APPENDIX

APPENDIX S1

Language proficiency, language balance and the DIALANG test

Language dominance is a multidimensional concept, which includes language proficiency, language exposure and language use (Silva-Corvalán & Treffers-Daller, 2016). Many studies define their participants' dominance by measuring solely one of these indicators, i.e., dominance is determined either in terms of the amount of exposure to the speakers' various languages or in terms of their relative proficiency (Treffers-Daller, 2019). Yet, research has shown that both indicators correlate. More specifically, language proficiency tends to positively correlate with language exposure and use (Flores et al., under review; Treffers-Daller, 2019; Unsworth, 2016), thus, they may yield comparable estimations for language dominance, although each method has strengths and weaknesses.

With respect to proficiency-based measurements, a wide range of instruments have been used, which assess, for instance, the participants' lexical repertoire, their phonological performance or their grammatical knowledge. Although proficiency cannot be reduced to solely one language domain, it is difficult to measure all indicators of language proficiency in one single study. Therefore, it has been a common practice to estimate language proficiency on the basis of one relevant indicator. Lexical competence has been shown to be a reliable predictor (Bonvin et al., 2021; Laufer & Nation, 1999; Treffers-Daller & Korybski, 2016), since the learners' lexical knowledge grows when proficiency increases and adequate lexical knowledge is a prerequisite of effective language use. For that reason, in the present study we have decided to choose lexical competence as our predictor of proficiency. Still, in order to test our hypotheses, we have based ourselves in the concept of language dominance rather than simply

language proficiency. Language dominance refers to the relative proficiency relationship between the two (or more) languages of a bilingual (Montrul, 2016). This implies to determine the relative strength of bilinguals' proficiency in each language, or, in other words, their language balance. Determine the language balance of a bilingual speaker can be done by subtracting the performance score of one language from that of the other language and, thus, obtaining between-language differentials (Unsworth et al., 2018). The interpretation of between-language differentials is rather straightforward: scores close to zero are indicative of language balance, whilst higher scores in the negative or in the positive direction signal imbalance in favor of one of the tested language (Birdsong, 2016). One of the existing instruments used in the literature to assess bilinguals' receptive lexical knowledge is the DIALANG Vocabulary Size Placement Test (Huhta et al., 2022; see Lloyd-Smith et al., 2020, for a study using Dialang to assess language dominance). The DIALANG test has the advantage of being one of the few receptive vocabulary tests that were validated in German and in Portuguese (the other one is the LexTALE test, Lemhöfer & Broersma [2012], which has a recent Portuguese version, see Zhou & Li, 2021).

In addition, also self-ratings may be complementary indicators of a speaker's language dominance (Jia et al., 2002). Flores, Zhou and Eira (under review) for instance, who asked their Portuguese-German bilingual informants to self-rate their speaking, reading, and writing skills in Portuguese and German, found a positive correlation between the self-evaluated and the behaviorally measured language proficiency (assessed through the DIALANG vocabulary test).

References:

Flores, C., Zhou, C. & Eira, C. (under review). "I no longer calculate in German". On dominance shift in returnee heritage speakers. *Applied Psycholinguistics*.

Huhta, A., Luoma, S., Oscarson, M., Sajavaara, K., Takala, S., & Teasdale, A. (2002). DIALANG: A diagnostic language assessment system for learners. Common European framework of reference for languages: Learning, teaching, assessment. Case studies. *Council of Europe*, 130-145.

Jia, G., Aaronson, D., & Wu, Y. (2002). Long-term language attainment of bilingual immigrants: Predictive variables and language group differences. *Applied Psycholinguistics,* 23, 599–621 doi: 10.1017/S0142716402004058

Lemhöfer, K., & Broersma, M. (2012). Introducing LexTALE: A quick and valid Lexical Test for Advanced Learners of English. *Behavior Research Methods,* 44, 325-343.

Lloyd-Smith, A., Einfeldt, M., & Kupisch, T. (2020). Italian-German bilinguals: The effects of heritage language use on accent in early-acquired languages. *International Journal of Bilingualism, 24*(2), 289–304. doi: 10.1177/1367006919826867

Montrul, S. (2016). *The Acquisition of Heritage Languages*. Cambridge: Cambridge University Press, doi: 10.1017/CBO9781139030502

Silva-Corvalán, C., & Treffers-Daller, J. (Eds.). (2016). Language Dominance in Bilinguals: Issues of Measurement and Operationalization. Cambridge: Cambridge University Press. doi: 10.1017/CBO978110 7375345

Treffers-Daller, J. (2019). What Defines Language Dominance in Bilinguals? Annual Review of Linguistics, 5, 375-393. doi: 10.1146/annurev-linguistics-011817-045554.

Unsworth, S. (2016). Amount of exposure as a proxy for dominance in bilingual language acquisition, In C. Silva-Corvalán & J. Treffers Daller (Eds.), Language Dominance in Bilinguals: Issues of Measurement and Operationalization (pp.

156–173). Cambridge: Cambridge University Press. doi: 10.1017/ CBO9781107375345.008

Unsworth, S., Chondrogianni, V., & Skarabela, B. (2018). Experiential Measures Can Be Used as a Proxy for Language Dominance in Bilingual Language Acquisition Research. Frontiers in Psychology, 9, 1809. doi: 10.3389/fpsyg.2018.01809

Zhou, C., & Li, X. (2021). LextPT: A reliable and efficient vocabulary size test for L2 Portuguese proficiency. *Behavior Research Methods.* doi: 10.3758/s13428-021-01731-1

APPENDIX S2

All target nouns according to their translation type

	Target nouns		
	Portuguese	**German**	**English Translation**
Heterogeneric F – M	abóbora	Kürbis	pumpkin
	alface	Salat	salad
	âncora	Anker	anchor
	ambulância	Krankenwagen	ambulance
	árvore	Baum	tree
	barba	Bart	beard
	barriga	Bauch	belly
	cabeça	Kopf	head
	cadeira	Stuhl	chair
	carta	Brief	letter
	cera	Wachs	wax
	colina	Hügel	hill
	dor	Schmerz	pain
	fama	Ruhm	fame
	ferrugem	Rost	rust
	fome	Hunger	hunger
	impressora	Drucker	printer
	lama	Schlamm	mud
	lareira	Kamin	chimney
	lua	Mond	moon
	luva	Handschuh	glove
	maçã	Apfel	apple
	mesa	Tisch	table
	migalha	Krümel	crumb
	pimenta	Pfeffer	pepper
	praia	Strand	beach
	sombra	Schatten	the shade
	tempestade	Sturm	storm
	torneira	Wasserhahn	water tap
	vassoura	Besen	broom
Heterogeneric M – F	moinho	Mühle	mill
	espantalho	Vogelscheuche	scarecrow
	ar	Luft	air
	punho	Faust	fist
	candeeiro	Lampe	lamp
	carvalho	Eiche	oak
	casaco	Jacke	jacket
	chocolate	Schokolade	chocolate
	cigarro	Zigarette	cigarette
	fígado	Leber	liver
	figo	Feige	cowardly
	gorro	Mütze	cap
	espectáculo	Veranstaltung	event

	hemisfério	Hemisphäre	hemisphere
	jornal	Zeitung	newspaper
	lábio	Lippe	lip
	leite	Milch	milk
	nabo	Rübe	turnip
	nariz	Nase	nose
	ombro	Schulter	shoulder
	palco	Bühne	stage
	pepino	Gurke	cucumber
	grupo	Gruppe	group
	berço	Wiege	cradle
	relógio	Uhr	clock
	sino	Glocke	bell jar
	sol	Sonne	sun
	teclado	Tastatur	keyboard
	tecto	Decke	ceiling
	tempo	Zeit	time
Homogeneric F	agulha	Nadel	needle
	alergia	Allergie	allergy
	amêndoa	Mandel	almond
	arte	Kunst	arts
	azeitona	Olive	olive
	batata	Kartoffel	potato
	blusa	Bluse	blouse
	farmácia	Apotheke	pharmacy
	cebola	Zwiebel	onion
	cenoura	Karotte	carrot
	chávena	Tasse	cup
	cor	Farbe	colour
	costela	Rippe	rib
	ervilha	Erbse	pea
	escola	Schule	school
	flor	Blume	flower
	fralda	Windel	diaper
	garrafa	Flasche	bottle
	gaveta	Schublade	drawer
	igreja	Kirche	church
	lágrima	Träne	tear
	moeda	Münze	coin
	muleta	Krücke	crutch
	natureza	Natur	nature
	noite	Nacht	night
	noz	Nuss	nut
	parede	Wand	wall
	pêra	Birne	pear
	pestana	Wimper	eyelash
	sopa	Suppe	soup
Homogeneric M	açúcar	Zucker	sugar

	alho	Knoblauch	garlic
	ângulo	Winkel	angle
	armário	Schrank	cabinet
	arroz	Reis	rice
	autocarro	Bus	bus
	bosque	Wald	forest
	botão	Knopf	stud
	braço	Arm	poor
	cabo	Kabel	cable
	cachecol	Schal	scarf
	calendário	Kalender	calendar
	cinzeiro	Aschenbecher	ashtray
	círculo	Kreis	circle
	comboio	Zug	train
	cotovelo	Ellbogen	elbow
	espírito	Geist	ghost
	estômago	Magen	stomach
	feitiço	Zauber	magic
	forno	Ofen	oven
	hálito	Atem	breath
	jardim	Garten	garden
	milho	Mais	corn
	musgo	Moos	moss
	osso	Knochen	bone
	queijo	Käse	cheese
	senado	Senat	senate
	tornozelo	Knöchel	ankle
	trigo	Weizen	wheat
	vinagre	Essig	vinegar
Neuter – F	água	Wasser	water
	poema	Gedicht	poem
	bagagem	Gepäck	baggage
	bicicleta	Fahrrad	bicycle
	cama	Bett	bed
	camisa	Hemd	shirt
	cerveja	Bier	beer
	nave	Raumschiff	spaceship
	corda	Seil	rope
	cotonete	Wattestäbchen	cotton swab
	espada	Schwert	sword
	estante	Regal	shelf
	faca	Messer	knife
	farinha	Mehl	flour
	ferradura	Hufeisen	horseshoe
	ferramenta	Werkzeug	tool
	fogueira	Lagerfeuer	campfire
	gorjeta	Trinkgeld	tip
	hormona	Hormon	hormone
	idade	Alter	age

	janela	Fenster	window
	lei	Gesetz	law
	loja	Geschäft	shop
	narina	Nasenloch	nostril
	orelha	Ohr	ear
	perna	Bein	leg
	pulseira	Armband	bracelet
	régua	Lineal	ruler
	toalha	Handtuch	hand towel
	trovoada	Gewitter	thunderstorm
Neuter – M	quiosque	Kiosk	kiosk
	ano	Jahr	year
	aquário	Aquarium	aquarium
	átomo	Atom	atom
	crime	Verbrechen	crime
	brinquedo	Spielzeug	toy
	buraco	Loch	hole
	cabelo	Haar	hair
	cacifo	Schließfach	locker
	cano	Rohr	pipe
	carro	Auto	automobile
	cérebro	Gehirn	brain
	copo	Glas	glass
	dinheiro	Geld	money
	esconderijo	Versteck	hiding place
	escritório	Büro	office
	feno	Heu	hay
	fogo	Feuer	fire
	fósforo	Streichholz	match
	golo	Tor	gate
	hospital	Krankenhaus	hospital
	isqueiro	Feuerzeug	lighter
	joelho	Knie	knee
	rumor	Gerücht	rumor
	papel	Papier	paper
	pêndulo	Pendel	pendulum
	terramoto	Erdbeben	earthquake
	teatro	Theater	theatre
	telhado	Dach	roof
	xadrez	Schach	chess

Values (means and standard errors) obtained for the control of Portuguese and German materials

Table S1

Means and standard errors of the controlled variables for Portuguese nouns across translation types

	HET F-M	HET M-F	HOM F	HOM M	N-F	N-M
FpM	23.71	71.62	39.01	17.78	30.63	81.30
	(6.83)	(31.49)	(14.57)	(4.20)	(13.14)	(40.79)
LogF	1.02	1.13	.96	.99	.98	1.18
	(.10)	(.14)	(.13)	(.09)	(.11)	(.14)
PN	4.97	5.03	2.87	4.27	3.93	4.07
	(.77)	(1.09)	(.63)	(1.09)	(.81)	(1.07)
ON	6.03	4.00	2.70	2.87	4.20	4.90
	(1.05)	(.86)	(.60)	(.80)	(1.08)	(1.23)
NL	6.03	6.00	5.93	6.40	6.20	6.33
	(.36)	(.39)	(.26)	(.29)	(.32)	(.36)
MLBF	2.69	2.60	2.47	2.46	2.58	2.46
	(.08)	(.06)	(.09)	(.06)	(.07)	(.09)
LogF-S	3.09	3.07	2.89	3.04	3.05	3.26
	(.12)	(.14)	(.14)	(.09)	(.15)	(.14)
SubjF	4.82	5.13	5.08	4.69	4.92	4.89
	(.20)	(.23)	(.19)	(.20)	(.24)	(.26)
Concret	5.94	6.15	6.18	6.02	6.13	6.02
	(.21)	(.19)	(.17)	(.23)	(.17)	(.16)
Imag	5.78	5.87	5.85	5.55	5.78	5.63
	(.13)	(.12)	(.08)	(.17)	(.14)	(.16)

Note. FpM = Frequency per million; LogF = Logarithmic Frequency; PN = Phonological number of neighbours; ON = Orthographic number of neighbours; NL = Number of letters; MLBF = Mean logarithmic bigram frequency. All obtained from the P-PAL database (Soares et al., 2018). LogF-S = Logarithmic Frequency. Obtained from the SubtLex-PT database (Soares et al., 2015). SubjF = Subjective Frequency; Concret = Concreteness; Imag = Imageability. All obtained from the Minho Word Pool database (Soares et al., 2017).

Table S2

Means and standard errors of the controlled variables for German nouns across

translation types

	HET F-M	HET M-F	HOM F	HOM M	N-F	N-M
LogF	3.27	3.63	3.28	3.47	3.41	3.63
	(.16)	(.23)	(.31)	(.14)	(.24)	(.22)
Neigh-L	4.87	5.19	4.58	4.75	5.32	5.29
	(.41)	(.48)	(.38)	(.44)	(.62)	(.53)
NL	5.83	6.13	5.80	5.50	6.63	6.10
	(.35)	(.46)	(.24)	(.36)	(.41)	(.46)
ILBF	4.64	4.66	4.21	4.30	5.39	5.19
	(.29)	(.33)	(.30)	(.30)	(.41)	(.39)
Fam	5.03	4.84	4.38	4.43	5.30	5.23
	(.31)	(.37)	(.34)	(.29)	(.46)	(.40)
LogF-S	2.52	2.56	2.29	2.53	2.50	2.73
	(.11)	(.13)	(.13)	(.09)	(.15)	(.14)

Note. LogF = absolute logarithmic frequency; Neigh-L= logarithmic number of

neighbours based on the Levenshtein distance; NL = Number of letters; ILBF = Initial

logarithmic bigram frequency; Fam = Familiarity. All obtained from the dlexDB

database (Heister et al., 2011). LogF-S = Logarithmic Frequency obtained from the

SubtLex-DE database (Brysbaert et al., 2011).

Table S3

Means and standard errors of the overlap measures

	HET F-M	HET M-F	HOM F	HOM M	N-F	N-M
Ort-Over	.15	.20	.23	.18	.13	.24
	(.03)	(.04)	(.04)	(.03)	(.03)	(.03)
Phon-Over	.39	.46	.47	.41	.43	.43
	(.03)	(.03)	(.04)	(.03)	(.03)	(.03)

Note. Ort-Over = Orthographic overlap. Obtained from the NIM database (Guasch et

al., 2013). Phon-Over = Phonological overlap. Obtained from the PHOR-in-One

database (Costa et al., 2021).

References:

Brysbaert, M., Buchmeier, M., Conrad, M., Jacobs, A. M., Bölte, J., & Böhl, A. (2011). The word frequency effect: A review of recent developments and implications for the choice of frequency estimates in German. *Experimental Psychology*, *58*(5), 412–424. doi: 10.1027/1618-3169/a000123

Costa, A. S., Comesaña, M., & Soares, A.P. (2021). *PHOR-in-One: A Multilingual Lexical Database With PHonological, ORthographic and Phonographic Word Similarity Estimates in Four Languages* [Manuscript in preparation]. School of Psychology, University of Minho.

Guasch, M., Boada, R., Ferré, P., & Sánchez-Casas, R. (2013). NIM: A Web-based Swiss Army knife to select stimuli for psycholinguistic studies. *Behavior Research Methods*, *45*(3), 765–771. doi: 10.3758/s13428-012-0296-8

Heister, J., Würzner, K.-M., Bubenzer, J., Pohl, E., Hanneforth, T., Geyken, A., & Kliegl, R. (2011). dlexDB—Eine lexikalische Datenbank für die psychologische und linguistische Forschung [dlexDB—A lexical database for the psychological and linguistic research]. *Psychologische Rundschau, 62*(1), 10–20. doi: 10.1026/0033-3042/a000029

Soares, A. P., Iriarte, A., Almeida, J. J., Simões, A., Costa, A., Machado, J., França, P., Comesaña, M., Rauber, A., Rato, A., & Perea, M. (2018). Procura-PALavras (P-PAL): A web-based interface for a new European Portuguese lexical database. *Behavior Research Methods*, *50*(4), 1461–1481. doi: 10.3758/s13428-018-1058-z

Soares, A. P., Machado, J., Costa, A., Iriarte, Á., Simões, A., de Almeida, J. J., Comesaña, M., & Perea, M. (2015). On the Advantages of Word Frequency and Contextual Diversity Measures Extracted from Subtitles: The Case of Portuguese.

Quarterly Journal of Experimental Psychology, *68*(4), 680–696. doi:

10.1080/17470218.2014.964271

Soares, A. P., Costa, A. S., Machado, J., Comesaña, M., & Oliveira, H. (2017). The

Minho Word Pool: Norms for imageability, concreteness and subjective frequency

for 3,800 Portuguese words. *Behavior Research Methods*, *49*(3), 1065–1081. doi:

10.3758/s13428-016-0767-4