Supplemental Materials

Power Analysis

A Monte Carlo power analysis was run in order to determine the sample size and stimuli size needed for this experiment. A logistic mixed effects, fit to the voiced stops data from Goldrick et al. (2014) was used to create simulated data, and a statistical model was re-fitted to the simulated data to test whether the crucial interaction between language and trial type could be detected by a likelihood ratio test. Based on 1,000 simulations with a varying numbers of participants and cognate and non-cognate target items, we found that 18 participants naming 8 cognate items and 16 non-cognate items per language yielded β exceeding 0.8. Results for this analysis can be found in Table S1.

Table S1: Monte Carlo power analysis results

Participants	N-Cognate	N-NonCognate	EstimatedPower
10	0	10	0.416
15	0	10	0.523
10	4	8	0.537
10	0	20	0.542
20	0	10	0.584
15	0	20	0.648
11	6	12	0.663
15	4	8	0.665
25	0	10	0.665
10	8	16	0.675
12	6	12	0.68
30	0	10	0.715
13	6	12	0.716
11	8	16	0.726
12	8	16	0.727
14	6	12	0.729
16	6	12	0.738
20	4	8	0.753
13	8	16	0.754
20	0	20	0.756
17	6	12	0.765
14	8	16	0.77
25	4	8	0.776
25	0	20	0.777
18	6	12	0.787
19	6	12	0.806
15	8	16	0.78
16	8	16	0.799
17	8	16	0.811
18	8	16	0.827
30	4	8	0.837
19	8	16	0.814
20	8	16	0.836
25	8	16	0.865
30	0	20	0.8
30	8	16	0.882

Stimulus norming

All of the target pictures were normed in two different norming tasks. The first norming task asked participants to give a one word label to each picture. Ten native Spanish speakers from Mexico and 11 native English speakers from the U.S. were recruited on Prolific (prolific.ac). One of the English participants had to be excluded because they mislabeled all pictures. Participants gave most of the pictures either the target label or a semantically related label. The only picture that was consistently mislabeled by Spanish participants was the picture for *texto* (text in English). This lead us to change that target word to telephone (*teléfono* in Spanish). The second norming task asked participants to rate the label given to each picture from not acceptable at all (1) or very acceptable (10). Ten native Spanish speakers from Mexico and 10 native English speakers from the U.S. were recruited on Prolific (prolific.ac). All of the pictures received scores of 7.8 or higher in both languages, suggesting that the target labels are appropriate for the pictures.

Filler items

Regular fillers

Non-cognate: English	Non-cognate: Spanish	Cognate: English	Cognate: Spanish
yarn	estambre	lion	leon
apple	manzana	mango	mango
raccoon	mapache	elephant	elefante
leaf	hoja	giraffee	jirafa
moon	luna		
watermelon	sandía		
shoe	zapato		
strawberry	fresa		

Note: English translation for Non-cognate: Spanish words and Cognate: Spanish words are in corresponding Non-cognate: English and Cognate: English rows respectively.

Other language fillers

Other language: English	Other language: Spanish
beak	castor (*beaver*)
floor	playa (*beach*)
mustache	pavo real (*peacock*)
library	tetera (*teapot*)
shark	babero (*bib*)
scissors	cerdo (*pig*)
drawing	platos (*dishes*)
pendant	boleto (*ticket*)
dog	tocino (*bacon*)
fish	repostería (*pastry*)
frosting	margarita (dasiy)
eggplant	mesa (table)
keyboard	cama (*bed*)
roof	chile (*pepper*)
finger	escritorio (*desk*)
breakfast	examen (test)

Note: English translation for Other language: Spanish words are in parentheses.

Results of follow up RT and phonetic measure models

Table S2: *Results for linear mixed effects model for voiceless VOT*

Fixed effects	β	*SE* β	t	p
single versus mix context	0.03	0.027	1.21	0.24
stay versus switch context	-0.02	0.01	-1.56	0.12
English versus Spanish	-0.79	0.09	-8.82	< 0.001***
RT (log-transformed and centered)	-0.07	0.02	-3.46	< 0.001***
single versus mix context X English versus Spanish	0.11	0.03	3.37	< 0.001***
stay versus switch context X English versus Spanish	-0.07	0.03	-2.77	< 0.01**
single versus mix context X RT	0.15	0.05	2.72	< 0.01**
stay versus switch context X RT	-0.04	0.04	-1.02	0.31
English versus Spanish X RT	0.19	0.04	4.97	< 0.001***
single versus mix context X English versus Spanish X RT	-0.03	0.1	-0.33	0.74
stay versus switch context X English versus Spanish X RT	0.03	0.07	0.45	0.65

Table S3: *Results for logistic mixed effects model for voiced VOT*

Fixed effects	β	*SE* β	χ^2 (1)	p
single versus mix context	0.05	0.19	0.06	0.81
stay versus switch context	0.19	0.1	3.73	0.053
English versus Spanish	2.11	0.35	25.77	< 0.001***
RT (log-transformed and centered)	0.09	0.15	0.35	0.55
single versus mix context X English versus Spanish	-0.8	0.29	7.13	< 0.05*
stay versus switch context X English versus Spanish	-0.26	0.21	1.57	0.21
single versus mix context X RT	0.04	0.43	0.01	0.92
stay versus switch context X RT	-0.2	0.28	0.52	0.47
English versus Spanish X RT	-0.62	0.29	4.38	< 0.05*
single versus mix context X English versus Spanish X RT	-0.65	0.83	0.61	0.43
stay versus switch context X English versus Spanish X RT	1.44	0.56	6.52	< 0.01**

Table S4: *Results for F1 (height) linear mixed effects model for high vowels*

Fixed effects	β	*SE* β	t	p
single vs mixed context	-3.69	2.29	-1.61	0.11
stay vs switch context	-2.2	2	-1.1	0.27
Spanish /i/ vs English /i/	-27.95	12.76	-2.19	< 0.05*
Spanish /i/ vs English /ɪ/	47.68	2.63	18.11	< 0.001***
RT (log-transformed and centered)	-8.27	2.53	-3.26	< 0.01**
single vs mixed context X Spanish /i/ vs English /i/	3.72	4.28	0.87	0.39
single vs mixed context X Spanish /i/ vs English /ɪ/	2.08	3.78	0.55	0.58
stay vs switch context X Spanish /i/ vs English /i/	5.69	3.8	1.5	0.13
stay vs switch context X Spanish /i/ vs English /ɪ/	5.95	3.29	1.81	0.07
single vs mixed context X RT	19.77	7.06	2.8	< 0.01**
stay vs switch context X RT	1.43	5.65	0.25	0.8
Spanish /i/ vs English /i/ X RT	11.858	4.56	2.6	< 0.01**
Spanish /i/ vs English /ɪ/ X RT	1.936	4.05	0.48	0.63
single vs mixed context X Spanish /i/ vs English /e/ X RT	-20.25	13.81	-1.47	0.14
single vs mixed context X Spanish /i/ vs English /ɪ/ X RT	-17.97	11.45	-1.57	0.12
stay vs switch context X Spanish /i/ vs English /i/ X RT	-2.94	9.78	-0.3	0.76
stay vs switch context X Spanish /i/ vs English /ɪ/ X RT	4.43	9.84	0.45	0.65

Table S5: *Results for F2 (front/back) linear mixed effects model for high vowels*

Fixed effects	β	*SE* β	t	p
single vs mixed context	21.95	8.23	2.67	< 0.01**
stay vs switch context	-3.23	7.19	-0.45	0.65
Spanish /i/ vs English /i/	151.11	55.9015	2.703	< 0.05*
Spanish /i/ vs English /ɪ/	-288.25	48.29	-5.97	< 0.001***
RT (log-transformed and centered)	-2.56	9.14	-0.28	0.78
single vs mixed context X Spanish /i/ vs English /i/	4.39	15.36	0.286	0.77
single vs mixed context X Spanish /i/ vs English /ɪ/	-13.79	13.58	-1.02	0.31
stay vs switch context X Spanish /i/ vs English /i/	-0.77	13.64	-0.06	0.95
stay vs switch context X Spanish /i/ vs English /ɪ/	6.38	11.82	0.54	0.59
single vs mixed context X RT	-7.05	25.33	-0.29	0.78
stay vs switch context X RT	24.91	20.26	1.23	0.22
Spanish /i/ vs English /i/ X RT	-85.56	16.36	-5.23	< 0.001***
Spanish /i/ vs English /ɪ/ X RT	43.79	14.67	2.99	< 0.01**
single vs mixed context X Spanish /i/ vs English /e/ X RT	7.76	49.55	0.16	0.88
single vs mixed context X Spanish /i/ vs English /ɪ/ X RT	21.77	41.1	0.53	0.59
stay vs switch context X Spanish /i/ vs English /i/ X RT	24.27	35.08	0.69	0.49
stay vs switch context X Spanish /i/ vs English /ɪ/ X RT	-58.3	35.29	-1.65	0.098

Table S6: *Results for F1 (height) linear mixed effects model for mid vowels*

Fixed effects	β	*SE* β	t	p
single vs mixed context	10.34	3.18	3.25	< 0.01**
stay vs switch context	-2.71	2.65	-1.02	0.31
Spanish /e/ vs English /e/	-78.27	16.9	-4.63	< 0.001***
Spanish /e/ vs English /ɛ/	153.69	15.1	10.18	< 0.001***
RT (log-transformed and centered)	-7.58	3.68	-2.06	< 0.05*
single vs mixed context X Spanish /e/ vs English /e/	-16.37	6.03	-2.71	< 0.01**
single vs mixed context X Spanish /e/ vs English /ɛ/	-20.72	5.33	-3.89	< 0.001***
stay vs switch context X Spanish /e/ vs English /e/	-0.82	4.96	-0.17	0.87
stay vs switch context X Spanish /e/ vs English /ɛ/	-0.26	4.62	-0.06	0.96
single vs mixed context X RT	0.85	9.94	0.09	0.93
stay vs switch context X RT	4.17	7.74	0.54	0.59
Spanish /e/ vs English /e/ X RT	20.85	5.98	3.49	< 0.001***
Spanish /e/ vs English /ɛ/ X RT	1.7	5.9	0.28	0.78
single vs mixed context X Spanish /e/ vs English /e/ X RT	-35.33	18	-1.96	< 0.05*
single vs mixed context X Spanish /e/ vs English /ɛ/ X RT	-65.16	17.45	-3.74	< 0.001***
stay vs switch context X Spanish /e/ vs English /e/ X RT	13.96	12.66	1.12	0.27
stay vs switch context X Spanish /e/ vs English /ɛ/ X RT	1.54	13.27	0.12	0.91

Table S7: *Results for F2 (front/back) linear mixed effects model for mid vowels*

Fixed effects	β	*SE* β	t	p
single vs mixed context	-25.27	8.24	-3.07	< 0.01**
stay vs switch context	13.8	6.86	2.01	< 0.05*
Spanish /e/ vs English /e/	-431.36	43.18	9.99	< 0.001***
Spanish /e/ vs English /ɛ/	-237.9	38.59	-6.17	< 0.001***
RT (log-transformed and centered)	44.06	9.54	4.62	< 0.001***
single vs mixed context X Spanish /e/ vs English /e/	65.47	15.62	4.19	< 0.001***
single vs mixed context X Spanish /e/ vs English /ɛ/	30.8	13.8	2.23	< 0.05*
stay vs switch context X Spanish /e/ vs English /e/	-3.73	12.84	-0.29	0.77
stay vs switch context X Spanish /e/ vs English /ɛ/	-8.96	11.98	-0.75	0.45
single vs mixed context X RT	6.43	25.75	0.25	0.8
stay vs switch context X RT	-8.35	20.05	-0.42	0.68
Spanish /e/ vs English /e/ X RT	-125.31	15.48	-8.09	< 0.001***
Spanish /e/ vs English /ɛ/ X RT	-5.15	15.54	-0.33	0.74
single vs mixed context X Spanish /e/ vs English /e/ X RT	52.48	46.64	1.13	0.26
single vs mixed context X Spanish /e/ vs English /ɛ/ X RT	52.25	45.19	1.16	0.25
stay vs switch context X Spanish /e/ vs English /e/ X RT	-26.05	32.8	-0.79	0.43
stay vs switch context X Spanish /e/ vs English /ɛ/ X RT	-0.94	34.37	-0.03	0.98

Degree of diphthongization and monophthongization of /e/

A linear mixed-effects model was run to examine the F1 of /e/ as a dependent variable on time point (20 versus 80 percent vowel duration). Our fitting procedure yielded two sets of correlated random effects factors: (1) by participants with a random intercept and single versus mix and language as random slopes and (2) by word with a random intercept and single versus mix as a random slope. Within each set, random effects were correlated.

As shown in Figure S1, bilinguals successfully switched between their two languages, with English /e/ produced with a lower, more English-like F1 than Spanish ($\beta = 63.2$, *SE* $\beta = 17.45$, $t = 3.62$, $p < 0.01$). They also produced vowels with F1 significantly differently between the two time points ($\beta = -22.48$, *SE* $\beta = 9.58$, $t = -2.46$, $p < 0.001$). There was a significant

interaction between time point and language (β = 67,7, *SE* β = 2.78, t = -24.78, p < 0.001), indicating that the F1 of /e/ was produced differently depending on whether it was produced in Spanish or English at 20 or 80 percent vowel duration. However, there was no indication of an increase or decrease of diphthongization depending on whether bilinguals were mixing (β = 4.93, *SE* β = 4.03, t = 1.22, p > 0.05) or switching (β = -0.07, *SE* β = 1.76, t = -0.04, p > 0.05) between their languages. Overall, these results indicate that there are no mixing or switching costs with regards to the degree of diphthongization and monophthongization of /e/. There were no other main effects, two way interactions, or three way interactions. More details about the fixed effects of this model can be found in Table S2.

Table S8: Results for F1 linear mixed effects model for /e/ degree of diphthongization

Fixed effects	β	*SE* β	t	p
twenty vs eighty percent duration	-27.59	1.39	-19.86	< 0.001***
single vs mixed context	4.93	4.03	1.22	0.23
stay vs switch context	-0.07	1.76	-0.04	0.97
English /e/ vs Spanish /e/	63.2	17.45	3.62	< 0.01**
twenty vs eighty percent duration X single vs mixed context	-0.26	3.84	-0.07	0.94
twenty vs eighty percent duration X stay vs switch context	-1.05	3.48	-0.3	0.76
twenty vs eighty percent duration X English /e/ vs Spanish /e/	67.7	2.78	24.78	< 0.001***
single vs mixed context X English /e/ vs Spanish /e/	8.16	5.55	1.47	0.16
stay vs switch context X English /e/ vs Spanish /e/	-2.89	3.52	-0.82	0.41
twenty vs eighty percent duration X single vs mixed context X English /e/ vs Spanish /e/	7.17	7.67	0.93	0.35
twenty vs eighty percent duration X stay vs switch context X English /e/ vs Spanish /e/	-7.83	6.96	-1.13	0.26

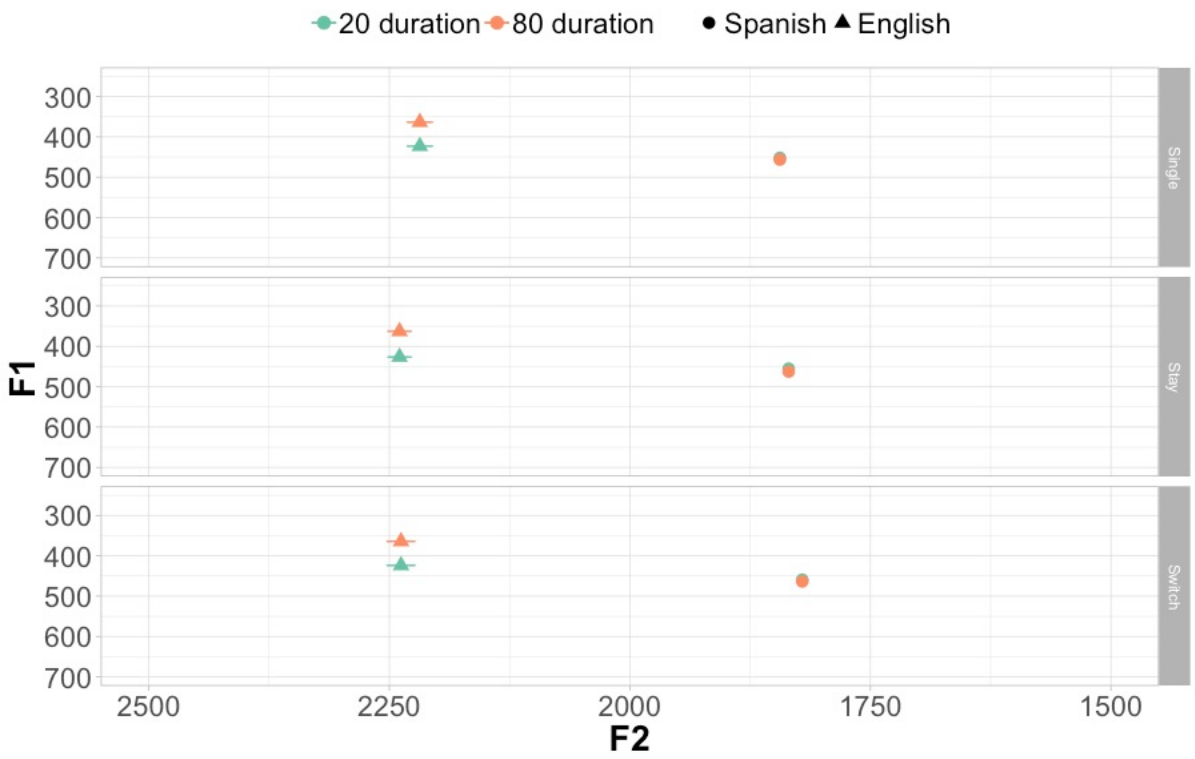

Figure S1: Mean /e/ formant values in English and Spanish at 20 and 80 percent vowel duration by language condition (vertical wings show standard error for F1 and horizontal wings show standard error for F2)