
	placeb	0.01678	0.1295	-0.71
	placed	0.06664	0.2581	0.50 -0.56
	placev	0.01305	0.1142	-0.10 0.70 0.03
	voice	0.03464	0.1861	-0.46 -0.08 0.49 -0.19
	mannerp	0.01111	0.1054	0.95 -0.49 0.55 0.23 -0.46

Residual 1.55720 1.2479

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.39634	0.33937	5.83081	10.008	6.88e-05 ***
placeb	-0.03104	0.10752	7.08038	-0.289	0.7811
placed	0.34802	0.15997	3.75194	2.176	0.0997 .
placev	-0.18207	0.08657	3.60956	-2.103	0.1108
voice	-0.24708	0.11802	4.68443	-2.094	0.0943 .
mannerp	-0.04464	0.12431	15.42331	-0.359	0.7244
angular_letter	-0.23078	0.09748	2594.53991	-2.368	0.0180 *

Model fit:

Df	AIC	BIC	logLik
30	10620	10802	-5280.2

Improvement of fit over model with just phoneme features: $\chi^2(1) = 5.3086$, $p = .02122$

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=softness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.8740	0.9349
stem	(Intercept)	0.3611	0.6009

Residual 1.6088 1.2684

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.112e+00	3.177e-01	3.710e+00	9.794	0.000877 ***
angular_letter	2.012e-02	4.585e-02	3.032e+03	0.439	0.660813

Model fit:

Df	AIC	BIC	logLik
5	10663	10693	-5326.6

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 85.358$, $p < .0001$.

Hard:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=hardness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0602	1.0297
stem	(Intercept)	0.1644	0.4054
Residual		1.5831	1.2582

Number of obs: 3404, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.13159	0.23742	5.50737	13.190	2.24e-05	***
placeb	0.08666	0.07403	3303.30543	1.171	0.241832	
placed	-0.19882	0.07347	3303.31884	-2.706	0.006840	**
placev	0.24569	0.06832	3303.64819	3.596	0.000327	***
voice	0.27329	0.04486	3303.67193	6.093	1.24e-09	***
mannerp	0.09511	0.06559	3303.00095	1.450	0.147128	
angular_letter	0.24342	0.05657	3303.23584	4.303	1.73e-05	***

Model fit:

Df	AIC	BIC	logLik
10	11551	11612	-5765.3

Improvement of fit over model with just phoneme features: $\chi^2(1) = 18.497$, $p < .0001$.

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=hardness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0592	1.029
stem	(Intercept)	0.1722	0.415
Residual		1.6219	1.274

Number of obs: 3404, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.427e+00	2.357e-01	4.879e+00	14.538	3.33e-05	***
angular_letter	6.801e-02	4.402e-02	3.309e+03	1.545	0.122	

Model fit:

Df	AIC	BIC	logLik
5	11626	11657	-5808.0

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(8) = 89.9$, $p < .0001$.

Fast:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=fastness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9463	0.9728
stem	(Intercept)	0.2712	0.5207
Residual		1.7667	1.3292

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.67769	0.28715	4.35738	12.807	0.000127	***
placeb	0.25130	0.07592	3027.08947	3.310	0.000944	***
placed	-0.12273	0.11197	3028.77800	-1.096	0.273145	
placev	0.27446	0.06929	3026.99818	3.961	7.63e-05	***
voice	0.24882	0.05338	3027.45575	4.662	3.27e-06	***
mannerp	-0.61319	0.07236	3027.46830	-8.474	< 2e-16	***
angular_letter	0.38847	0.06206	3027.52365	6.260	4.41e-10	***

Model fit:

Df	AIC	BIC	logLik
10	10958	11019	-5469.1

Improvement of fit over model with just phoneme features: $\chi^2(1) = 38.944$, $p < .0001$.

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=fastness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9445	0.9719
stem	(Intercept)	0.2506	0.5006
Residual		1.8280	1.3520

Number of obs: 3128, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)	
(Intercept)	3.492e+00	2.719e-01	4.092e+00	12.844	0.000185	***
angular_letter	3.795e-01	4.924e-02	3.032e+03	7.706	1.74e-14	***

Model fit:

Df	AIC	BIC	logLik
5	11056	11087	-5523.2

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 119.41$, $p < .0001$.

Slow:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=slowness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9692	0.9845
stem	(Intercept)	0.2446	0.4946
Residual		1.7469	1.3217

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.39308	0.31904	8.16014	10.635	4.6e-06 ***
placeb	0.05560	0.08498	3119.08300	0.654	0.513
placed	0.06600	0.09170	3119.07106	0.720	0.472
placev	0.02310	0.06890	3118.99788	0.335	0.737
voice	0.04735	0.07179	3119.45930	0.660	0.510
mannerp	0.06841	0.11602	3119.17906	0.590	0.555
angular_letter	-0.11977	0.09950	3119.24285	-1.204	0.229

Model fit:

Df	AIC	BIC	logLik
10	11241	11301	-5610.3

Improvement of fit over model with just phoneme features: $\chi^2(1) = 1.4565$, $p = .2275$

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=slowness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	0.9693	0.9845
stem	(Intercept)	0.2444	0.4943
Residual		1.7446	1.3208

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.53057	0.26984	4.17656	13.084	0.000151 ***
angular_letter	-0.17929	0.04678	3124.13043	-3.833	0.000129 ***

Model fit:

Df	AIC	BIC	logLik
5	11232	11262	-5610.8

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 1.0011$, $p = .9948$.

Femininity:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=femininityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.	Corr
subject	(Intercept)	1.107110	1.05219	
stem	(Intercept)	0.289396	0.53796	
	placeb	0.031794	0.17831	-0.09
	placed	0.023984	0.15487	1.00 -0.14
	placev	0.012861	0.11341	-0.89 0.53 -0.92
	voice	0.007683	0.08765	-0.84 0.62 -0.87 0.99
	mannerp	0.025937	0.16105	-0.34 -0.90 -0.29 -0.11 -0.22
Residual		1.578076	1.25622	

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.60701	0.29713	4.16453	12.140	0.000209 ***
placeb	0.03358	0.11422	3.60335	0.294	0.784898
placed	0.08256	0.11910	5.02395	0.693	0.518951
placev	-0.05214	0.08885	4.67263	-0.587	0.584498
voice	-0.13173	0.06566	4.53577	-2.006	0.106949
mannerp	-0.32745	0.10379	3.39411	-3.155	0.043114 *
angular_letter	-0.12034	0.05688	3007.37470	-2.116	0.034448 *

Model fit:

Df	AIC	BIC	logLik
9	11170	11224	-5575.8

Improvement of fit over model with just phoneme features: $\chi^2(1) = 4.4422$, $p = .03506$

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=femininityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.1060	1.0517
stem	(Intercept)	0.2008	0.4481
Residual		1.6141	1.2705

Number of obs: 3220, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.269e+00	2.512e-01	4.638e+00	13.015	7.93e-05 ***
angular_letter	5.265e-03	4.532e-02	3.124e+03	0.116	0.908

Model fit:

Df	AIC	BIC	logLik
5	10999	11029	-5494.5

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(7) = 57.616$, $p < .0001$.

Masculinity:

Phoneme feature model, with letter shape :

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + place + voice + manner + angular_letter, data=masculinityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.00308	1.0015
stem	(Intercept)	0.02653	0.1629
Residual		1.60102	1.2653

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.02213	0.14583	25.03015	20.724	< 2e-16 ***
placeb	0.09229	0.07161	3578.99993	1.289	0.197513
placed	-0.26485	0.07161	3578.99993	-3.699	0.000220 ***
placev	0.22826	0.06596	3578.99993	3.461	0.000545 ***
voice	0.31464	0.04318	3578.99993	7.287	3.89e-13 ***
mannerp	-0.02446	0.06596	3578.99994	-0.371	0.710821
angular_letter	0.22535	0.05575	3578.99993	4.042	5.40e-05 ***

Model fit:

Df	AIC	BIC	logLik
10	12497	12559	-6238.6

Improvement of fit over model with just phoneme features: $\chi^2(1) = 16.331$, $p < .0001$.

Letter-shape model:

Syntax in R: `lmer(response ~ (1|subject) + (1|stem) + angular_letter, data=masculinityness_r)`

Random effects:

Groups	Name	Variance	Std.Dev.
subject	(Intercept)	1.0022	1.0011
stem	(Intercept)	0.0265	0.1628
Residual		1.6383	1.2800

Number of obs: 3680, groups: subject, 92; stem, 4

Fixed effects:

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.274e+00	1.357e-01	1.875e+01	24.131	1.41e-15 ***
angular_letter	2.935e-02	4.220e-02	3.584e+03	0.695	0.487

Model fit:

Df	AIC	BIC	logLik
5	12575	12606	-6282.3

Improvement of fit of phoneme model over model with just letter shape: $\chi^2(8) = 97.893$, $p < .0001$.