

**Supplementary Materials for "Effects of semantic diversity and word frequency on single word processing" by Curtiss A. Chapman and
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Table S1

Correlations between lexical and semantic measures

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 log SUBTLEX frequency																
2 log SUBTLEX CD	0.98***															
3 AoA (ratings)	-0.63***	-0.64***														
4 AoA (test-based)	-0.48***	-0.50***	0.69***													
5 SemD (Hoffman)	0.37***	0.41***	-0.28***	-0.16***												
6 SemD (Jones)	0.80***	0.81***	-0.56***	-0.47***	0.50***											
7 Concreteness	0.17***	0.14***	-0.38***	-0.27***	-0.33***	0.21***										
8 Near Neighbors	-0.23***	-0.28***	0.22***	0.05	-0.11*	-0.27***	-0.07									
9 Distant Neighbors	0.01	-0.01	-0.04	-0.06	0.12*	0	0.07	-0.07								
10 Sem Neighborhood Density	0.68***	0.68***	-0.39***	-0.32***	0.21***	0.63***	0.11***	-0.11*	0.04							
11 Sem Neighborhood Size	0.66***	0.66***	-0.42***	-0.29***	0.40***	0.55***	0.01	-0.14***	0.03	0.61***						
12 Num Features (McRae)	0.23***	0.22***	-0.30***	-0.09	0.03	0.15***	0.20***	-0.02	0.17***	0.13***	0.13***					
13 Num Features (Buchanan)	0.04*	0.04*	-0.15***	-0.06***	-0.06***	0.04*	0.18***	-0.05	0.02	-0.04*	-0.03*	0.17***				
14 Num Associates (Nelson)	0.11***	0.14***	0.06***	0.05***	0.16***	0.15***	-0.18***	-0.10	0.04	0.19***	0.16***	0.07	-0.03			
15 Num Associates (DeDeyne)	0.10***	0.13***	0.06***	0.04***	0.23***	0.14***	-0.29***	-0.18***	0.05	0.17***	0.17***	0.07	-0.04*	0.68***		
16 Num Senses (WordNet)	0.45***	0.47***	-0.37***	-0.21***	0.30***	0.43***	0.11***	-0.15***	0.06	0.36***	0.44***	0	0.03*	0.11***	0.13***	

***p<.001, *p<.05. Note that the sample of available words ranges widely across variables, with variables based on McRae et al. (2005) norms (8, 9, 12) including only 541 words, measures 13 and 14 including approximately 4000-5000 words, and all other measures including 12,000 to 80,000 words. Overlapping samples for correlations therefore range from roughly 400 to 75,000. 1-2 Brysbaert & New (2009); 3 Kuperman et al. (2012); 4 Brysbaert & Biemiller (2017); 5 Hoffman et al. (2013); 6 Brendan Johns, personal

communication; 7 Brysbaert et al. (2014); 8-9 derived from McRae et al. (2005) per Mirman & Magnuson (2008); 10-11 Shaoul & Westbury (2010); 12 McRae et al. (2005); 13 Buchanan et al. (2019); 14 Nelson et al. (1998); 15 DeDeyne et al. (2019)

Table S2

Standardized coefficients from mixed models with different frequency and SemD measures

<u>Database & Test</u>	<u>Freq meas.</u>	<u>SemD meas.</u>	<u>DV</u>	<u>Obs.</u>	<u>Words</u>	<u>Ss</u>	<u>Freq</u>	<u>Freq sq</u>	<u>SemD</u>	<u>SemD sq</u>	<u>SemD x Freq</u>	<u>Conc.</u>	<u>Length</u>	<u>Ortho N.</u>	<u>Phon N.</u>
ELP WR	SUBTLEX Zipf	Hoffman	Errors	480861	16804	460	-0.580***	0.971***	-0.134***	-0.013	-0.057***	-0.232***	-0.327***	0.081*	0.326***
ELP WR	log BNC freq	Hoffman	Errors	480831	16803	460	-0.402***	0.605***	-0.190***	0.280**	-0.078***	-0.331***	-0.206***	0.034	0.361***
ELP WR	SUBTLEX Zipf	Jones	Errors	635513	22214	460	-0.532***	0.664***	-0.132***	-0.947***	0.015	-0.216***	-0.310***	0.069*	0.304***
ELP WR	Jones	Jones	Errors	480831	16803	460	-0.299***	0.022	-0.448***	-5.410***	0.700***	-0.225***	-0.263***	0.088*	0.262***
ELP WR	SUBTLEX Zipf	Hoffman	log RTs	448308	16803	460	-0.038***	0.059***	-0.012***	0.005	0	-0.014***	0.022***	0.010***	0.023***
ELP WR	log BNC freq	Hoffman	log RTs	448325	16803	460	-0.027***	0.039***	-0.014***	0.037***	-0.004***	-0.019***	0.030***	0.007***	0.025***
ELP WR	SUBTLEX Zipf	Jones	log RTs	617478	22212	460	-0.030***	0.068***	-0.030***	0.033***	-0.002***	-0.012***	0.016***	0.016***	0.026***
ELP WR	Jones	Jones	log RTs	448337	16803	460	-0.011***	0.050*	-0.048***	-0.186***	0.027***	-0.011***	0.028***	0.008***	0.017***
ELP LD	SUBTLEX Zipf	Hoffman	Errors	572497	16804	818	-0.810***	0.566***	-0.129***	0.154*	-0.003	-0.16***	-0.765***	0.421***	-0.010
ELP LD	log BNC freq	Hoffman	Errors	572497	16804	818	-0.642***	0.748***	-0.172***	0.719***	-0.067***	-0.290***	-0.598***	0.341***	0.041
ELP LD	SUBTLEX Zipf	Jones	Errors	756791	22214	818	-0.660***	0.836***	-0.361***	-0.445***	-0.133***	-0.129***	-0.843***	0.419***	0.027
ELP LD	Jones	Jones	Errors	572497	16804	818	-0.568***	0.716*	-0.481***	-4.090***	0.375***	-0.173***	-0.659***	0.415***	-0.121***
ELP LD	SUBTLEX Zipf	Hoffman	log RTs	512833	16804	818	-0.063***	0.071***	-0.012***	0.016***	-0.002***	-0.016***	0.015***	0.024***	0.024***
ELP LD	log BNC freq	Hoffman	log RTs	512825	16804	818	-0.049***	0.064***	-0.014***	0.070***	-0.008***	-0.026***	0.028***	0.018***	0.028***
ELP LD	SUBTLEX Zipf	Jones	log RTs	745870	22214	818	-0.047***	0.076***	-0.038***	-0.033***	-0.003***	-0.014***	0.021***	0.019***	0.020***
ELP LD	Jones	Jones	log RTs	512869	16804	818	-0.030***	0.120***	-0.061***	-0.183***	0.008	-0.015***	0.025***	0.023***	0.014***

***p < .001, **p < .01, *p < .05, ^p < .10, ELP WR = ELP word reading, ELP LD = ELP lexical decision, Freq = frequency, SemD = semantic diversity, Conc = concreteness, Ortho N = orthographic neighborhood, Phon N = phonological neighborhood, Obs = observations, Ss = Subjects. All main effects are from models with no higher order terms.

Table S3

Relative Size of frequency and SemD effects with Hoffman SemD vs. Jones SemD

<u>Model predictors</u>	<u>SemD measure</u>	<u>Freq measure</u>	<u>Data set</u>	<u>log RT models</u>			<u>error models</u>		
				<u>Freq</u>	<u>SemD</u>	<u>Higher</u>	<u>Freq</u>	<u>SemD</u>	<u>Higher</u>
freq & SemD	Jones	SUBTLEX	ELP word reading	-0.040***	-0.049***	SemD	-0.530***	-0.293***	freq
	Jones	Jones	ELP word reading	-0.033***	-0.060***	SemD	-0.208**	-0.649***	SemD
freq & SemD + control variables	Hoffman	SUBTLEX	ELP word reading	-0.068***	-0.001^	freq	-0.687***	-0.052***	freq
	Hoffman	BNC	ELP word reading	-0.046***	-0.004***	freq	-0.506***	-0.064***	freq
	Jones	SUBTLEX	ELP word reading	-0.030***	-0.030***	-	-0.532***	-0.132***	freq
	Jones	Jones	ELP word reading	-0.011***	-0.048***	SemD	-0.299***	-0.448***	SemD
	Hoffman	SUBTLEX	ELP word reading	-0.038***	-0.012***	freq	-0.580***	-0.134***	freq
	Hoffman	BNC	ELP word reading	-0.027***	-0.014***	freq	-0.402***	-0.190***	freq
	Jones	SUBTLEX	ELP LDT	-0.061***	-0.063***	SemD	-0.523***	-0.320***	freq
	Jones	Jones	ELP LDT	-0.047***	-0.083***	SemD	-0.287***	-0.591***	SemD
freq & SemD + control variables	Hoffman	SUBTLEX	ELP LDT	-0.097***	0.001	freq	-0.665***	-0.133***	freq
	Hoffman	BNC	ELP LDT	-0.074***	0.001	freq	-0.627***	-0.091***	freq
	Jones	SUBTLEX	ELP LDT	-0.047***	-0.038***	freq	-0.660***	-0.361***	freq
	Jones	Jones	ELP LDT	-0.030***	-.061***	SemD	-0.568***	-0.481***	freq
	Hoffman	SUBTLEX	ELP LDT	-0.063***	-0.012***	freq	-0.810***	-0.129***	freq
	Hoffman	BNC	ELP LDT	-0.049***	-0.014***	freq	-0.642***	-0.172***	freq

***p < .001, **p < .01, *p < .05

Table S4

Frequency effects in models with and without Hoffman SemD

Test		Measure	Frequency effect		Change	SemD effect
			no SemD model	SemD model		
ELP	Word Reading	Errors	-0.638***	-0.580***	0.058	-0.134***
ELP	Word Reading	log RTs	-0.043***	-0.038***	0.005	-0.012***
ELP	Lexical Decision	Errors	-0.865***	-0.810***	0.055	-0.129***
ELP	Lexical Decision	log RTs	-0.068***	-0.063***	0.005	-0.012***
BLP	Lexical Decision	Errors	-1.112***	-1.011***	0.101	-0.249***
BLP	Lexical Decision	log RTs	-0.069***	-0.063***	0.006	-0.013***
MAPPD	Obj. Naming	Errors	-0.285	-0.240	0.045	-0.093
MAPPD	Obj. Naming	log RTs	-	-	-	-
IPNP	Obj. Naming	Errors	-0.561***	-0.527***	0.034	-0.091
IPNP	Obj. Naming	log RTs	-0.092***	-0.081***	0.011	-0.027***
CSDP	Conc. Decision (abs.)	Errors	-0.112***	-0.003	0.109	-0.337***
CSDP	Conc. Decision (abs.)	log RTs	-0.030***	-0.023***	0.007	-0.021***
CSDP	Conc. Decision (conc.)	Errors	-0.245***	-0.280***	-0.035	0.094***
CSDP	Conc. Decision (conc.)	log RTs	-0.045***	-0.045***	0	0.001

***p < .001, **p < .01, *p < .05, ^p < .10, SemD = semantic diversity

Table S5

Frequency effects in models with and without Jones SemD

<u>Database</u>	<u>Task</u>	<u>Measure</u>	<u>Frequency effect</u>		<u>Change</u>	<u>SemD effect</u>
			<u>no SemD model</u>	<u>SemD model</u>		
ELP	Word Reading	Errors	-0.620***	-0.532***	0.088	-0.132***
ELP	Word Reading	log RTs	-0.049***	-0.030***	0.019	-0.03***
ELP	Lexical Decision	Errors	-0.899***	-0.660***	0.239	-0.361***
ELP	Lexical Decision	log RTs	-0.071***	-0.047***	0.024	-0.038***
BLP	Lexical Decision	Errors	-1.280***	-0.730***	0.55	-0.838***
BLP	Lexical Decision	log RTs	-0.069***	-0.043***	0.026	-0.042***
MAPPD	Obj. Naming	Errors	-0.297	-0.339	-0.042	0.051
MAPPD	Obj. Naming	log RTs	-	-	-	-
IPNP	Obj. Naming	Errors	-0.618***	-0.436*	0.182	-0.248
IPNP	Obj. Naming	log RTs	-0.104***	-0.077***	0.027	-0.038^
CSDP	Conc. Decision (abs.)	Errors	-0.149***	0.178***	0.327	-0.441***
CSDP	Conc. Decision (abs.)	log RTs	-0.033***	-0.001	0.032	-0.043***
CSDP	Conc. Decision (conc.)	Errors	-0.166***	-0.257***	-0.091	0.123***
CSDP	Conc. Decision (conc.)	log RTs	-0.040***	-0.037***	0.003	-0.004

***p < .001, **p < .01, *p < .05, ^p < .10, SemD = semantic diversity

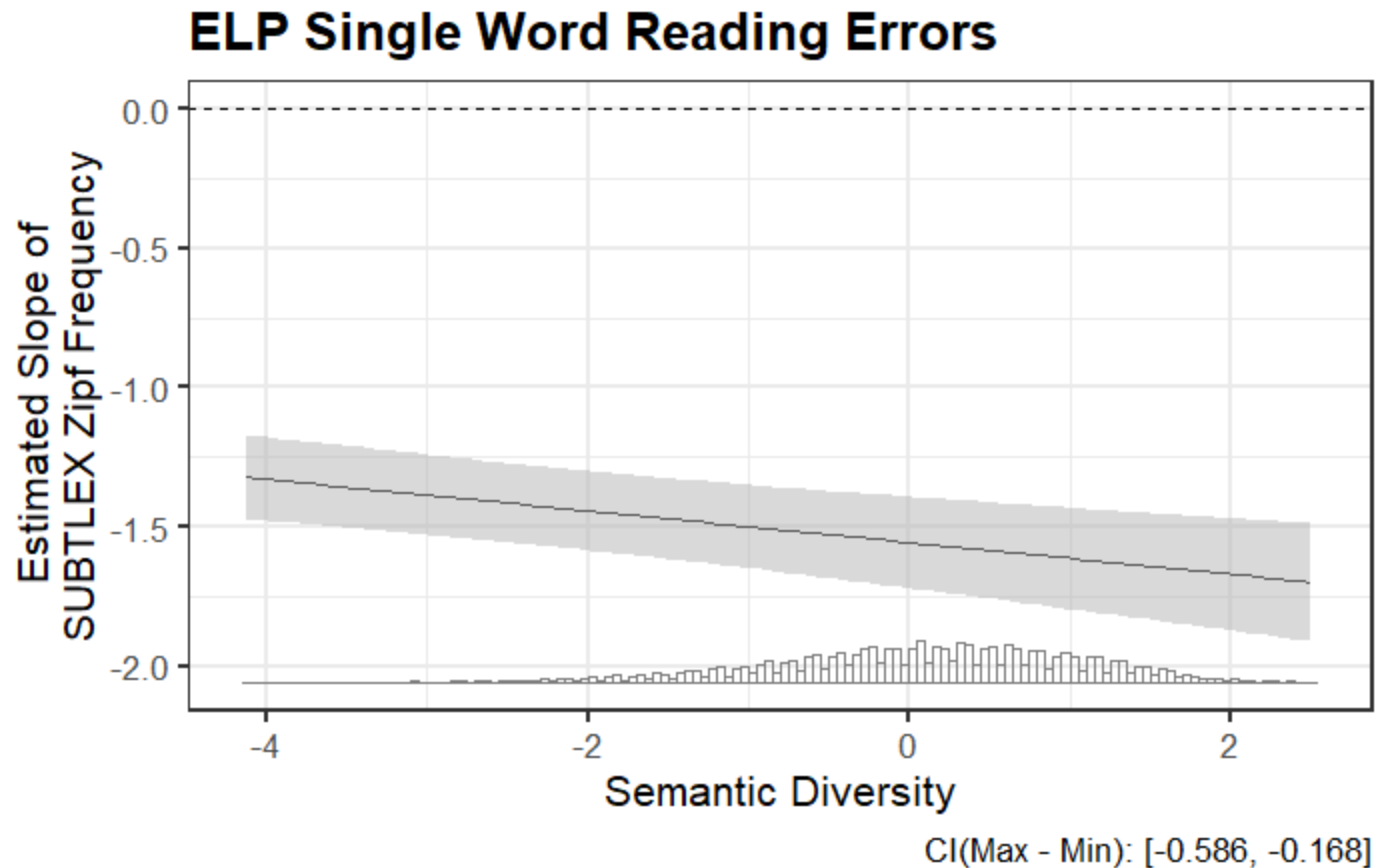


Figure S1. Interaction between frequency and SemD in ELP single word reading errors. Plot shows the model-estimated effect of frequency across the range of semantic diversity values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

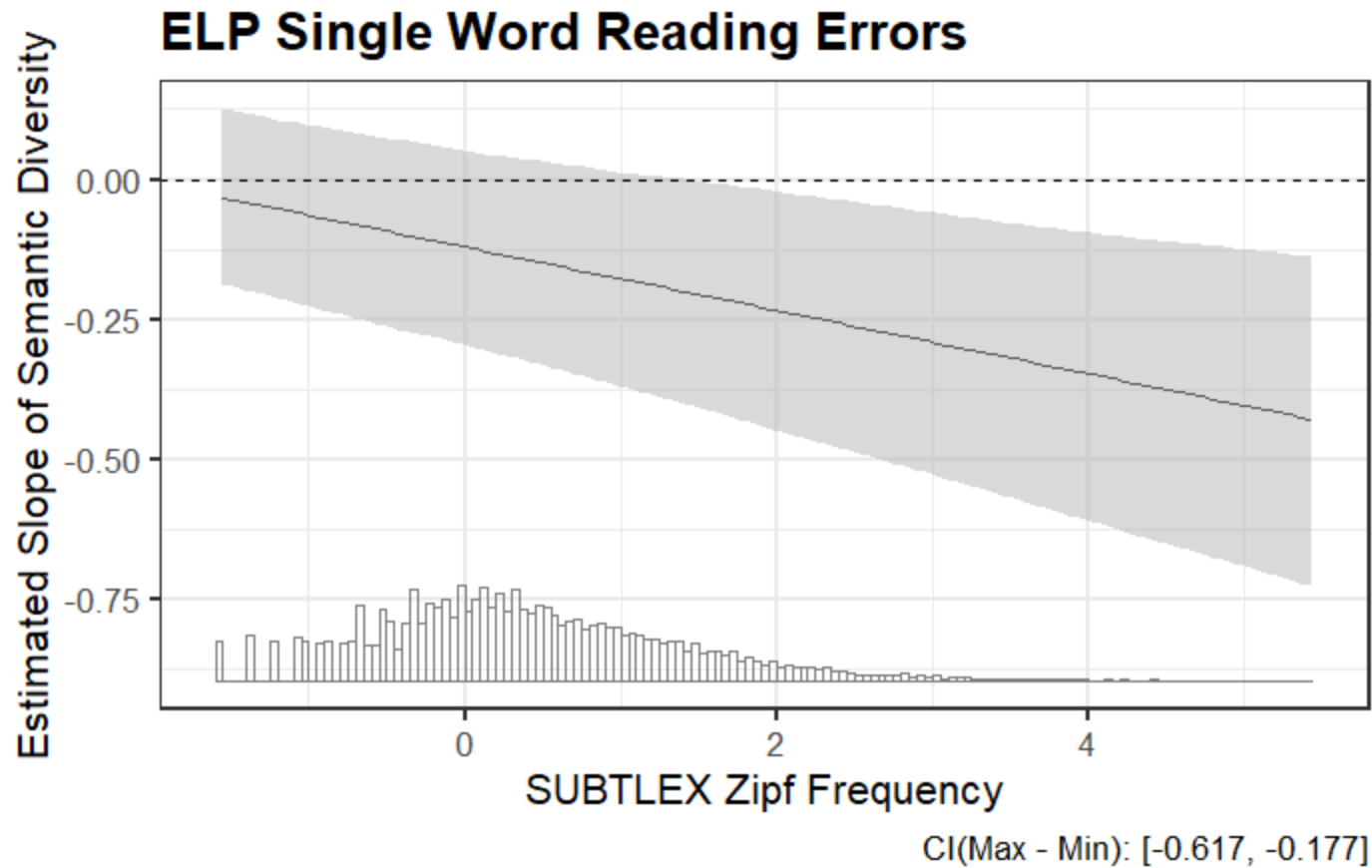


Figure S2. Interaction between frequency and SemD in ELP single word reading errors. Plot shows the model-estimated effect of SemD across the range of frequency values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

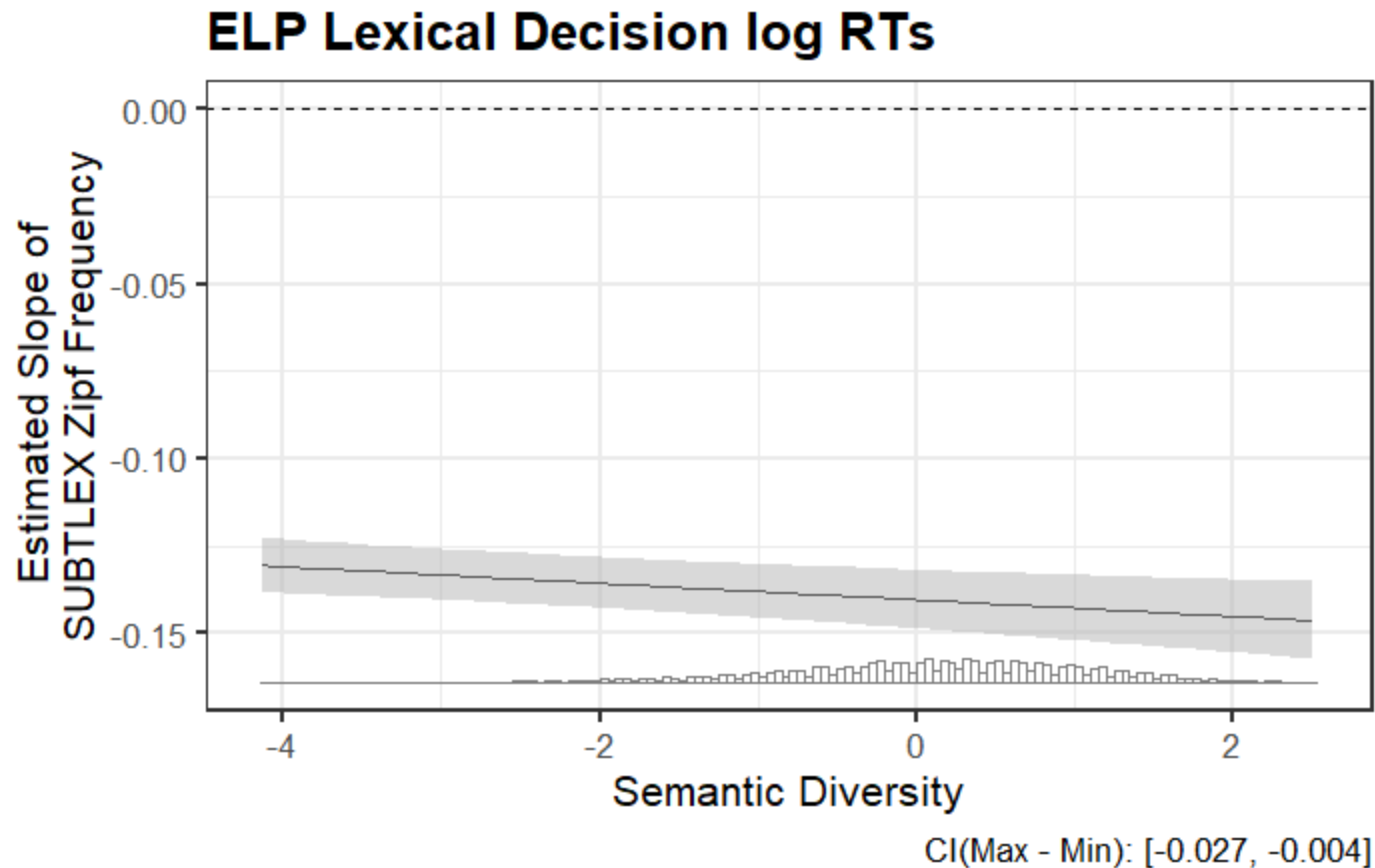


Figure S3. Interaction between frequency and SemD in ELP lexical decision errors. Plot shows the model-estimated effect of frequency across the range of semantic diversity values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

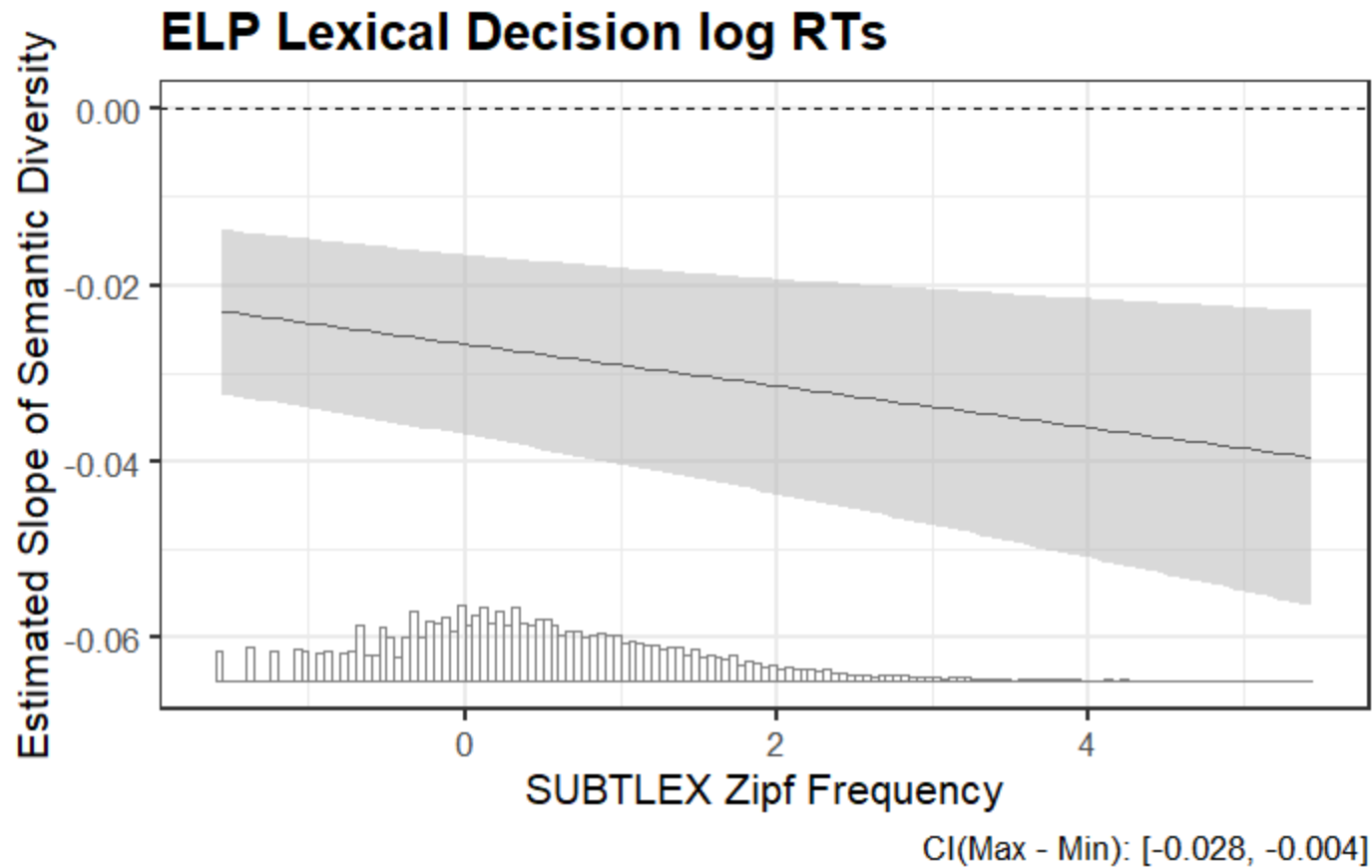


Figure S4. Interaction between frequency and SemD in ELP lexical decision errors. Plot shows the model-estimated effect of SemD across the range of frequency values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

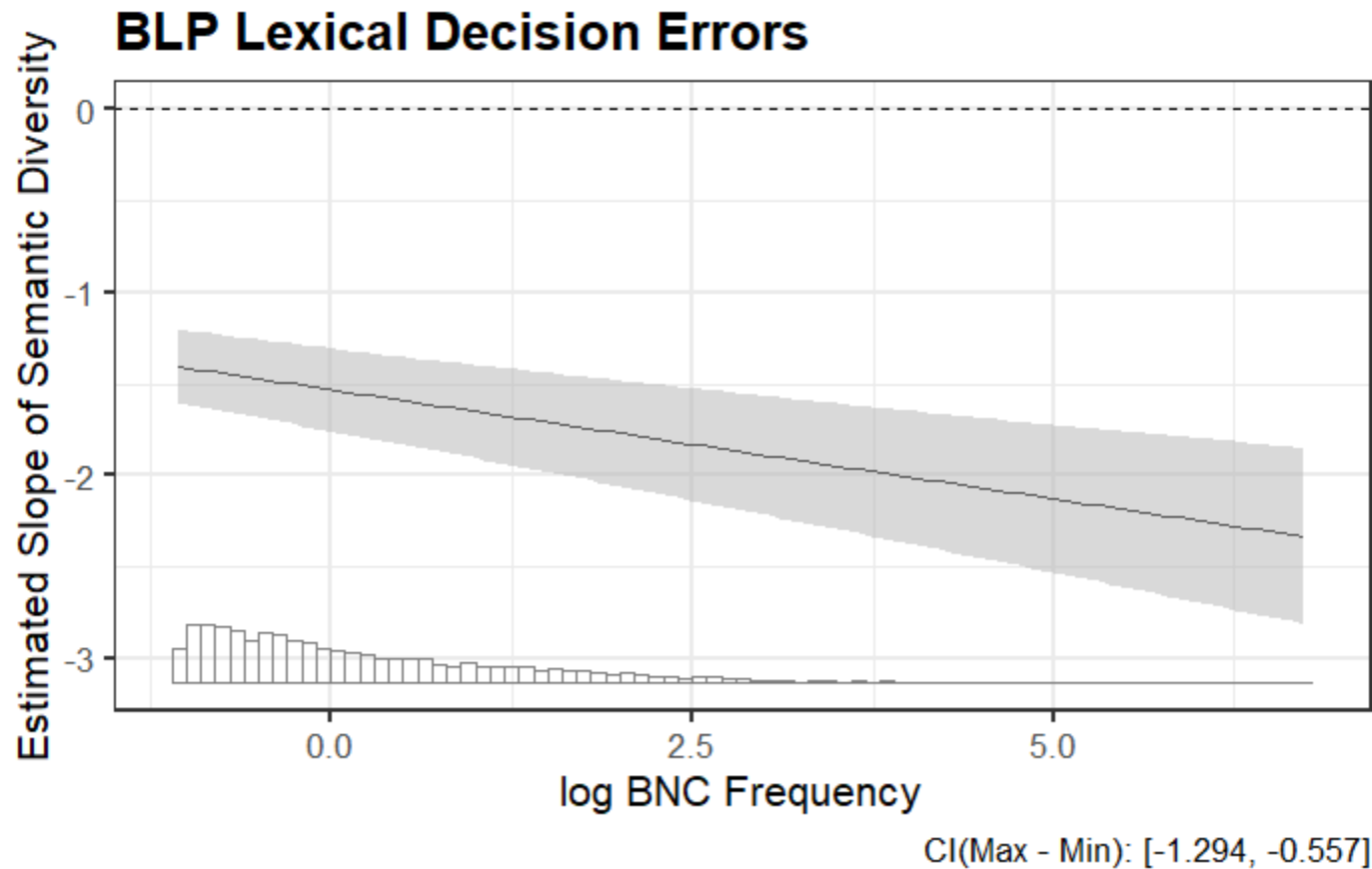


Figure S5. Interaction between frequency and SemD in BLP lexical decision errors. Plot shows the model-estimated effect of SemD across the range of frequency values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

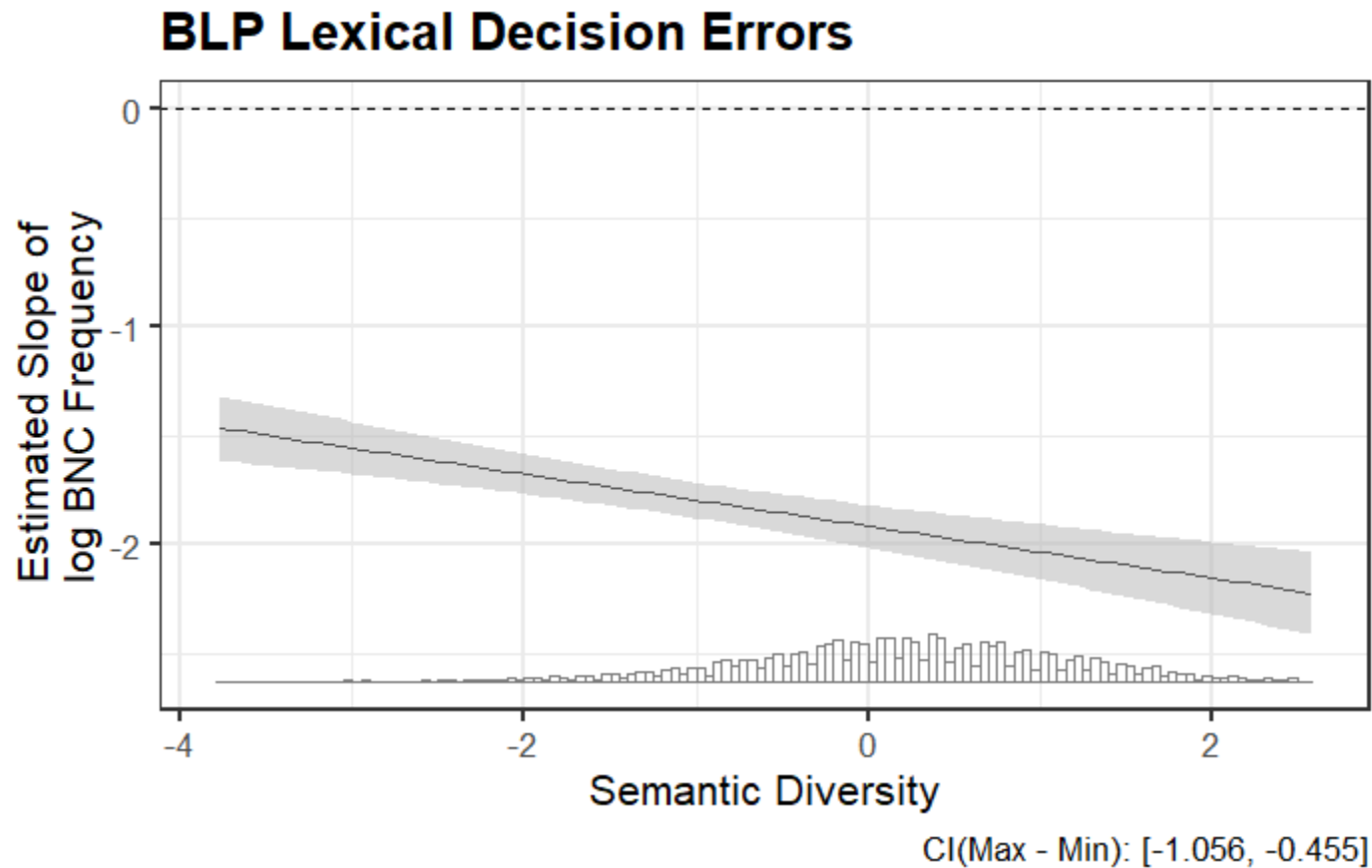


Figure S6. Interaction between frequency and SemD in BLP lexical decision errors. Plot shows the model-estimated effect of frequency across the range of semantic diversity values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

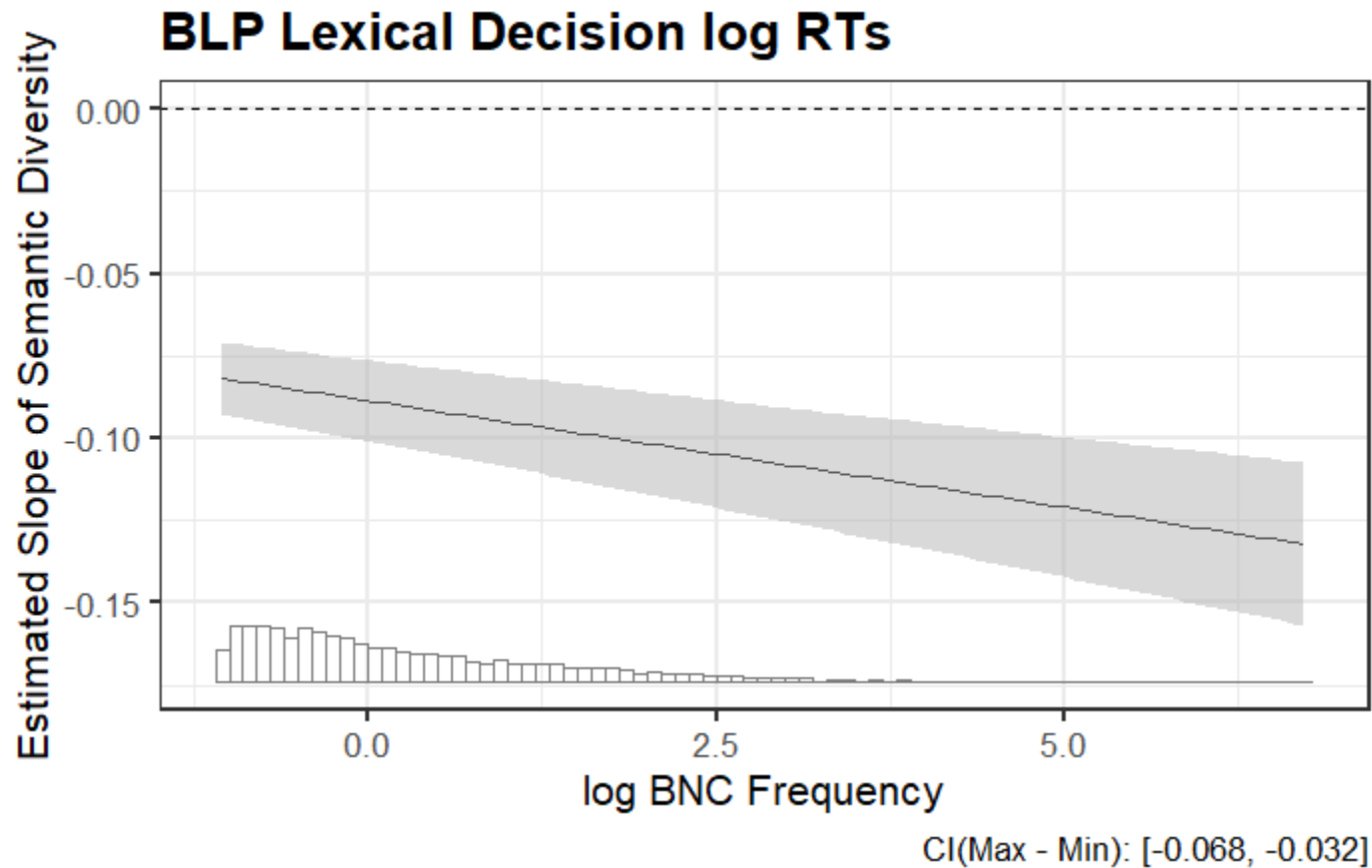


Figure S7. Interaction between frequency and SemD in BLP lexical decision log RTs. Plot shows the model-estimated effect of SemD across the range of frequency values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

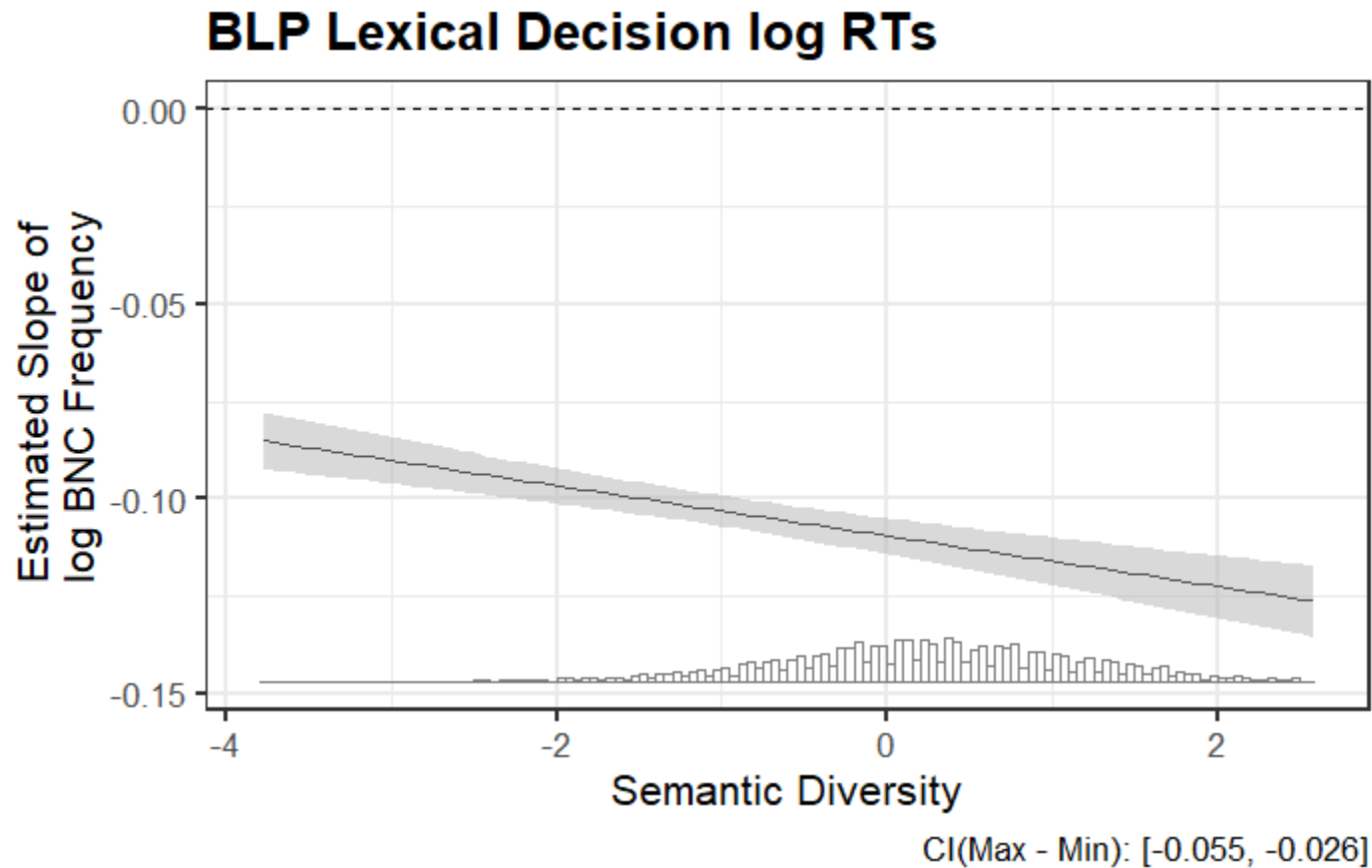


Figure S8. Interaction between frequency and SemD in BLP lexical decision log RTs. Plot shows the model-estimated effect of frequency across the range of semantic diversity values (both variables standardized). Plot made with the *interplot* package in R (Solt & Hu, 2019).

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