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Factors that moderate global similarity in initial L3 transfer:

Intervocalic voiced stops in heritage Spanish/English bilinguals' L3 Italian

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Abstract

Much of the formal linguistic research on third language (L3) acquisition has focused on transfer source selection, with the overall finding that (global) structural similarity between the L1/L2 and L3 is the strongest predictor of initial transfer patterns. Recently, Cabrelli and Pichan (2021) reported data from the production of underlying intervocalic voiced stops in L3 Brazilian Portuguese (BP) and L3 Italian that highlight the notion that global similarity is likely moderated by other factors. Specifically, data from heritage Spanish/English bilinguals learning L3 BP reflected reliance on (non-facilitative but globally more similar) Spanish, while L3 Italian data reflected greater reliance on (facilitative, but globally less similar) English. The current study is a first step towards identifying the source(s) of the disparity, in which we examine the roles of degree of dominance and explicit knowledge in heritage Spanish/English bilinguals. Thirty-four L3 Italian learners completed a delayed repetition task in all three languages. We report English-like patterns that contradict the L3 BP data and cannot be accounted for by degree of dominance or explicit knowledge. We connect these results to existing L3 transfer accounts and the need for further consideration of linguistic and methodological variables, particularly acoustic salience in L3 input and task modality.

Keywords: third language acquisition, transfer, phonology, heritage speaker bilingualism, salience

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1. Introduction

In recent years, much of the formal linguistic research on third language (L3) acquisition has centered on the dynamics of transfer source selection (L1, L2, or both). In their systematic review of L3 morphosyntax studies, Puig-Mayenco et al. (2020a) found that global structural similarity between the L1/L2 and the target L3 was the most explanatory—yet not exclusive—variable. Although there is no question of the importance of global structural similarity, several lacunae remain in our understanding of L3 transfer.[1]

For one, is the primacy of global structural similarity as robust in other modules of grammar (in this case, phonology)? To our knowledge, there are only two studies that examine source selection of phonological transfer at the very initial stages of L3 development (Cabrelli & Pichan, 2021; Kopečková et al., 2022). As we will see in Section 2.1, these studies contrast substantially in their samples, context, language triads, modalities, and linguistic phenomena. Unsurprisingly, then, they also differ in their outcomes. Further, despite clear trends, there is

[1] Following Rothman et al. (2019), we distinguish transfer (here, operationalized as crosslinguistic influence (CLI) at the level of representation) from crosslinguistic effects (i.e., CLI at other levels, including processing). Also per Rothman et al., we use 'global similarity' to refer to the relative similarity between two grammars (i.e., L3 and L1, L3 and L2). We assume this similarity is determined by the learner's computational parser, which is responsible for generating representations of linguistic input based on the linguistic cues available in the L3 input. Following the Typological Primacy Model (TPM), the parser evaluates the cues against each existing grammar. The evaluation is done hierarchically and via statistical comparison, starting with the lexis (see Rothman et al., p. 163). If lexical information is not sufficient for the parser to determine which grammar is more similar to the L3, the parser continues to evaluate cues at each level until a determination can be made. At that point, transfer occurs in a wholesale manner even if the determination was made prior to reaching lower levels of the hierarchy, hence the term 'global similarity'.

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under-explored individual variability to account for, which we engage with more deeply herein with the data from Cabrelli and Pichan (2021).

Cabrelli and Pichan (2021) examined intervocalic voiced stop realization in two Romance L3s, Brazilian Portuguese and Italian. The phenomenon patterns similarly in both L3s and English whereby underlyingly voiced stops surface faithfully as [-cont] while surfacing as [+cont] in Spanish (see Section 2.2). The authors found a dominant pattern of (non-facilitative) transfer from Spanish, the structurally more similar language to the L3s[2], regardless of age or context of acquisition of Spanish. This finding aligns with a substantial body of L3 morphosyntactic research on English/Spanish bilinguals acquiring L3 Portuguese (see Cabrelli Amaro & Iverson, 2018, for overview), claiming a primacy role for global structural similarity in initial L3 transfer. However, 28% of their data was consistent with English transfer. These results were highly skewed by the target L3: 82% of the subsample came from L3 Italian learners. The clear effect of the L3 is interesting, if not perplexing, considering that the learners share the same previously acquired languages and were matched for L3 experience. Could there be a moderating variable that either (a) overrides transfer that is driven by global structural similarity or (b) accelerates the acquisition process (whether on the surface or at the level of representation) after initial non-facilitative transfer?

Cabrelli and Pichan (2021) discussed two possible variables that might have yielded these disparate outcomes: Explicit knowledge and acoustic salience. Cabrelli and Pichan reported that the L3 Italian instructor—unlike the Portuguese instructor—had explicitly provided the relevant

[2] While we recognize that Portuguese and Italian each pattern to different degrees with Spanish, the two languages (a) evidence comparable lexical similarity with Spanish (89% and 82%, respectively, Ethnologue, Eberhard et al., 2022) and mutual intelligibility (Peninsular Spanish-Italian, 56%, Gooskens et al., 2018; Brazilian Portuguese-Latin American Spanish, 50%, Jensen, 1989) and (b) are globally more similar to Spanish than to English.

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phonological rule in class (i.e., that intervocalic /b d g/ are not lenited in Italian, unlike in Spanish), and a debriefing questionnaire completed by a subset of the sample suggested a positive link between English-like production patterns and explicit knowledge that (a) pronunciation of intervocalic /b d g/ is 'softer' in Spanish than in English, and that (b) Italian intervocalic /b d g/ are pronounced similarly to English (versus Spanish). As for salience, while underlying intervocalic voiced stops are realized as [-cont(inuant)] in both non-contact varieties of Italian and Brazilian Portuguese, only Italian learners are exposed to intervocalic geminate voiced stops, which might put them at a perceptual advantage. The increased duration of the geminates (see e.g., Payne, 2005) yields acoustic salience such that even naïve English listeners have been found to accurately perceive intervocalic geminate/singleton contrasts (Pajak, 2013). This degree of salience, which is absent in the L3 Portuguese input, could privilege the L3 Italian learners in attending to the [-cont] feature of underlying /b d g/ and subsequently mapping the feature in intervocalic /b d g/ inputs to the output (see Archibald, 2009, for discussion of the role of cue robustness in the representation revision process). This notion of differential learnability underscores the need to consider a phonological phenomenon in its relationship to each language's grammar and is in line with the tenets of the Scalpel Model (Slabakova, 2017), which predicts that linguistic variables such as complexity and frequency can moderate the rate and difficulty of L3 acquisition (see also Jensen et al. 2021). While we leave explicit testing of the role of salience for a future study, we have isolated explicit knowledge in the current study by including an additional 21 heritage Spanish/English bilinguals at the initial stages of L3 Italian that were not exposed explicitly to the relevant phonological rule.

A second question regards deterministic variables in initial L3 transfer across heritage speaker (HS) populations. To what extent do existing accounts of initial transfer, several of

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which are based primarily on adult sequential bilinguals, apply to HS bilinguals (see e.g., Rothman, 2015, for discussion), and must we consider additional population-specific variables? As outlined in Lloyd-Smith (2020), there is growing interest in L3 processes in HS bilinguals for theoretical and practical reasons alike. Unlike L2 classroom learners acquiring an L3 in a similar context, HS bilinguals have two early, naturalistically acquired systems available to them at the onset of L3 acquisition, which allows us to control for age and context of acquisition. Further, while adult sequential bilinguals are typically dominant in their home language, which tends to coincide with the dominant societal language, adult HSs tend toward dominance in the societal majority language after initial dominance in the heritage language (e.g., Kupisch & Rothman, 2018). On a practical level, HS bilinguals account for a significant percentage of classroom L3 learners. There are 20.6 million US-born individuals with Spanish as a home language, including 23.6% of households in Chicago, Illinois (2019 ACS 1-year estimate), where thisstudy took place. A solid understanding of the developmental processes that underlie L3 acquisition for HSs and the role of individual differences would thus allow us to better serve this heterogeneous population in an L3/L*n* learning context. In this study, we treat dominance as gradient rather than categorical (e.g., Solís-Barroso & Stefanich, 2019), focusing on the role that degree of dominance has at the L3 initial stages.

In the present study, a total of 34 heritage Spanish/English bilinguals in a first-semester Italian class (including the 13 in Cabrelli & Pichan, 2021) completed a delayed repetition task in all three languages. As in Cabrelli and Pichan, results indicate a trend towards English-like stop production patterns, with no effect of degree of dominance. We discuss these outcomes as they relate to existing accounts of initial L3 transfer, with a primary focus on variability driven by linguistic factors other than global structural similarity.

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2. Background

2.1 L3 phonology at the initial stages

Although interest in L3 phonology has gained much ground in the last decade (see Wrembel, 2023, for a current review), studies carried out at the earliest stages of L3 acquisition with a mirror-image design (typically, two bilingual groups whose L1 and L2 order of acquisition mirror one another) remain rare. In fact, to date, only Kopečková et al. (2022) and Cabrelli and Pichan (2021) have reported data on initial transfer using a mirror-image design.

2.1.1 Kopečková et al. (2022)

Kopečková et al. (2022) depart from the typical mirror-image design by mirroring the L1 and L3 (in this case, German and Polish) while keeping the L2 (English) constant. Using a delayed repetition task, the authors tested production of (a) rhotics (distinct in all three languages), (b) /w/, present in English and Polish, and (c) final obstruent devoicing, present in German and Polish. Of methodological note is the novel inclusion of a phenomenon that presents differently in each language, as this permits the researcher to adjudicate between transfer and acquisition as the source of target-like data.

Kopečková et al.'s results pointed to a primary trend towards L1 transfer, which the authors attributed to the entrenchment of L1 articulatory routines, although there were patterns consistent with facilitative L2 transfer of /w/ in L3 Polish[3]. Interestingly, there were also appreciable rates of productions that (a) were L3 target-like or (b), particularly for the rhotics, could not be traced to either the L1 or L2. In the latter case, although the rhotics were salient

[3] The authors recognize that facilitative transfer is difficult to tease apart from acquisition but note the low likelihood that learners would establish a stable L3 representation in the L3 initial stages.

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enough in the input for the learners to perceive their dissimilarity to the L1 and L2, the articulatory complexity yielded novel substitutions in production.

Addressing the unpredicted L3 target-like rhotic productions, the authors hypothesized that these did not reflect acquisition, given the very early stage. They cited a possible task effect (specifically, a mimicry effect) due to the role of repetition, particularly with /w/, which is articulatorily less complex than the L3 rhotic sounds. However, as they note, trials contained a 1000 ms delay between the stimulus and the repetition promptto avoid mimicry and instead invoke reliance on the phonological representation.

Considering the data set as a whole, Kopečková et al. posited that the attested inter- and intraindividual variability might be relevant only to phonetic and phonological acquisition, thus limiting the applicability of existing models of L3 morphosyntactic transfer to L3 phonology. We return to this issue in Section 5.

2.1.2 Cabrelli and Pichan (2021)

As referenced in Section 1, Cabrelli and Pichan (2021) found that, overall, English/Spanish bilinguals learning L3 Portuguese and Italian tended to rely on Spanish when producing intervocalic /b d ɡ/ (see Section 2.2 for an overview of intervocalic voiced stop realization in the relevant languages). This was the case across mirror-image English/Spanish bilingual groups as well as heritage Spanish/English bilinguals. However, although separate models fit on the L3 Italian and L3 Portuguese data yielded parallel outcomes, the individual-level analysis (see Tables 1 and 2) showed that 82% of the learners that produced English-like segments were L3 Italian participants. While the mirror-image groups were not large enough to elicit any clear patterns between the L3 BP and Italian outcomes, a stark difference was found between the HS

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groups: None of the L3 Portuguese learners produced patterns consistent with English/the L3, compared with half of the L3 Italian learners.

****INSERT TABLE 1 HERE****

****INSERT TABLE 2 HERE****

For the participants that produced English-like segments, the authors were not able to explain their data in terms of proficiency in the non-dominant language or continuous dominance scores, and the question whether their data reflected an L3 representation (obtained either via facilitative transfer or early acquisition) or could be attributed to an unanticipated moderating variable remained. While they identified a tentative link between explicit knowledge of the relevant phonological rule and English/L3 production patterns, they also acknowledged a potential role for salience in the Italian input. The authors noted the need for additional L3 Italian data from learners that had not had explicit exposure to the rule, which we address in the current study.

2.2 Heritage speakers as L3 learners

HSs acquire their home language from birth and the majority language either concurrently or subsequently (see Montrul, 2011, for a detailed breakdown by age). Of what is now a substantial collection of studies examining the role of a bilingual's background languages in L3 acquisition (see e.g., Puig-Mayenco et al., 2020a, for a review), a growing number examine early bilinguals that fit the profile of HSs (see Lloyd-Smith & Kupisch, 2023, for a content review of existent studies).[4] Of the roughly two dozen studies to date, very few have examined the L3 at the initial stages (Cabrelli & Pichan, 2021; Fallah et al., 2016; Giancaspro et al., 2015; Iverson, 2009). Yet,

[4] The scope of the studies we review here does not include studies of early bilinguals who are formally educated in the minority language, such as Basque/Spanish (e.g., Slabakova & García Mayo, 2015) and Catalan/Spanish bilinguals (e.g., Puig-Mayenco et al., 2020b).

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all but Cabrelli and Pichan (2021) examine morphosyntax. Except for Fallah et al. (2016), these initial stages studies tested a language triad in which one of the background languages (Spanish versus English) was undisputedly closer to the L3. In these cases, learners were heritage Spanish/English bilinguals who were exposed to L3 Brazilian Portuguese, and, in the case of Cabrelli and Pichan, L3 Italian. Data from the three remaining studies span a wide range of morphosyntactic phenomena, with each indicating transfer from Spanish. Comparing the heritage Spanish data with data from mirror-image late bilinguals in each study, the authors found that the groups generally patterned together regardless of age of acquisition of Spanish or (categorical) English dominance. Taken together with the findings from Cabrelli and Pichan, existent evidence seems to point to a primary role for relative global structural similarity when Romance languages match the target L3. However, although neither categorical nor continuous dominance has predicted initial transfer for English/Spanish bilinguals, there is substantial evidence that dominance operationalized as a continuous variable can predict morphosyntactic processing (e.g., Stover et al., 2021), lexical processing (e.g., Soo & Monahan, 2022), and phonological production (e.g., Lloyd-Smith, 2021). With these findings in mind, we consider the role of degree of dominance in the current study with a larger and more varied HS sample than in Cabrelli and Pichan.

Beyond the initial stages, observations of transfer effects are limited, particularly when one of the background languages patterns with the L3. This is because if a learner's data do not evidence non-facilitative transfer, it is not possible to confirm whether the data reflect L3 target-like knowledge or facilitative transfer from one of the background languages.[5] Several L3 data

[5] Studies such as Özaslan and Gabriel (2019) have employed a subtractive L2 group of L1 German/L2 English learners to compare with heritage Turkish/German bilingual learners of L3 English and found that the L3 learners produce target-like patterns of word-final voiced obstruents reflective of facilitative transfer, while the L2 group does not. However, since these learners are beyond the initial stages, there is

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sets from later stages of learning that examine phenomena that are similar in the L3 and one of the background languages show persistent non-facilitative transfer effects. Of these, Llama and López Morelos (2016 and a series of studies by Gabriel and colleagues (e.g., Gabriel et al., 2016, 2018, 2022) are the only phonology studies of HS bilinguals that show persistent non-facilitation in the L3. In their study of heritage Spanish/English bilinguals learning L3 French, Llama and López Morelos (2016, 2020) reported effects of non-facilitative English voice onset time (VOT) and attributed the outcome to the learners' English dominance. Gabriel et al.'s (2016, 2018) studies found homeland German influence (and not HL Mandarin) in L3 French VOT in voiceless and voiced stops, respectively. Although German is more similar than Mandarin, Gabriel et al. (2018) proposed that low salience of the prevoicing associated with French voiced stops might impede acquisition, again signaling differences in learnability and the role of cue robustness. As in Llama and López Morelos, the dominant language in Gabriel and colleagues' work predicted each outcome.

In sum, the limited HS L3 data available point to transfer patterns most often associated with dominance and global similarity, which might be moderated by other learner-centered factors (e.g., HL proficiency and use, explicit knowledge) and linguistic factors (e.g., salience). While tricky to make concrete predictions for the present study based on this research, it is prudent to consider the roles of (degree of) dominance and salience.

2.3 Intervocalic stop lenition

no way to confirm that the target-like patterns do not reflect acquisition. For example, because the L3 group had a facilitative option available to them (i.e., heritage Turkish), it is possible that they could have originally transferred German and, by the time of testing, had revised their grammar to reflect the facilitative option available to them. In comparison, the L1 German/L2 English group would not have an existing facilitative representation available and would have to unlearn the relevant word-final devoicing rule via other mechanisms.

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Underlying intervocalic stops /b d ɡ/ are reported to surface as [-cont] in monolingual varieties of English (e.g., Hualde, 2005, (1)) and Italian (e.g., Krämer, 2009, (2)) while Spanish /b d ɡ/ systematically surface as [+cont], most commonly as approximants (e.g., Hualde et al., 2011, (3)).

(1) a. abbey [ˈæ.**b**i]

b. caddy [ˈkæ.**d**i]/[ˈkæ.**ɾ**i]

c. buggy [ˈbʌ.**ɡ**i]

(2) a. *tubo* [ˈtu.**b**o] ‘tube’

b. *ludo* [ˈlu.**d**o] ‘game’

c. *figo* [ˈfi.**ɡ**o] ‘cool’

(3) a. *rabo* [ˈra.**β̞**o] ‘tail’

b. *lado* [ˈla.**ð̞**o] ‘side’

c. *lago* [ˈla.**ɣ̞**o] ‘lake’

While we expect variability in the English and Spanish productions of bilingual English/Spanish speakers due to varied experience with the heritage language (e.g., Rao & Amengual, 2021), previous research (e.g., Cabrelli & Pichan, 2021) indicates that heritage data largely align with reported monolingual patterns.

Because Spanish is globally more similar to Italian but patterns differently from Italian here, Cabrelli and Pichan (2021) chose this phenomenon to track whether (a) global similarity determines transfer, whereby production patterns with Spanish data, or (b) property-level similarity between a background language and the L3 determines transfer, whereby production patterns with English data.

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2.4 Research question and predictions

(RQ1): In the absence of explicit exposure to the phonological rule, do heritage Spanish/English bilinguals produce intervocalic /b d ɡ/ segments in initial stages L3 Italian as [-cont] (consistent with English/Italian) or [+cont] (consistent with Spanish)?

We predict that, if explicit knowledge drove the outcome in Cabrelli and Pichan (2021), the additional L3 Italian sample will approximate their Spanish production. If, however, participants' Italian production approximates their English production, we will need to test the hypothesis that L3 Italian input patterns underlie the disparity in the L3 Portuguese versus L3 Italian data in Cabrelli and Pichan.

(RQ2): Are heritage Spanish/English bilinguals' intervocalic /b d ɡ/ production patterns in L3 Italian moderated by the degree of relative dominance in the previously acquired languages?

This question is exploratory, since there was no observable relationship between degree of dominance and transfer patterns in Cabrelli and Pichan (2021), while other studies of HS bilinguals acquiring an L3 have found such an effect.

3. Methods

3.1 Participants and procedure

We recruited 36 (30 female) Spanish/English heritage bilinguals from first-semester Italian university-level classes (three contact hours per week) for participation. Italian was used

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exclusively in class sessions and input came from either a native speaker of Southern Italian (31 participants) or a near-native speaker of Central Italian (3 participants); neither variety of Italian lenites intervocalic stops. The participants (M_{age} = 20, SD = 1.67) were all born and raised in the Chicago area (29% Hispanic/Latino, 2020 US Census) and attended the same public four-year Hispanic Serving Institution. Participants must have been exposed to Spanish from birth and to English no later than age 8, with no experience in additional languages. Participants completed the Bilingual Language Profile (BLP, Birdsong et al., 2012) as a dominance measure. Asa proxy for Spanish proficiency, we report scores from a commonly used 50-item cloze assessment composed of portions of the DELE and the MLA, along with the self-reported composite (i.e., the sum of speaking, listening, reading, and writing scores) and speaking proficiency scores from the BLP. Age of acquisition of English and L3 Italian, written proficiency in Spanish, and dominance are included in Table 3; self-reported scores are in Table 4.

****INSERT TABLE 3 HERE****

****INSERT TABLE 4 HERE****

Only participants who exhibited distinct representations in English and Spanish—operationalized as significantly different proportions of [+cont] segments as determined by McNemar tests—were included in the analysis. This criterion excluded one participant. The English and Spanish data aligned with data from native speakers of (non-heritage) Spanish and English reported in Cabrelli and Pichan (2021): [-cont] segments comprised 90% of English productions and [+cont] segments accounted for 77% of Spanish productions (compared with 98% and 92% respectively from the L1 English/L2 Spanish sample in Cabrelli & Pichan). Finally, one participant did not produce sufficient viable L3 tokens and was excluded from analysis, leaving a final sample of 34..

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3.2 Delayed repetition task

Each delayed repetition task consisted of 30 critical items and 30 fillers in the respective language. Stimuli were embedded in a carrier phrase ('I say X for you' or translation equivalent) and were phonotactically permissible nonsense words that followed a (C)Ca.Ca structure. Thus, we could use equivalent items across languages while controlling for frequency and familiarity. Stimuli were produced by phonetically trained native speakers of Midwest American English, Peninsular Spanish, or Northwest (Turin) Italian. Repetition cues in English and Spanish were recorded by different talkers from the same regions and the Italian cue was recorded by a talker from northeast (Padova) Italy. Fifteen critical items containing /b d ɡ/ in the onset of the second syllable (five per phoneme) were repeated two times (see Appendix B for list); fillers did not contain /b d ɡ/. Trials were presented across two pseudorandomized blocks using E-prime (v2.0, Psychology Software Tools, Inc., 2013). For each trial, participants heard the item in the carrier phrase (e.g., 'I say *faba* for you'), followed by 1000 ms of silence and a repetition cue ('Can you repeat that, please?' or its translation equivalent).

3.3 Procedure

Testing took place in weeks 5-7 of the semester; participants completed three testing sessions—one per language—on separate days. Italian was always tested first, after approximately 9-12 hours of instruction, and the order of English and Spanish was counterbalanced. English and Spanish sessions began with a 10-15-minute guided interview to establish language mode; the Italian session was also conducted fully in the target language, though the interview portion was excluded due to learners' novice proficiency. Participants then completed the delayed repetition task. Audio was recorded in a sound-attenuated booth using a Shure 10A head-mounted microphone and a Marantz PMD661 steady-state recorder with a sampling rate of 44.1

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kHz. Participants completed the dominance measure at the end of the Italian session and the written Spanish proficiency measure at the end of the Spanish session.

3.4 Analysis

3.4.1 Acoustic analysis

Delayed repetition data were segmented and analyzed in Praat (Boersma & Weenink, 2022). Critical segments were coded as [-cont] where occlusion was present (i.e., interruption of energy in the spectrogram and absence of amplitude in the waveform; where visible, presence of a release burst) and [+cont] otherwise. Figure 1 demonstrates target-like [+cont] production of intervocalic /b/ in Spanish; Figures 2 and 3 show target-like [-cont] production of equivalent tokens in English and Italian.

****INSERT FIGURE 1 HERE****

****INSERT FIGURE 2 HERE****

****INSERT FIGURE 3 HERE****

3.4.2 Statistical analysis

Unless stated otherwise, all analyses and data visualizations were done using R Statistical Software (v4.1.3, R Core Team, 2022). For the group-level analysis, we conducted a mixed-effects logistic regression model on the participants' production of intervocalic /b d g/ segments. Data were fitted using the *glmer* function of the *lme4* package (v1.1-29; Bates et al., 2015). The binary dependent variable was [+/- cont], with [-cont] coded as 1 and [+cont] as 0. We first fit the random-effects structure using the *anova* function; the best fit included by-item and by-subject intercepts and a by-subject slope over Language. We then fit the fixed effects, starting with a simple effect of Language (reference category: English) and building hierarchically with Phoneme (reference category: /b/), Dominance, and their interactions. The final model's fixed

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effects included Language, Phoneme, and their interaction (Stop ~ Language * Phoneme + (1 | Item) + (1 + Language | Participant) (see Appendix C for models and model comparisons). We used the *parameters* (v0.18.1; Lüdecke et al., 2020) package to calculate the estimates' odds ratios and 95% confidence intervals and the *emmeans* package (v1.7.4-1; Lenth, 2022) to obtain estimated marginal means and planned Tukey-corrected pairwise comparisons and to plot the group-level Language*Phoneme estimated marginal means (Figure 4).

To determine individual transfer patterns, we followed Cabrelli and Pichan (2021) and ran McNemar tests in IBM SPSS Statistics (Version 28.0) to compare the proportion of [-cont] segments in the L3 versus English and Spanish. If the English test was significant and the Spanish was not, we labeled the transfer pattern 'Spanish'; we labeled the inverse outcome as 'English'. If both tests were significant, we labeled the pattern as 'Combined'. Cases in which neither test was significant and thus inconclusive (n = 5, including two from Cabrelli & Pichan) were excluded from individual-level analysis. Individual-level data were plotted using *ggplot2* (v3.3.6; Wickham, 2016) (Figures 5-6). Alpha was set to .05 for all analyses.

4. Results

4.1 Group-level results

The output of the mixed logistic regression (Table 5) included a significant main effect of Language and a significant Language*Phoneme interaction.

****INSERT TABLE 5 HERE****

For the main effect of Language, odds ratios indicate that participants were approximately 90 times more likely to produce a [-cont] segment in English than in Spanish and eight times more likely to produce a [-cont] segment in English than in Italian. The planned Spanish-Italian

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comparison (z = 11.16, p < .001, *OR* = 12.89) indicated that participants were nearly 13 times less likely to produce a [-cont] segment in Spanish than in Italian. The significant interaction, illustrated in the estimated marginal means interaction plot in Figure 4, stemmed from a within-language difference in Italian between /b/ and /g/ (z = -2.81, p = .014, *OR* = 2.59) and /d/ and /g/ (z = -2.96, p = .008, *OR* = 2.83). As evident in the plot, between-language comparisons were significant for all three phonemes (all p < .05). Despite a significant difference between English and Italian /g/ (z = 2.60, p = .025, *OR* = 3.62), the magnitude is visibly smaller in the interaction plot than English and Italian /b/ (*OR* = 7.71) and /d/ (*OR* = 10.23). Visualization of the relative proximity of the Italian means to the English versus the Spanish means, coupled with the odds ratios between Italian and English versus Italian and Spanish, suggest a greater proximity of Italian to English than to Spanish.

****INSERT FIGURE 4 HERE****

4.2 Individual-level results

A review of the group-level data might generate the conclusion that the learners' Italian productions fall between the English and Spanish productions and that the dominant transfer pattern is combined (i.e., a reflection of influence from both background languages). However, the McNemar tests reveal a prominent pattern consistent with English transfer (see Appendix D for McNemar outcomes and odds ratios). Figure 5 plots the transfer patterns and differentiates between the sample from Cabrelli and Pichan (2021) (labeled 'original') and the 21 additional participants (labeled 'expanded').

****INSERT FIGURE 5 HERE****

Unlike the equal distribution between English and Spanish transfer in the original sample (n = 5 each), the prominent transfer pattern in the expanded sample is consistent with English (78%)

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compared with Spanish (22%). Comparing these L3 Italian learners with the HSs learning L3 Portuguese in Cabrelli and Pichan (2021) (Figure 6), all participants with English-like transfer patterns were learning L3 Italian. The other relevant pattern regards degree of dominance: As in Cabrelli and Pichan, there is no discernible dominance-based trend for English transfer, as indicated by the outcome of the model fitting process for the mixed effects logistic regression.

****INSERT FIGURE 6 HERE****

5. Discussion

At the group level, the L3 Italian pattern of intervocalic /b d ɡ/ production falls between English and Spanish production patterns. However, the individual data show that the dominant production pattern is [-cont] and therefore English-/L3-like, even in the absence of explicit instruction (Research Question 1). The data also indicate that individual variation cannot be explained by degree of dominance (Research Question 2). The current set of dominance scores, by virtue of being limited to a sample that tends to skew English-dominant in the Chicago area, covers a smaller range than in Cabrelli and Pichan (2021), which included Spanish-dominant L1 Spanish speakers. It is possible that, in a sample including Spanish-dominant heritage speakers, there would be a more discernible pattern; however, our results echo the lack of a relationship between degree of dominance and transfer pattern in the previous study. The question is, why did the majority produce [-cont] segments? Considering this data set in isolation, the fact that 91% of the sample is (categorically) English dominant might lead us to posit that dominance drove this outcome. This hypothesis would be in line with some previous findings on heritage bilinguals and L3 acquisition (see Section 2.2). However, none of the heritage L3 Portuguese participants in Cabrelli and Pichan (2021), all of whom were English-dominant, produced

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English-like data, a trend found throughout L3 research in English/Spanish bilinguals learning Portuguese. It is of note that the distinct outcomes for the L3 Italian and Portuguese learners would not be predicted by models that appeal to a primary role for a variable that privileges a single source as a default, whether it be global similarity, cumulative experience, or order of acquisition. Rather, explicit consideration of the potential for property-level differences driven by linguistic factors beyond similarity (e.g., salience, frequency, complexity) is limited to the Scalpel Model (Slabakova, 2017), and, more recently, an expansion of the Linguistic Proximity Model (Westergaard, 2021). Westergaard posits that these other factors can affect the strength of a structure's activation. In caseof a disparity in activation in the two previously acquired languages, the parser would select the more activated structure.

The objective of analyzing L3 Portuguese and L3 Italian as a single sample in Cabrelli and Pichan (2021) was to increase sample size, a perpetual challenge in L3 research. However, their outcome together with that of the current study underscore the need to keep L3s separate,rather than assuming that learners of related L3s will pattern together because the target phenomenon presents similarly cross-linguistically, even when context and exposure are held constant. Instead, we can (a) prioritize a greater variety of language triads and subject competing hypotheses to more varied crosslinguistic scrutiny and (b) home in more closely on moderating variables that have occupied a secondary plane in L3 research. Here, we discuss one of these moderating variables – salience – and address f related theoretical and methodological considerations.

5.1 Salience in L3 acquisition

While Cabrelli and Pichan (2021) could not determine whether explicit exposure to the phonological rule (i.e., that intervocalic /b d g/ are produced as [-cont] in English and Italian and

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[+cont] in Spanish) was deterministic in their original sample, we can discard it as explanatory *per se*, given that the present expanded sample was not taught the rule, and yet 78% of those participants produced [-cont] L3 patterns. In eliminating explicit knowledge from consideration, we are left with the proposal that salience drives the difference between L3 Italian versus L3 Portuguese. Specifically, in line with Gabriel (2018), we hypothesize that intervocalic voiced stop geminates in Italian input provide a robust duration cue to their [-cont] representation that could have a trickle-down effect on the mapping between the [-cont] underlying representation (UR) and [-cont] surface representation (SR) (as opposed to a Spanish-like mapping between a [-cont] UR and [+cont] SR). In addition to acoustic salience, we recognize the potential positive effect of functional load on the establishment of the Italian mapping, given the contrastive status of geminate versus singleton stops (see e.g., Boomershine et al., 2008, for discussion of salience of phonemic versus surface/allophonic contrasts). However, Payne (2005) reported very low functional load of two Italian voiced stop geminate/singleton contrasts (/b/~/b:/ = 2.36% and /d/~/d:/ = 0.54% of the total load of all geminate/singleton contrasts). To confirm this hypothesis, we need to test salience as a predictor by comparing L3 phenomena that vary in acoustic salience (and, ideally, functional load) while controlling for other linguistic variables, such as frequency, markedness, and articulatory complexity.

5.1.1 Testing the timing of the effects of salience

In their review of Gabriel et al. (2018), Lloyd-Smith and Kupisch (2023) note that a high degree of salience may override non-facilitative transfer driven by similarity or dominance. We ask whether salience can derail transfer otherwise driven by one of these other variables, or whether its role could be triggered in acquisition after non-facilitative initial transfer. That is, assuming a distinction between transfer and CLI (Footnote 1), would salience in the current scenario lead to

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(a) evidence for property-by-property transfer or (b) speeding up the acquisition process (whether on the surface or at the level of representation) after a short period of initial non-facilitative transfer driven by global similarity? While Kopečková et al. (2022) posit that acquisition is not possible at such an early stage, we consider this an empirical question that can be addressed via a targeted methodology.

The two most important elements to consider when testing between transfer and acquisition are phenomena and task type. First, the phenomenon needs to present distinctly in each language such that its status in neither previously acquired language matches the L3, as in Kopečková et al. (2022). Second, to verify whether target-like behavior reflects representation, the task should require learners to show that they have knowledge not just of what the L3 target is, but also what is *not* licit, and should measure perception to avoid the myriad intervening variables in production data. The optimal behavioral task, then, is a lexical decision task in which a listener hears a nonsense word and must judge whether it could be a licit word in the relevant language. While this paradigm has been used extensively in L3 lexical research (see Lemhöfer, 2023), the only lexical decision phonology data to our knowledge are reported in Mora (2017). *5.1.2 Salience and individual variation*

While the individual data show a dominant English-like production pattern, how do we account for the data consistent with the other patterns? For learners whose productions are Spanish-like, it is possible that they have used perceptual cues differently. First, there is ample evidence in the adult acquisition literature that input does not guarantee intake. Second, individual differences (IDs) in cognitive resources have been found to correlate with perceptual accuracy and/or processing. These can include working memory and attention (Darcy et al., 2015), phonological short-term memory (e.g., Inceoglu, 2019), and inhibitory control (Darcy et

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al., 2016) (see also Mora, 2017, for an example of ID measures in L3 phonological processing). The use of validated measures of these cognitive resources should be used in future research to better understand sources of individual variation.

5.2 Implications for the comparison of L3 phonological and morphosyntactic transfer

Perception data will also help determine whether individual variation in L3 phonology, which has not been observed in L3 morphosyntax to the same degree, is "a characteristic of phonetic and phonological acquisition only" (Kopečková et al., 2022) or a byproduct of modality. Speech production is a complex modality that, unlike the primary measures used in L3 morphosyntax research (e.g., judgment and preference tasks), involves perception, message planning, and articulation. Further, production tends to precede perception (see Wrembel et al., 2022 for L3 evidence). To compare apples to apples, we should focus more on perception data and define acquisition by perceptual acuity at the level of phonological representation. In doing so, we might find there are more similarities between L3 morphosyntax and phonology than we think.

5.3 Next steps

Beyond implementation of perception paradigms, future steps should address th study's limitations via additional phonological phenomena and L3s. Ideally, we would test larger samples of L3 Italian and L3 Brazilian Portuguese learners, pitting perception and production of underlying intervocalic voiced stops against (a) a phenomenon with more comparable salience in Italian and Brazilian Portuguese (e.g., the phonemic tense/lax front mid vowel contrast found in English but not Spanish[6] and/or (b) a a phenomenon not found in English or Spanish (e.g., the palatal lateral /ʎ/, whose contrastive status has been neutralized in most regions of the Spanish-speaking world). If salience moderates similarity, both groups should continue to pattern

[6] This distinction is neutralized in some varieties of Northern and Southern Italian.

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differently with underlying intervocalic /b d g/ and similarly with the other phenomena. If this outcome is not realized, we will go back to the drawing board in our effort to understand the intricacies of initial transfer in L3 acquisition.

Data availability statement

The data that support the findings of this study and all appendices are openly available in OSF at https://osf.io/ksxjw/?view_only=eb9776fdd4634566ae327dcfa2cd2f11.

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Tables

Table 1

Individual transfer patterns in L3 Italian by group, as determined by English vs. L3 and Spanish vs. L3 McNemar tests in Cabrelli and Pichan (2021).

	English transfer		Spanish transfer		Combined transfer*	
	n		*n*		*n*	
L1 English/ L2 Spanish (*n* = 5)	2	(40%)	2	(40%)	1	(20%)
L1 Spanish/ L2 English (*n* = 1)	1	(100%)	0	(0%)	0	(0%)
Heritage Spanish (*n* = 12)	6	(50%)	5	(42%)	1	(8%)
Total *(n = 18)*	9	(50%)	7	(39%)	2	(11%)

*Combined transfer = both McNemar outcomes $p > .05$.

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Table 2

Individual transfer patterns in L3 Portuguese by group, as determined by English vs. L3 and Spanish vs. L3 McNemar tests in Cabrelli and Pichan (2021).

	English transfer		Spanish transfer		Combined transfer	
	n		*n*		*n*	
L1 English/ L2 Spanish (*n* = 8)	1	(12 %)	5	(63%)	2	(25%)
L1 Spanish/ L2 English (*n* = 4)	1	(25%)	1	(25%)	2	(50%)
Heritage Spanish (*n* = 9)	0	(0%)	8	(89%)	1	(11%)
Total *(n = 21)*	2	(9%)	14	(67%)	5	(24%)

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Table 3

Age of acquisition, proficiency, dominance

N	AoA English (years)		AoA L3 (years)		Written proficiency Spanish (0-50)		Dominance (-218 to 218)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
34	3.52	2.94	20.05	1.72	34.44	7.44	37.47	29.87

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Table 4

Self-reported speaking and composite scores

Self-reported speaking Spanish (1-6)		Self-reported speaking English (1-6)		Self-reported composite Spanish (1-24)		Self-reported composite English (1-24)	
M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
4.90	1.10	5.74	.45	19.76	3.50	23.18	1.33

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Table 5

*Generalized linear mixed model output (Stop ~ Language * Phoneme + (1 | Item) + (1 + Language | Participant). Reference categories: English (Language), /b/ (Phoneme).*

	Stop		
Predictors	*Odds Ratios*	*CI*	*p*
(Intercept)	16.73	7.66 – 36.51	**<.001**
Language [Italian]	0.12	0.05 – 0.27	**<.001**
Language [Spanish]	0.01	0.00 – 0.02	**<.001**
Phoneme [/d/]	1.19	0.57 – 2.49	.640
Phoneme [/g/]	1.11	0.54 – 2.27	.785
Language [Italian] *Phoneme [/d/]	0.78	0.39 – 1.57	.487
Language [Spanish] * Phoneme [/d/]	1.35	0.62 – 2.94	.450
Language [Italian] * Phoneme [/g/]	2.37	1.18 – 4.74	**.015**
Language [Spanish] * Phoneme [/g/]	1.77	0.87 – 3.62	.116

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Figures

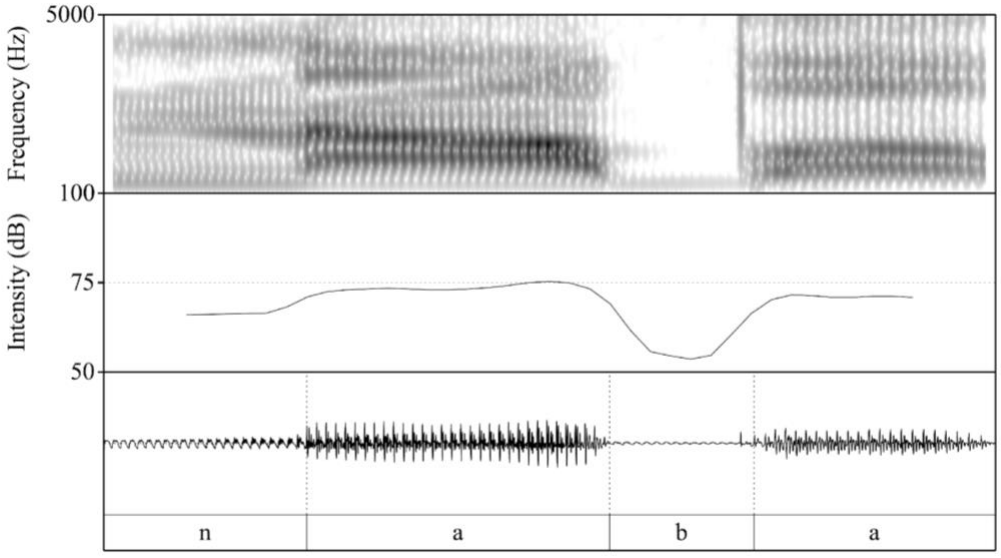

Figure 1. [-cont] production of /naba/ [ˈnɑ.bə] in English by participant HS 21.

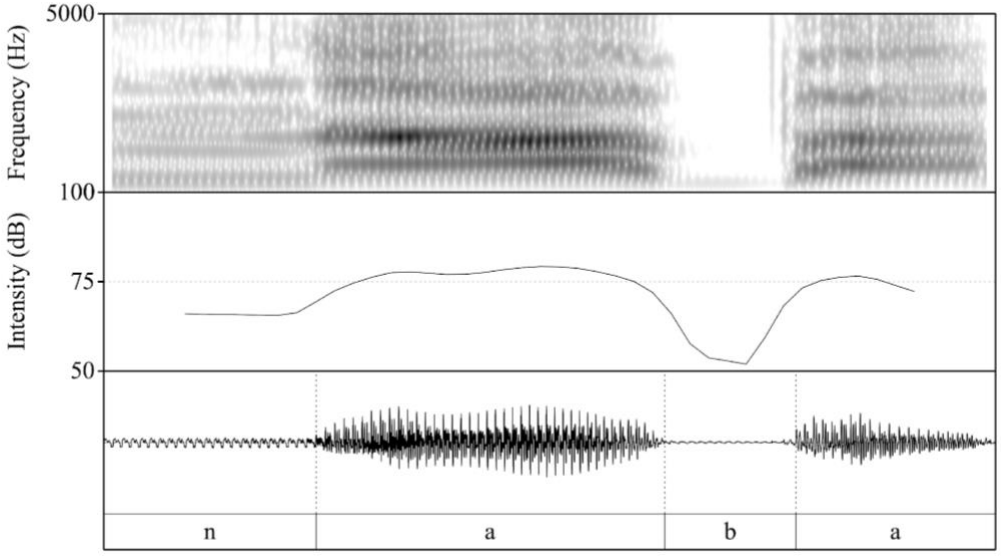

Figure 2. [-cont] production of /naba/ [ˈna.ba] in Italian by participant HS 28.

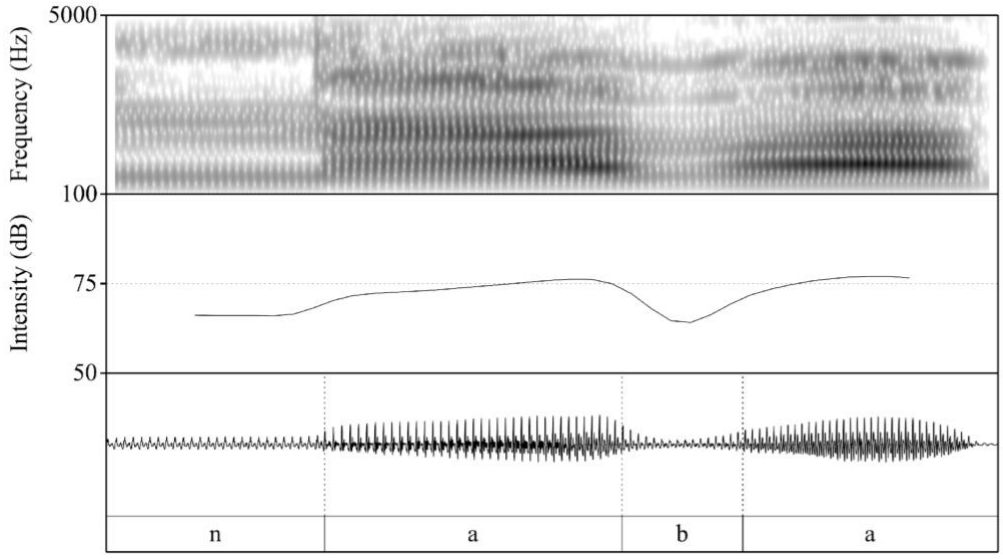

Figure 3. [+cont] production of /naba/ [ˈna.β̞a] in Spanish by participant HS 34.

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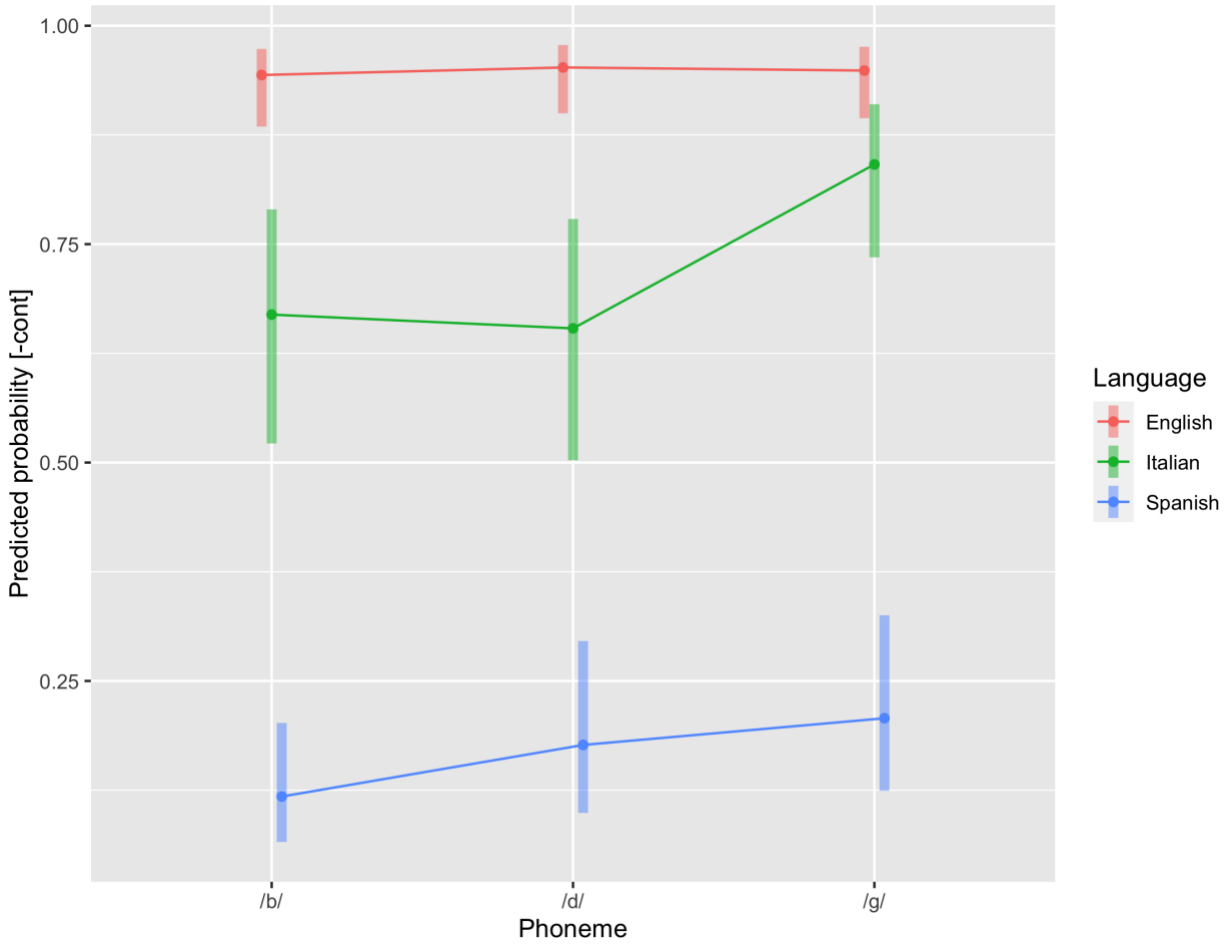

Figure 4. Predicted probabilities of [-cont] production in English, Italian, and Spanish by phoneme. Error bars represent 95% confidence intervals.

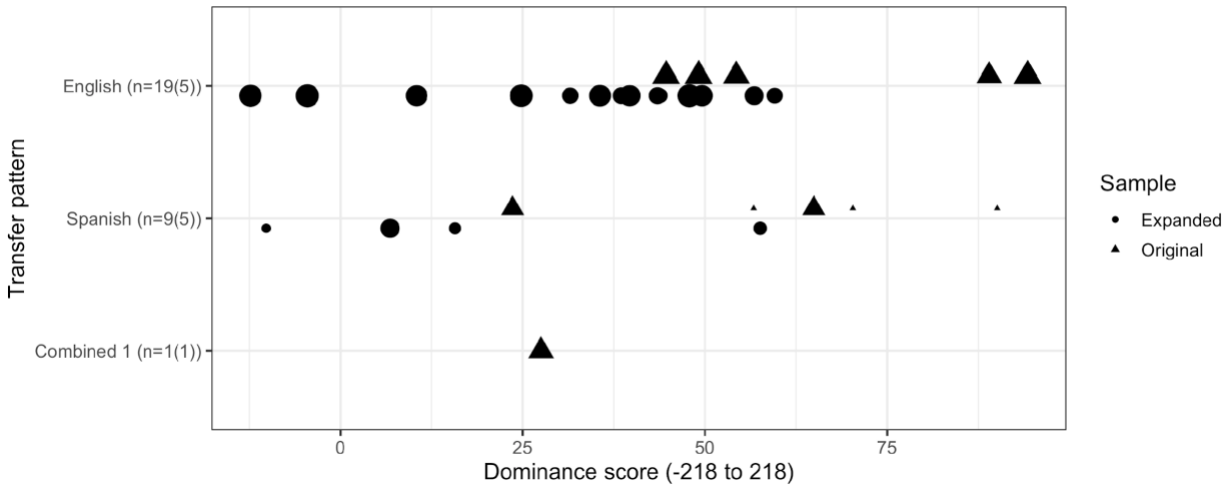

Figure 5. Individual transfer patterns according to McNemar tests and plotted by dominance score. Point sizes reflect the probability of producing a [-cont] segment in Italian (larger point size = greater probability).[7]

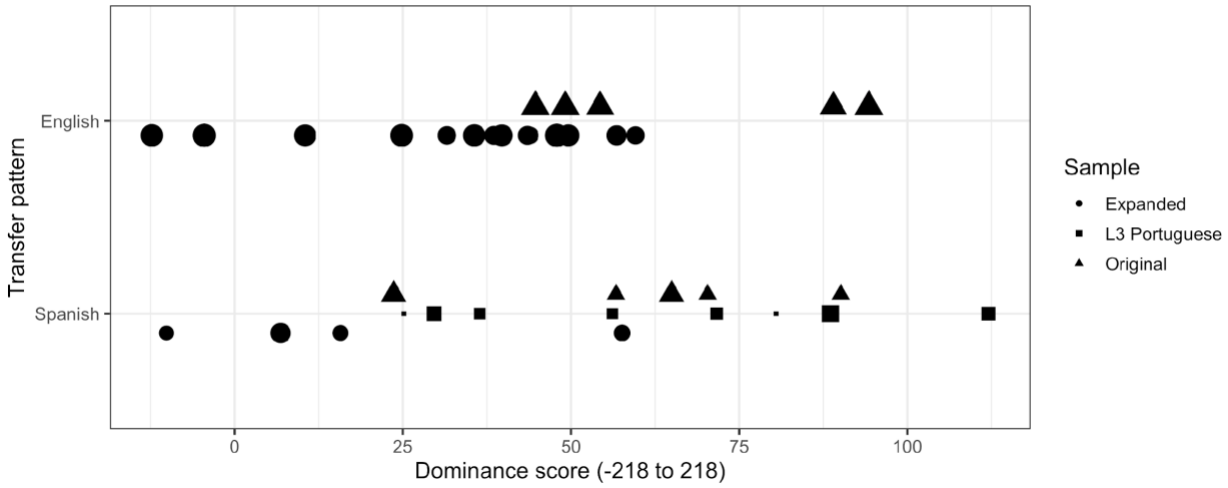

Figure 6. Individual transfer patterns of L3 Italian and Portuguese learners from Cabrelli and Pichan (2021) according to McNemar tests and plotted by dominance score. Point sizes reflect the probability of producing a [-cont] segment in Italian or Portuguese.

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[7] While we excluded data from participants with inconclusive McNemar outcomes, the odds ratios (Appendix D) suggest an English-like pattern in four out of five cases.