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Lexical Conservatism in phonology: theory, experiments, and computational modeling

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Lexical Conservatism in phonology: theory, experiments, and computational modeling

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Doctor of Philosophy in Linguistics

by

Canaan Breiss

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ABSTRACT OF THE DISSERTATION

Lexical Conservatism in phonology: theory, experiments, and computational modeling

by

Canaan Breiss

Doctor of Philosophy in Linguistics

University of California, Los Angeles, 2021

Professor Bruce Hayes, Chair

In my dissertation I examined the interaction of the phonological grammar and lexicon through the lens of Lexical Conservatism (Steriade, 1997). Lexical Conservatism is a theory about what kinds of lexical and phonological factors influence speakers' decision about how to pronounce a novel word. The hypothesis of Lexical Conservatism states that speakers avoid creating novel allomorphs, and instead preferentially recruit other stem allomorphs from elsewhere in a morphosyntactic paradigm to resolve marked structures created by affixation. I probed these questions using three experiments on English stress placement (chapter 2), and two experiments on Spanish mid-vowel diphthongization (chapter 3).

I found that English words which have phonologically advantageous Remote Bases are produced on a free-response task with right-shifted stress more often than nouns which do not. This effect only holds for individual participants who know both the Local and Remote Bases. The lexical qualities of the Remote Base such as semantic similarity and frequency, as well as classical phonological factors such as the Stress-to-Weight Principle and the avoidance of long lapses, also impact the stress placement in the novel form. I also find that the role of the Remote Base can be influenced on the level of the individual trial by priming, indicating that the Remote Base is actively recruited from the lexicon by the phonology, implying a rich and dynamic interaction unfolding over time and across grammatical domains.

I modeled this grammar-lexicon interaction in a Maximum Entropy Harmonic Grammar framework, proposing a new theory where each Base in the lexicon gets to exert a pull on the novel derivative, which is cross-cut by markedness considerations (chapter 4). This model incorporates information about the lexical status of the Remote Base into a contemporary constraint-based phonological framework by treating the lexicon as prior on the accessibility of different words to the grammar (chapter 5).

The dissertation of Canaan Breiss is approved.

Kie Zuraw

Claire Moore-Cantwell

Megha Sundara

Bruce Hayes, Committee Chair

University of California, Los Angeles

2021

To all the friends I found along the way.

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to continue in Indo-European Studies and wanted to change degree programs in the start of my first year at UCLA.

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VITA

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CHAPTER 1

Introduction

1.1 Introduction

This dissertation[1] is about Lexical Conservatism, a phenomenon first observed by Steriade (1997) and Burzio (1998), and developed largely by Steriade and collaborators in the over two decades since. Lexical Conservatism describes a correlation in the lexicon between the phonological shape of stem allomorphs in a paradigm, and the types of morphophonological alternations that word-formation processes induce in members of that paradigm. This dissertation focuses on two instances of Lexical Conservatism: one in English, and one in Spanish.

Steriade (1997) initiated her discussion of Lexical Conservatism with the observation that English words fall into two different classes with respect to stress placement under affixation. She notes that words that have a morphologically related form that exhibits rightward-shifted stress preferentially undergo rightward stress shift when affixed with the affix *-able*, whose status with regard to morphological level has long been debated (see, for example Aronoff, 1976). Thus, the form *cómpensate*, the compositional source that I term the *Local Base*, yields an affixed coining *compénsable*, which I term the *Derivative*, which undergoes rightward stress shift to relieve the long lapse created by the affix. On the other hand, the Local Base *ínundate* yields *ínundable* with fixed stress, despite the lapse. This difference, Steriade argued, stems not from the Local Bases *cómpensate* and *ínundate* themselves, but rather from the other members of the morphological paradigms they are embedded in. Specifically, *cómpensate* has a morphologically related form *compénsatory*, which I term the *Remote Base*, with stress on the second syllable, while *ínundate*

[1] All data, code, and simulation materials associated with this dissertation can be found on the OSF repository at https:osf.ioucj7e?view_only=bee0b72d233b429c8329ea473bf7fe68.

has no such related form with a similar shape, **inún-d.* Steriade argued that speakers shift stress rightward in *compénsable* because the presence of *compénsatory* allows them to remain faithful to the stress placement of *some* morphological relation of *cómpensate*, while still repairing the *LAPSE violation. In *ínundable*, on the other hand, speakers have no such recourse, and so remain faithful to stress placement in the Local Base *ínundate*, at the expense of the more marked lapse in the Derivative. This dependency between the existence of a phonologically-advantageous stem allomorph and the shape of the Derivative is what leads Steriade to dub the phenomenon "Lexical Conservatism".

We can classify the types of paradigm members in Steriade's theory as in table 1.1, which demonstrates terminology I use throughout the dissertation.

Local Base	Remote Base	Derivative
ínundate	-	*ínundable* ~ *inúndable*
cómpensate	*compénsatory*	*cómpensable* ~ *compénsable*

Table 1.1: Distribution of paradigm members according to Steriade (1997).

This dissertation contains the one of the first extensive controlled experimental investigation of Lexical Conservatism in English,[2] and also extends to a novel case of Lexical Conservatism in Spanish mid-vowel diphthongization wherein some cases of unstressed *e* [e] and *o* [o] alternate with stressed *ie* [je] and *ue* [we]. This alternation is generally thought of as being phonotactically motivated, reducing the markedness of unstressed diphthongs. I ask if, given a stressed diphthong, will speakers rely on their knowledge of Local Base's morphological paradigm to infer whether it can be *monophthongized* once stress is removed from it in a novel Derivative, as evidenced by other stem allomorphs in its paradigm. An example of two related forms of this

[2]It is important to note that a study reported in Steriade and Stanton (2020) also examples the phenomenon experimentally, but takes a different tack, using more targeted stimulus selection that demonstrates the existence of Lexical Conservatism, but not its interaction with other phonological and lexical factors.

type are *niébla* ∼ *neblína* "fog, mist" and *muéble* ∼ *moblár* "furniture, to furnish". The Spanish case also allows us to ask a new question about the role of the Remote Base. Three types of Local Base exist in Spanish, those that have no Remote Base (*hueco*, "gap"), those that have a phonologically-optimizing Remote Base, which I term *benign* (*muéble* ∼ *moblar*, which allows the emergence of classical phonologically-optimizing Lexical Conservatism as discussed in the literature via the Derivative *moblóso*), and finally those that have a Remote Base whose phonological properties are not markedness-improving which I term *malign* (*juérga* ∼ *juerguísta* "spree, reveler"). Thus, we can directly test whether participants are sensitive to a Remote Base which is not phonologically-optimizing.

The table in 1.2 below illustrates how the Spanish cases align with the terminology used above in English.

Local Base	Benign Remote Base	Malign Remote Base	Derivative
ungüénto, siniéstro	-	-	*ungüentóso* ∼*ungontóso, siniestróso* ∼*sinestróso*
muéble, niébla	*moblár, neblína*	-	*mueblóso* ∼*moblóso, nieblóso* ∼*neblóso*
juérga, ambiénte	-	*juergísta, ambientál*	*juergoso* ∼*jorgoso, ambientóso* ∼*ambentóso*

Table 1.2: Demonstration of the paradigmatic structure and relations relevant to the current study of Spanish monophthongization.

Data from five experiments motivates a novel theoretical proposal about the nature of the grammar-lexicon relationship and how it gives rise to Lexical Conservatism. The analysis is implemented in a MaxEnt framework (Smolensky, 1986; Goldwater and Johnson, 2003), and addresses the role of processing in influencing motivating Base effects and how phonological theory can encompass them.

1.1.1 Why study Lexical Conservatism?

There have been numerous cases of the type of dependency that characterizes Lexical Conservatism noted in the descriptive and theoretical literature in the time since Steriade first proposed the idea (Burzio, 1998; Bat-El, 2002; Asherov and Bat-El, 2016; Pertsova, 2005; Pertsova and Kuznetsova, 2015; O'Brien, 2007; Steriade, 2008; Bonet and Torres-Tamarit, 2010; Gunkel, 2010, 2011; Steriade, 2012; Simonović, 2012; Simonović and Baroni, 2014; Steriade and Yanovich, 2015; Steriade and Stanton, 2020; Guekguezian and Jesney, 2021). However, there has only been recently a resurgence of interest in the theoretical significance of the data pattern. Recent work by Steriade herself, as well as in collaboration with Juliet Stanton, has begun to situate the status of Lexical Conservatism in the space of other possible "Base" effects, such as Paradigm Uniformity (see Steriade and Stanton (2021)), including an interest in the dual role of frequency and paradigm structure in conditioning whether or not Derivatives resemble their Local or Remote bases.

Although Steriade's original findings were significant, there are many questions that remain unresolved regarding Lexical Conservatism. Below I give an overview of some of these topics, and how they are addressed in the dissertation.

1.2 Summary of issues

1.2.1 Gradience

Although Steriade noted that there were exceptions to some of the generalizations she made in her 1997 paper, this has not been followed up on in later work. I found that although the broad pattern of Lexical Conservatism she noted was indeed reproduced in both her original items and also the new Local Bases, the effect is probabilistic, with exceptions in both directions. That is, if a participant knew the Remote Base *compénsatory*, they still occasionally produced Derivatives like*cómpensable* that resembled the Local Base *cómpensate*, and conversely, if a participant didn't know the Remote Base, sometimes the Derivative had shifted stress relative to the Local Base (*compénsable*).

1.2.2 Priming and the role of lexical characteristics

One determinant of the variability noted above is demonstrated to be the lexical characteristics of the Remote Base. I found that by asking participants to declare their knowledge of the Remote Base before carrying out the Derivative-formation task, I could increase the chance of the Derivative resembling that Remote Base. Crucially, this behavior only emerged in cases where the participant answered affirmatively to knowing the Remote Base (i. e., the Remote Base cannot be "taught" on the spot to the participant through mere exposure without context.) This suggests that the status of the lexicon in real time is relevant to the outcomes of the phonological grammar. I also found a persistent inhibitory effect of semantic similarity between the Local and Remote Bases, such that Derivatives whose Remote Base is semantically similar to the Local Base are less influential, all things considered, than Remote Bases that are more semantically dissimilar. I discuss the significance of this pattern, and how it can be related to the dynamics of resting activation and inhibition in the lexicon in retrieval and speech production.

1.2.3 Benign vs. malign Remote Bases

Experiments 3, 4, and 5 manipulated whether the Remote Base was phonologically optimizing (which I term *benign*, as in *lábor* $\sim$ *labórious*) or phonologically non-optimizing (which I term *malign*, as in *resíde* $\sim$ *résident*). Malign Remote Bases are a test case for whether markedness alone influences Base choice, or whether there are other considerations involved. In experimental work on English, I found that there were almost zero forms like *résidable*, where the Derivative matches the malign Remote Base *résident* , while there were numerous cases of Derivatives like *labórable*, where the Derivative matches the benign Remote Base *labórious*. In contrast, in the experiments on Spanish diphthongization, participants' Derivative formation reflected the influence of both the benign Remote Base. That is, when there was a Local Base *muéble* "furniture" with a benign Remote Base *moblár* "to furnish", speakers exhibited more markedness-reducing monophthongization in Derivatives, like *moblóso* "full of furniture" than when there was no Remote Base at all, as in the case of *hueco* "(a) hole", with Derivative *hocóso* "full of holes". When the Local Base had a malign Remote Base, however, as in *juérga* "spree" with malign Remote Base *juergísta* "reveller", participants exhibited *less* monophthongization in Derivatives than when there was no Remote Base present at all, contradicting Steriade's assumption that Lexical Conservatism is phonologically optimizing.

1.2.4 A "voting" theory of Bases

To account for these facts, in Chapter 4 I propose a new grammatical model which holds that Lexical Conservatism is an emergent effect that is epiphenomenal to the grammar and lexicon, and is best captured by a model of the phonological grammar where different listed allomorphs compete for realization in the Derivative, with their influence scaled by their resting activation (a quantity influenced by, among others, priming, salience, frequency, semantic similarity to the Local Base). I demonstrate schematically that the behavior seen in English (classical Lexical Conservatism, with only benign Remote Bases having an impact on Derivative formation) and the more unexpected behavior seen in Spanish (where both malign and benign Remote Bases play a role) emerge from the proposed framework under differing strengths of markedness and faithfulness. The fact that pressures favoring paradigmatic uniformity arise when markedness is weak, as in Spanish, suggests that the theory I proposed to account for Lexical Conservatism may be sufficient to account for many cases of Paradigm Uniformity discussed in the literature, and may be a good candidate for a general theory of Base accessibility and the effects that arise from the interplay of morphological paradigm structure and the phonological grammar. I also demonstrate that the frameworks proposed by Steriade (1997) and by Steriade and Stanton (2020) are less ideal models of the phenomenon, particularly in the light of the Spanish data showing influences of both benign and malign Remote Bases.

1.3 Conclusion

The dissertation treats a classical phonological phenomenon using contemporary experimental and computational methods. I find that the canonical facts hold, but are cross-cut and influenced by a range of gradient phonological and lexical factors, suggesting dynamic interplay between grammatical principles of markedness housed in the phonology, and psycholinguistic characteristics of the lexicon. Based on these findings, I propose a new framework of Base accessibility which proposes that processing plays a role in a competition among Bases for realization in the Derivative. The proposed model makes novel connections between phonological theory and psycholinguistics, as well as predictions about how these factors should interact. It is my hope and intent that in future this theory will be computationally implemented and experimentally tested, so that its strong typological claims can be supported or refined by contact with with broader empirical data.

CHAPTER 2

Lexical Conservatism in English stress

2.1 Introduction

This chapter offers three controlled experimental studies with linguistically-naïve subjects further probing Steriade's findings on English stress, and provides a more precise picture of the interaction between the phonology and the lexicon during the creation of novel word forms.

2.2 Summary of Steriade (1997) on English

Recall the taxonomy of Base types laid out in chapter 1, which kicked off Steriade's inquiry into the role of paradigm structure in word formation.

Local Base	Remote Base	Derivative
ínundate	-	*ínundable* ∼*inúndable*
cómpensate	*compénsatory*	*cómpensable* ∼*compénsable*

Table 2.1:

To test the generality of her observation, Steriade carried out an informal reading-aloud study. She asked 22 linguistically-trained participants to read aloud Derivatives formed by adding *-able* to a range of Local Bases (available in table 2.2, in section 2.4.1.2 below), and noted whether their response matched that of the Local (as in *cómpensable*) or the Remote Base (*compénsable*). The results of her survey by and large supported her theoretical proposal; however, some of the Local

Bases which had a benign Remote Base did not follow the pattern. For example, while *íllustrate*, with transparently related Remote Base *illústrative* yielded *illústrable*, Local Bases such as *íntegrate* and *cóncentrate*, with semantically distant Remote Bases *intégrity* and *concéntric*, yielded Local Base-matching Derivatives *íntegrable* and *cóncentrable*, not *intégrable* and *concéntrable*. Steriade hypothesized that this was because of the opaque semantic relationship between the Local and Remote Bases, which might make speakers hesitant to draw on the Remote Base in these cases.

2.3 Unpacking Lexical Conservatism

Since their publication, Steriade's findings have been recognized to be revealing about the interaction between grammar and lexicon, with implications both for psycholinguistic models of grammar-lexicon interaction and phonological theories of word-formation (Burzio, 2002; Albright, 2002; Bermádez-Otero, 2011; Rolle, 2018). The phenomenon of Lexical Conservatism broadly construed as a dependence between existing allomorphs and phonological process application has also accrued a growing number of empirical cases (a possibly exhaustive list is Burzio (1998) on Italian, Bat-El (2002); Asherov and Bat-El (2016) on Modern Hebrew, Pertsova (2005); Pertsova and Kuznetsova (2015) on Russian, O'Brien (2007) on Irish, Steriade (2008) on Romanian, Bonet and Torres-Tamarit (2010) on Catalan, Gunkel (2010, 2011) on Ancient Greek, Steriade (2012) on Latin, Simonović (2012); Simonović and Baroni (2014) on Serbo-Croatian, Steriade and Yanovich (2015) on Ukrainian, Steriade and Stanton (2020) on English, Guekguezian and Jesney (2021) on Chukchansi Yokuts, and Breiss (this dissertation, chapter 3) on Spanish). However, as I argue below, there are several respects in which the assembled data do not clearly delimit the status of the phenomenon in the synchronic grammar, since almost all studies after Steriade (1997) have used existing lexical data (with the notable recent exception of Steriade and Stanton (2020)). Thus, a range of possibilities remain open for what status Lexical Conservatism might have in the synchronic grammar of a given speaker, and thus how it should be modeled in phonological theory.

One way in which the results described above under-determine a completely explicit analysis is that Steriade did not test how readily speakers produce Derivatives formed from Local Bases that did *not* have phonologically advantageous Remote Bases. That is, we do not know the *base rate* at which Derivatives match their Local Bases in stress placement in the absence of a Remote Base (although it seems that Steriade tacitly assumed it was 100%) — p(stress shift | Remote Base exists) is presumed to be different from p(stress shift | Remote Base does note exist), but the second quantity was never examined. Thus we do not know whether Lexical Conservatism is probabilistic (with Derivatives shifting stress *more often* when there is a Remote Base) or categorical (given a Remote Base, the Derivative *always* exhibits stress shift).

Further, we do not know whether morphologically-related forms that have a non-optimizing form with respect to the relevant markedness constraint play a role in Derivative formation. For example, in English the Remote Base *résident* for the verb *resíde* which differs in stress placement but in such a way that, if it exerted a pull on the Derivative, would *increase* markedness, rather than keep it steady or reduce it. In light of this question, I will distinguish the two types of Remote Bases by calling phonologically-optimizing Remote Bases *benign*, for example *compénsatory* is a benign Remote Base to Local Base *cómpensate*; and phonologically non-optimizing Remote Bases *malign*, such as *résident* to *resíde*. This distinction takes a back seat until section 2.6, however, since Steriade only considered benign Remote Bases, under the assumption that any Remote Base involvement in Derivative formation had to be optimizing.

Finally, and more subtlely, Steriade's data don't actually distinguish between a grammatical mechanism for Lexical Conservatism where the mere presence of a benign Remote Base makes the Derivative more likely to stress shift, and the account she assumes, where the presence of a Remote Base actually encourages the Derivative to resemble it specifically. This is because she primarily examined cases where there was only one alternative post-tonic syllable in the stem of the Local Base that could host the stress, which also happened to be the location of stress in the Remote Base (as in *átom* ∼ *atómic*). Experiment 3 yields data that distinguish these two possibilities using trisyllabic Local Bases (as in *ánalog* ∼ *análogy* vs. *vítriol* ∼ *vitriólic*), and is discussed at length in section 2.6.

The results reported in Steriade (1997) are also unclear in exactly what role the lexicon is playing in determining the shape of the Derivative. Steriade assumed that all non-nonce words known to a speaker were accessible in a "output lexicon" and that these words were accessible at all times during Derivative-formation. Although she readily acknowledges that this idealization is likely impacted by factors such as word frequency, she leaves as a topic for future research (Steriade, 1997:section 2)[1]. Contemporary psycholinguistic evidence seems to broadly align with Steriade on this point: it is a fairly well-established finding that many, if not most, words (morphologically simple as well as complex) are encoded in the lexicon to some degree (see, for example, Hay, 2003:among others). The strength of the lexical representation is generally taken to depend on the frequency of the form in question, as well as possibly the degree to which that item is unpredictable given the phonological grammar (see Moore-Cantwell, *ms*). There is also a growing body of research demonstrating that a word or morpheme's lexical characteristics — both static qualities such as global frequency, as well as dynamic qualities like resting activation which can be manipulated in real time via priming — influence its phonological behavior. Bybee (1985) long ago noted a correlation between verb frequency and a tendency to be irregular, a finding which is carried forward in Smith and Moore-Cantwell (2017)'s more recent work that demonstrates that frequent words are more likely to behave idiosyncratically with respect to the general phonological grammar, demonstrating in the domain of word-level morphophonology the general finding of Morgan and Levy (2016) in binomial expression ordering (ex., *bishops and seamstresses* vs. *seamstresses and bishops*). Zuraw (2007); Zuraw and Peperkamp (2015); Zuraw et al. (2020) find that alongside frequency, priming manipulations can influence the phonological behavior of morphologically complex words. Steriade's finding that semantic opacity blocks the phonological optimization of the Derivative could therefore also fall into this class of lexical effects in phonology.

In sum, Steriade's original findings suggest a strong connection between grammar and lexicon, although it is not possible to conclude with great detail exactly what the nature of this connection is. Therefore, there is much to be gained by studying Lexical Conservatism in more

[1] She also suggests that even extremely-predictable nonce formations, such as nouns with antepenultimate stress in *-ídity* formed to adjectives in *-id*, might play a role, but does not bring data to bear on the question. Unfortunately, this question remains outside the scope of this thesis as well.

detail. In the sections that follow, I take up this task in three nonce-word production experiments.

2.4 Experiment 1

Experiment 1 replicated the findings of Steriade (1997) using more controlled task and a larger sample of Local Bases.

2.4.1 Methods

2.4.1.1 Participants

36 undergraduate students were recruited from the UCLA SONA Psychology Subject Pool, and were compensated with course credit. Data from 5 were excluded because they did not self-report having spoken English since before the age of 7, leaving data from 31 subjects included in the analysis reported below.

2.4.1.2 Materials

The 29 Local Bases with benign Remote Bases which Steriade included in her 1997 study were included as stimuli, [2] as well as 28 of the forms Steriade noted as not having the requisite Remote Base. Because most of the 57 Local Bases drawn from Steriade's experiment were already suffixed (ex., *illustr-ate, obfusc-ate, domestic-ate*), speakers could create Derivatives either by stripping the derivational affix to access the stem, or attaching the new affix to the existing stem. For example, the Local Base *íllustrate* (Remote Base *illústrative*) can form Derivatives *illustrable* and *illustratable.* To make sure the effect was general to morphologically-simple Local Bases (that is, those not affixed with *-ate* to start with), I chose an additional 30 unsuffixed Local Bases with benign Remote Bases, and 32 Local Bases without, such as *lábor* (benign Remote Base *labórious*) and *pláster* (no Remote Base). Because of this mixture of morphologically-complex and morphologically-

[2] Steriade actually only used 26/29 of these items in her survey, as some were noticed after conducting the study; see Steriade (1997:p. 22).

simple Local Bases, I used a reading-aloud task in Experiment 1 to limit participants' production choices to those of vowel quality and stress placement; this choice is discussed in more detail below in section 2.4.1.3. A complete list of stimuli from Experiment 1 is displayed in table 2.2.

Four affixes were chosen for testing: *-able, -ism, -ify,* and *-ity*. *-able* and *-ism* were combined with the 57 Local Bases drawn from Steriade (1997), and the other two were combined with the novel Local Bases. Due to experimenter error, *-ity* was included even though it typically attaches to adjectives, rather than nouns. In spite of this, speakers did not treat this affix differently than the other selectionally appropriate affixes, and do not exhibit reluctance to produce Derivatives with it (see table 2.3 and figure 2.3).

Each Local Base (shown in 2.5) was combined with both designated affixes to create 234 Derivatives, the target stimuli. For each Derivative, a carrier sentence was created which gave a periphrastic definition of the Derivative using the Local Base. For example, for the Local Base *íllustrate* and the affix *-ism*, the carrier sentence was "*An ideology which centers on illustrating could be called illustrism.*" Minor alterations to this template were made depending on the affix and part of speech of the Local Base.

Note that although the word *granític* is an attested form for some speakers, it was not known to me, and therefore I doubt constituted a striking confound to the experimental participants. Note also that certain Local Bases like *nylon* and *rubric* contain subsequences (*-on* and *-ic*) that are elsewhere affixal and may exert influences on the stress of the Base. It is not known how exactly such subsequences might affect the current experiment, but I doubt they did so strongly, since, until it was pointed out, my own intuitions did not judge either word to be at all pseudo-morphologically-complex (in comparison, for example, to a word like *oblong* that seems, intuitively to have morphological structure, though not one licensed by any synchronic grammatical rule of English.)

Local Base	Remote Base	Affixes	Source
carrot	—	*-ify, -ity*	Novel
cotton	—	*-ify, -ity*	Novel

Table 2.2 continued from previous page

Local Base	Remote Base	Affixes	Source
denim	—	*-ify, -ity*	Novel
diamond	—	*-ify, -ity*	Novel
fennel	—	*-ify, -ity*	Novel
flannel	—	*-ify, -ity*	Novel
fungus	—	*-ify, -ity*	Novel
garlic	—	*-ify, -ity*	Novel
granite	—	*-ify, -ity*	Novel
leather	—	*-ify, -ity*	Novel
lettuce	—	*-ify, -ity*	Novel
lumber	—	*-ify, -ity*	Novel
marble	—	*-ify, -ity*	Novel
mushroom	—	*-ify, -ity*	Novel
muslin	—	*-ify, -ity*	Novel
nylon	—	*-ify, -ity*	Novel
onion	—	*-ify, -ity*	Novel
pepper	—	*-ify, -ity*	Novel
plaster	—	*-ify, -ity*	Novel
protein	—	*-ify, -ity*	Novel
pumice	—	*-ify, -ity*	Novel
resin	—	*-ify, -ity*	Novel
rubber	—	*-ify, -ity*	Novel
rubric	—	*-ify, -ity*	Novel
silver	—	*-ify, -ity*	Novel
spandex	—	*-ify, -ity*	Novel
spinach	—	*-ify, -ity*	Novel
tartan	—	*-ify, -ity*	Novel

Table 2.2 continued from previous page

Local Base	Remote Base	Affixes	Source
turnip	—	*-ify, -ity*	Novel
velvet	—	*-ify, -ity*	Novel
acid	acidic	*-ify, -ity*	Novel
agent	agentive	*-ify, -ity*	Novel
angel	angelic	*-ify, -ity*	Novel
artist	artistic	*-ify, -ity*	Novel
atom	atomic	*-ify, -ity*	Novel
autumn	autumnal	*-ify, -ity*	Novel
carbon	carbonic	*-ify, -ity*	Novel
cherub	cherubic	*-ify, -ity*	Novel
courage	courageous	*-ify, -ity*	Novel
demon	demonic	*-ify, -ity*	Novel
ether	ethereal	*-ify, -ity*	Novel
habit	habitual	*-ify, -ity*	Novel
icon	iconic	*-ify, -ity*	Novel
insect	insecticide	*-ify, -ity*	Novel
justice	justiciable	*-ify, -ity*	Novel
logic	logician	*-ify, -ity*	Novel
magic	magician	*-ify, -ity*	Novel
metal	metallic	*-ify, -ity*	Novel
moment	momentous	*-ify, -ity*	Novel
moron	moronic	*-ify, -ity*	Novel
music	musician	*-ify, -ity*	Novel
novice	novitiate	*-ify, -ity*	Novel
office	official	*-ify, -ity*	Novel
organ	organic	*-ify, -ity*	Novel

Table 2.2 continued from previous page

Local Base	Remote Base	Affixes	Source
parent	parental	*-ify, -ity*	Novel
person	personification	*-ify, -ity*	Novel
pirate	piratical	*-ify, -ity*	Novel
program	programmable	*-ify, -ity*	Novel
sentence	sentential	*-ify, -ity*	Novel
super	superfluous	*-ify, -ity*	Novel
abdicate	—	*-able, -ism*	Steriade
accelerate	—	*-able, -ism*	Steriade
agitate	—	*-able, -ism*	Steriade
allocate	—	*-able, -ism*	Steriade
ameliorate	—	*-able, -ism*	Steriade
annihilate	—	*-able, -ism*	Steriade
communicate	—	*-able, -ism*	Steriade
dedicate	—	*-able, -ism*	Steriade
educate	—	*-able, -ism*	Steriade
eradicate	—	*-able, -ism*	Steriade
examine	—	*-able, -ism*	Steriade
exterminate	—	*-able, -ism*	Steriade
generate	—	*-able, -ism*	Steriade
illuminate	—	*-able, -ism*	Steriade
investigate	—	*-able, -ism*	Steriade
irrigate	—	*-able, -ism*	Steriade
nominate	—	*-able, -ism*	Steriade
penetrate	—	*-able, -ism*	Steriade
pollinate	—	*-able, -ism*	Steriade
precipitate	—	*-able, -ism*	Steriade

Table 2.2 continued from previous page

Local Base	Remote Base	Affixes	Source
predicate	—	*-able, -ism*	Steriade
procrastinate	—	*-able, -ism*	Steriade
prognosticate	—	*-able, -ism*	Steriade
propagate	—	*-able, -ism*	Steriade
relegate	—	*-able, -ism*	Steriade
remunerate	—	*-able, -ism*	Steriade
resuscitate	—	*-able, -ism*	Steriade
segregate	—	*-able, -ism*	Steriade
tolerate	—	*-able, -ism*	Steriade
venerate	—	*-able, -ism*	Steriade
attribute	attribution	*-able, -ism*	Steriade
compensate	compensatory	*-able, -ism*	Steriade
concentrate	concentric	*-able, -ism*	Steriade
confiscate	confiscatory	*-able, -ism*	Steriade
contemplate	contemplative	*-able, -ism*	Steriade
contribute	contribution	*-able, -ism*	Steriade
(take) custody	custodian	*-able, -ism*	Steriade
demonstrate	demonstrative	*-able, -ism*	Steriade
domesticate	domesticity	*-able, -ism*	Steriade
equilibrate	equilibrium	*-able, -ism*	Steriade
infiltrate	filter	*-able, -ism*	Steriade
illustrate	illustrative	*-able, -ism*	Steriade
impregnate	pregnant	*-able, -ism*	Steriade
incorporate	incorporeal	*-able, -ism*	Steriade
inculpate	inculpable	*-able, -ism*	Steriade
indicate	indicative	*-able, -ism*	Steriade

Table 2.2 continued from previous page

Local Base	Remote Base	Affixes	Source
influence	influential	*-able, -ism*	Steriade
integrate	integrative	*-able, -ism*	Steriade
interrogate	interrogative	*-able, -ism*	Steriade
intuit	intuition	*-able, -ism*	Steriade
obfuscate	obfuscatory	*-able, -ism*	Steriade
oblige	obligate	*-able, -ism*	Steriade
expurgate	purgatory	*-able, -ism*	Steriade
reciprocate	reciprocity	*-able, -ism*	Steriade
remediate	remedial	*-able, -ism*	Steriade
remonstrate	remonstrance	*-able, -ism*	Steriade
sequester	sequestrate	*-able, -ism*	Steriade
designate	signatory	*-able, -ism*	Steriade
assimilate	similitude	*-able, -ism*	Steriade

Table 2.2: Local Bases for the Lexical Conservatism task in Experiment 1, listed with Remote Base (if any), the affixes they were combined with, and the source (novel in this experiment, or from Steriade (1997)).

2.4.1.3 Procedure

Participants completed the experiment individually in a sound-attenuated room in the presence of a member of the study team (the primary researcher, a trained Research Assistant, or both). After giving informed consent to participate in the experiment, participants completed a language background questionnaire, followed by the Lexical Conservatism task.

Participants were assigned to one of four randomization lists, and were told that they would be reading definitions of possible new English words. They were advised that some of the words might sound a little unusual, or might not be exactly how they'd choose to express a certain concept (for example, one might prefer to call an ideology centered around illustrating "illustrationism" or simply "an illustration cult"), but that they should pronounce the stimuli however felt most natural to them. Participants were instructed to read the sentence to themselves silently in their head, and then say the last word of the sentence, the Derivative, out loud. I used a reading task because pilot data indicated that if simply prompted to fill in a blank, given a Local Base and an affix (ex., *illustrate* + *-able*) participants would not strip the affix (here *-ate*) from the Local Base to access the stem, saying Derivatives such as *ìllustráteable*, whose stress placement is uninformative with respect to the Base used. The reading-aloud task was similar to the method used by Steriade, see Steriade (1997:p. 15), and due to the nature of English orthography, does not distinguish stress placement, allowing the speaker to choose either option of interest without orthographic bias. After the researcher guided participants through six practice trials, they completed the 234 Lexical Conservatism task trials at their own pace.

After the Lexical Conservatism task, a vocabulary questionnaire was administered, hereafter called the *knowledge check*. Participants were asked to read each Local Base out loud, and indicate whether they knew the word or not. They were instructed that in this context, "knowing the word" meant that they wouldn't need to stop and ask what the word meant if they heard it in conversation. Participants were also instructed that if hadn't heard the word before but could deduce its likely meaning from its constituent morphemes, they should still indicate that they did not have prior knowledge of the word in question. After the list of Local Bases, participants were asked to read aloud and indicate whether they knew each Remote Base, for the half of Local Bases which had them. The entire experiment took approximately an hour.

2.4.2 Data annotation

On each experimental trial, the researcher manually noted where the primary stress fell in the form produced. In ambiguous cases, the participant was asked to repeat the word, and in cases of sustained ambiguity participants were asked which syllable in the word that they were saying sounded the strongest to them. In cases where participants vacillated between multiple different pronunciations of a given Derivative, the last one produced by the participant before continuing on was chosen.

For analysis, each participant's responses were processed in the following way. The dependent variable, stress placement in the Derivative, was calculated by comparing each Derivative's stress placement to that participant's stress placement in the corresponding Local Base, and coded as either matching or mismatching. Further, each Derivative was coded for whether the participant indicated knowing the Local Base and (if extant) the Remote Base, so as to relativize the effect of Lexical Conservatism to the lexicon of each speaker. This avoids the assumption that all speakers know all relevant Local and Remote Bases.

2.4.3 Data exclusion

Trials on which the participant did not know the Local Base (ex., *obfuscate* in *obfuscable* and *obfuscism*) were excluded from analysis. Further, trials containing the Local Base *designate* were excluded because participants frequently pronounced its Derivatives *designable, designism* as though they were based on the word *design*, as in [dəˈza͡ɪnəbəl, dəˈza͡ɪnɪzm]. Trials of the Local Base *inculpate* were also excluded because the Remote Base *culpable* was excluded from the *knowledge check* due to experimenter error.[3]

2.4.4 Statistical analysis

Statistical analysis was carried out in R (R Core Team, 2021) using Bayesian hierarchical logistic regression implemented using the `brms` package (Bürkner et al., 2017). Bayesian models estimate the posterior distribution of credible values for the statistical parameters of interest by integrating prior information (if any) about the likely values of the parameters with information in the data being analyzed. For a linguistically-oriented introduction to Bayesian methods for both theory-building and data analysis, see Nicenboim and Vasishth (2016); for tutorial materials on the `brms` package in a linguistic context, see Nalborczyk et al. (2019); Vasishth et al. (2018); for a more

[3]Note that even if the error had not caused the exclusion of the Remote Base, data from the Local Base *inculpate* would have needed to be excluded because the *-able*-affixed Derivative *inculpable* is in fact a dictionary-listed word.

general primer in Bayesian modeling, see Kruschke (2014).

Common summary statistics for the posterior distribution are the median (corresponding conceptually, though not mathematically, to the maximum likelihood estimate obtained from frequentist models fit using the popular `lme4` package), and the range of values contained in the central 95% the distribution, a measure known as a 95% Credible Interval (abbreviated "95% CI", followed by upper and lower bounds in square brackets). Another way of assessing the evidence for an effect is by calculating the proportion of posterior credible values which lie to one side of zero; this measure ranges from 0.5 (equal evidence for a null effect as a non-zero effect in the direction of the parameter's coefficient) to 1 (extremely strong evidence for a nonzero effect in the direction of the parameter's coefficient). Both methods are reported in this paper.

All models used dummy-coding for binary fixed effects, meaning that the intercept was coded as the reference level, and the coefficient for the fixed effect can be read in the change in the dependent variable when the property of interest (ex., knowing the Remote Base, having a heavy post-tonic syllable, etc.) is positive or present relative to the intercept. The meaning of the intercepts and each fixed effect is detailed in the tables reporting the statistical results. The models also used default weakly-informative Bayesian priors unless specified locally, and four Markov chains were run using the No-U-Turn Sampler to draw samples from the posterior distribution, with with a burn-in period of 1000 iterations followed by a sampling period of 9000 iterations. In all reported models, the $\hat{R}$ values were non-problematic 1 ± 0.01; the *adapt delta* parameter was set to 0.9 and the *maximum treedepth* was 10; for details on the interpretation of these metrics in the context of a Bayesian workflow, see Schad et al. (2021).

2.4.5 Results

2.4.5.1 Evidence for Lexical Conservatism

The first question we can ask is simply whether the generalization made in Steriade (1997) holds: does the presence of a benign Remote Base in a participant's lexicon make Derivative more likely to undergo stress shift? Figure 2.1 plots the proportion of Derivatives whose stress placement matches that of the Local Base, in words with and without Remote Bases known to the participant. The facets of the plot divide the data by source, novel to this experiment vs. taken from Steriade (1997).

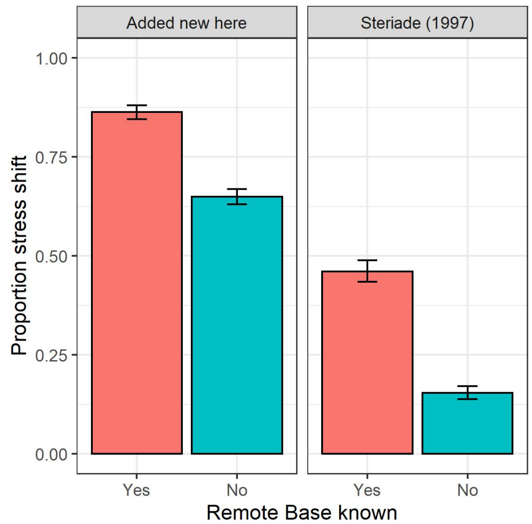

Figure 2.1: Means and binomial confidence interval of the proportion of stress shift in Derivatives in Experiment 1, split by knowledge of the Remote Base (horizontal axis) and source of the Local Base (facets).

It is clear that the presence of a Remote Base in a participant's lexicon increases the likelihood of stress shift. This finding is confirmed by the results of the statistical model presented below in table 2.3. It is interesting to note that Steriade's Local Bases have a notably lower rate of stress shift than the novel ones do; I speculate that this is due to a difference in lexical stratum, with Steriade's words belonging to the Latinate stratum of the English lexicon, unlike most of the new words. Nevertheless, the effect of the Remote Base is robust across both groups.

Another aspect of these data is that unlike Steriade's original formulation of the hypothesis, it is evident that the effect is not categorical. This implies that sometimes participants who know the relevant Remote Base still match the Local Base in Derivative stress placement, and sometimes participants who don't know the Remote Base still violate faithfulness to Local Base to repair the long lapse with stress shift. Though Steriade's original work displays hints of this kind of optionality (specifically in study responses on pp. 22-23), she does not discuss the data in depth.

Here we ask what factors condition this type of variation, and find that the effects fall into two classes, phonological and lexical.

2.4.5.2 Phonological influences on probabilistic Lexical Conservatism

It is well known that syllable weight and secondary stress both affect primary stress placement in English (cf. Chomsky and Halle, 1968; Hayes, 1982; Burzio, 1994; Pater, 2000). Affixes also influence stress placement with some theories proposing a binary distinction between stress-neutral and stress-affecting affixes (Siegel, 1974), or proposing by-affix propensities to trigger stress shift (cf. Zuraw and Hayes, 2017; Zymet, 2018; Shih, 2018). To examine the role of these factors in influence stress placement in the Derivative, I fit a model which predicted Derivative Stress (0 = faithful to the Local Base, 1 = stress shift) on the basis of whether the Remote Base was known, and Affix identity (*-able, -ism, -ity, -ify*). I also used two metrical well-formedness principles, both referring to the status of what I term here the "target syllable", namely the syllable in the Derivative to the right of the stress placement in the Local Base (the underlined syllable in *rémedy, párody, íllustrate*, etc.): the weight of the target syllable (levels 0 = *light* as in *indicate*, 1 = *heavy* as in *inundate*), and whether the target syllable hosted secondary stress in Local Base (levels 0 = *no* as in *cústŏdy*, 1 = *yes* as in *ícòn*). The model also included random intercepts for subject, Local Base, and unique Derivative (that is, the unique combination of affix + Local Base; ex., *plaster-ity* and *plaster-ify* are two different levels of this random effect), with random slopes of all fixed effects by subject, and of Remote Base Known and Affix by Local Base.

Table 2.3 contains a summary of the fixed effects of the model, which are plotted in figure 2.2. Positive coefficients indicate an increase in the log-odds of stress shift relative to the Local Base.

As anticipated by figure 2.1, we the statistical model indicates that knowledge of the Remote Base increases the chance of stress shift, following the prediction of Steriade's formulation of Lexical Conservatism. However, this finding is cross-cut by expected phonological influences on stress placement in English. Heavy target syllables increase the log-odds of a Derivative shifting stress to satisfy the Stress-to-Weight principle (Pater, 2000). This finding bears out the discussion in Steriade (1997:p. 20).

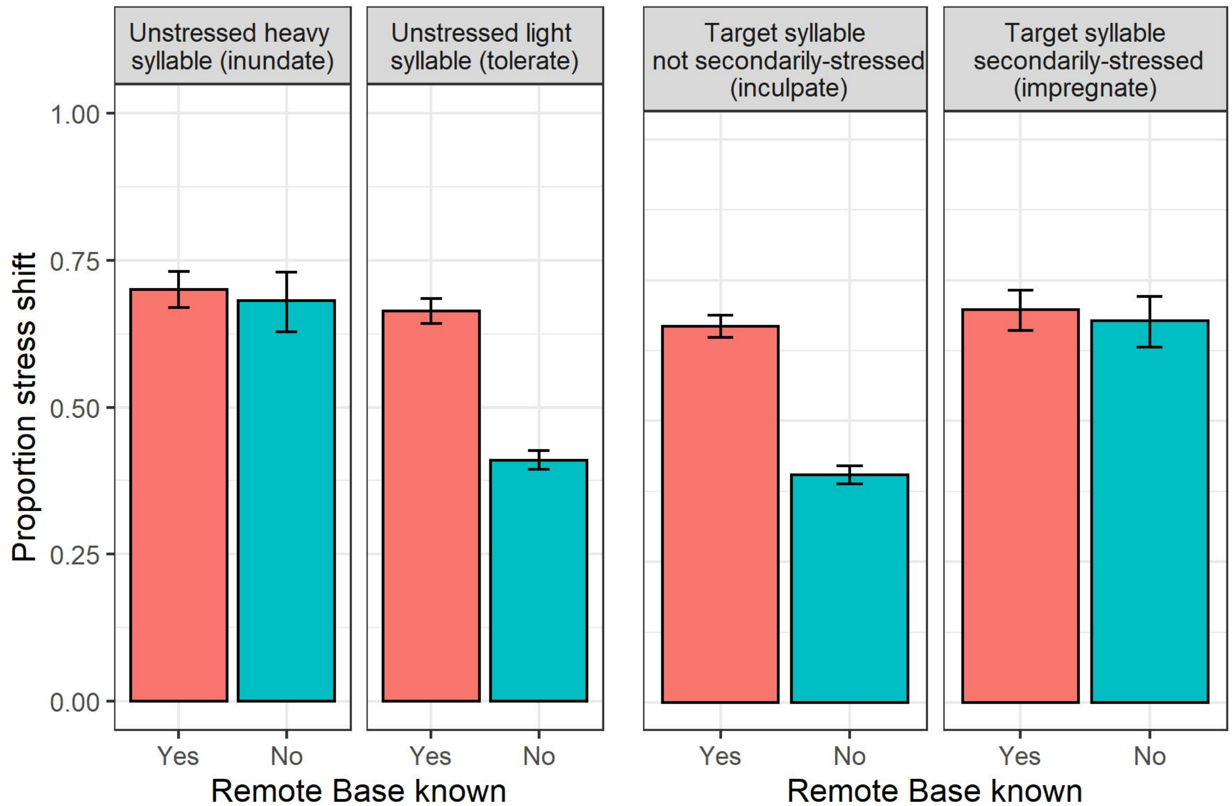

Figure 2.2: Means and binomial confidence interval from Experiment 1 of the proportion of Derivative stress placement, split by knowledge of the Remote Base (horizontal axis), and weight and secondary stress on the target syllable (facets).

Secondary stress on the target syllable is also a predictor of stress placement in Derivatives, indicating that there is a diminished faithfulness penalty for promoting to full stress a vowel which already has secondary stress in the Local Base. Another compatible cause of this effect is that because secondarily-stressed vowels are protected from vowel reduction in English, placing primary stress in the Derivative on a secondarily-stressed vowel in the Local Base avoids the faithfulness violation associated with having to "un-reduce" an underlyingly unstressed vowel, which would require creating a novel vowel quality unmotivated by the Local Base.

On visual inspection, figure 2.2 might lead to the conclusion that the effect of Remote Base *only* matters in Local Bases where the target syllable is light and not secondarily-stressed. Since there is no theoretical reason to suspect that the attractive force of the Remote Base is zeroed

Parameter	*Median*	*95% CI*	*P* $(\|\hat{\beta}\| > 0)$
Intercept:			
Affix = *-able*,			
Know Remote Base = *no*			
Target Syllable Heavy = *no*,			
Target Syllable Secondary Stress = *no*	-2.21	[-2.93, -1.50]	
Target Syllable Heavy = *yes*	0.86	[0.11, 1.66]	0.99
Target Syllable Secondary Stress = *yes*	1.27	[0.46, 2.15]	≈ 1
Affix = *-ify*	2.37	[1.53, 3.21]	≈ 1
Affix = *-ism*	-0.58	[-0.95, 0.22]	≈ 1
Affix = *-ity*	4.17	[3.34, 5.05]	≈ 1
Know Remote Base = *yes*	1.30	[0.74, 1.84]	≈ 1

Table 2.3: Model of Experiment 1, all Local Bases. Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

out in such forms, I suspect that what we see in the data is rather a confounding side-effect of the distribution of weight and secondary stress in target syllables created by the combination of two different types of stimuli (those from Steriade (1997) and novel ones). This hypothesis is supported by the fact that the apparent interaction does not occur in Experiment 2 (see figure 2.5), where all of the Local Bases are of the same approximate lexical stratum, and further don't require stripping *-ate*.

We also find, as expected, that individual affixes exert their own distinctive preferences on the stress patterns of the Base.

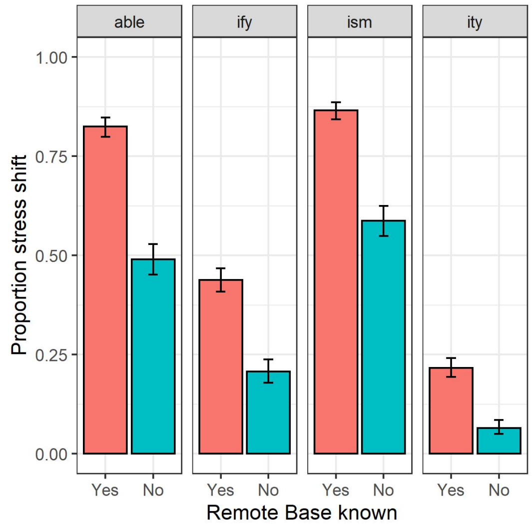

Figure 2.3: Mean and binomial confidence interval of the proportion of stress shift in Derivatives from Experiment 1, split by knowledge of the Remote Base (horizontal axis) and affix in the Derivative (facets).

2.4.5.3 Lexical influences on probabilistic Lexical Conservatism

Recall from section 2.2 that not all Local Bases Steriade examined behaved the same way: certain Local Bases, despite having Remote Bases which were phonologically optimizing, did not form stress-shifted Derivatives. Steriade hypothesized this was due to the opaque semantic relationship between the Local and Remote Bases, but also noted that the absolute or relative frequency of the Remote Base itself might play a role. In this section, I examine whether lexical characteristics of the Remote Base — specifically semantic similarity to the Local Base and overall frequency — influence the form of the Derivative.

To approximate Remote Base frequency, I used the HAL metric of log-frequency from the English Lexicon Project database (Balota et al., 2007). I operationalized semantic similarity using the coefficients extracted from the similarity judgment study reported in appendix A. Both of these predictors were centered and scaled before being entered into the regression model with the same structure as the one fit above, with the addition of the interaction of the semantic similarity and Remote Base log-frequency measures. The effects of the lexical characteristics of interest are plotted in figure 2.4., and the results of this model are shown in table 2.4 below.

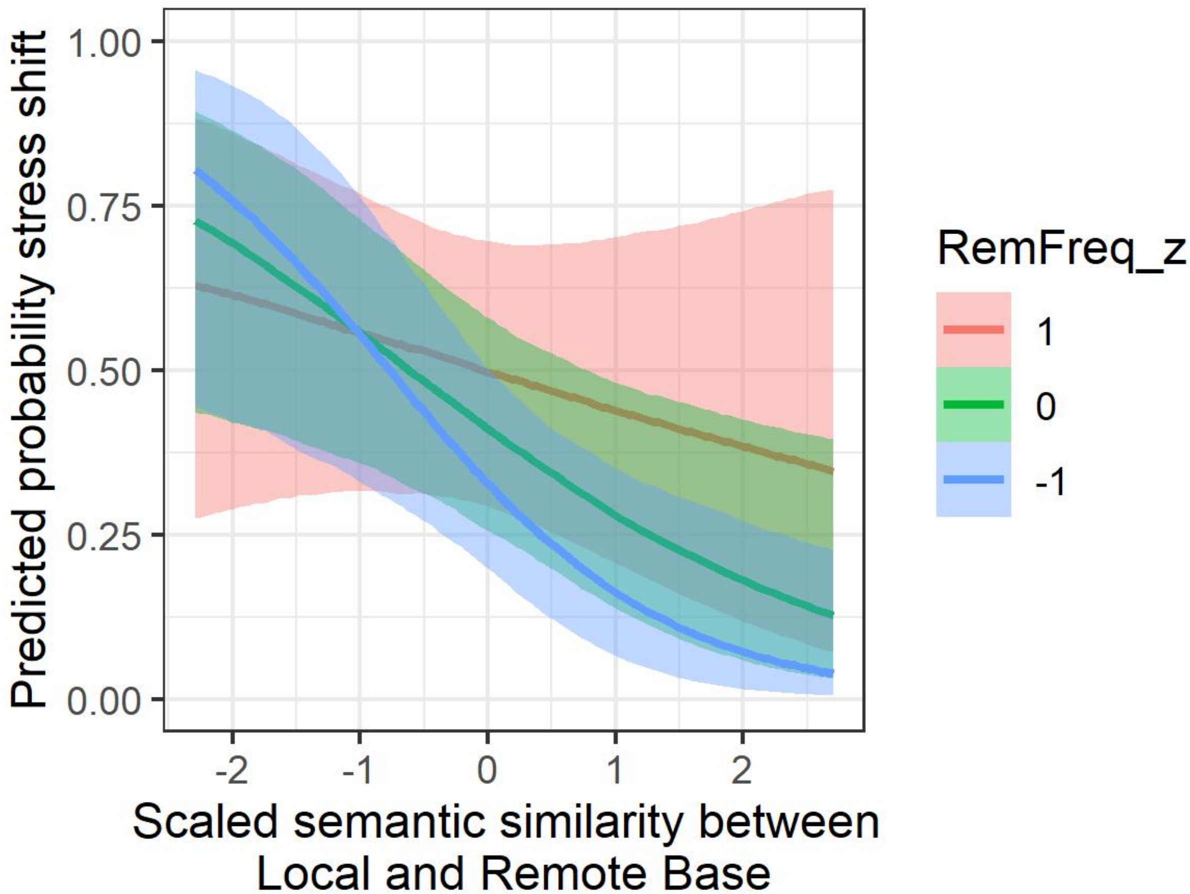

Figure 2.4: Predicted marginal effects of static lexical characteristics of the Remote Base — semantic similarity and Remote Base log frequency, and their interaction — on Derivative stress placement from Experiment 1. Solid lines indicate the mean of the posterior distribution of credible values for the marginal effect, with shaded regions encompassing 95% of the credible values. Note that "RemFreq_z" indicates the continuous variable of centered and scaled Remote Base log-frequency.

The model provides provides robust evidence for static lexical characteristics of the Remote Base playing a role in Derivative formation: increased semantic similarity between the Remote Base and Local Base decreases the influence of the Remote Base on the Derivative, and is moderated by Remote Base frequency, such that frequent Remote Bases exert a stronger effect on the

Parameter	*Median*	*95% CI*	*P* ($\lvert\hat{\beta}\rvert > 0$)
Intercept:			
Semantic sim., Rem. freq. = *average values*			
Affix = *-able*			
Target Syllable Heavy = *no*			
Target Syllable Secondary Stress = *no*	-0.36	[-1.07, 0.32]	
Target Syllable Heavy = *yes*	1.12	[0.17, 2.15]	0.99
Target Syllable Secondary Stress = *yes*	0.52	[-0.65, 1.71]	0.81
Affix = *-ify*	1.92	[0.92, 2.98]	0.99
Affix = *-ism*	-0.59	[-1.17, -0.03]	0.99
Affix = *-ity*	3.81	[2.73, 4.98]	≈ 1
Semantic similarity (*scaled 1-unit increase*)	-0.58	[-1.06, -0.13]	0.99
Remote Base freq. (*scaled 1-unit increase*)	0.35	[-0.02, 0.72]	0.97
Remote Base freq. $\times$ Semantic similarity	0.35	[-0.07, 0.77]	0.95

Table 2.4: Model of Experiment 1, only Local Bases with the Remote Base known. Coefficients are in log-odds, with positive signs indicating an increase in probability of stress shift relative to the intercept.

Derivative, despite high semantic similarity. Thus is unexpected, because the effect of semantic similarity runs in the opposite direction to Steriade's hypothesis about semantic transparency facilitating the use of the Remote Base. The effect of Remote Base frequency is more interpretable, and follows Steriade's speculation. This makes intuitive sense given the known effect of word-frequency on lexical retrieval more broadly: a Local Base whose Remote Base is more frequent forms a Derivative which is more likely to show the influence of that Remote Base. I return to the interpretation of these lexical effects, in particular the semantic similarity, in chapter 5.

2.4.6 Discussion

Experiment 1 gave evidence broadly supporting the claim made by Lexical Conservatism about the role of the lexicon in forming novel words, and also revealed that the presence or absence or a Remote Base is not uniquely determinative in whether a Derivative's stress placement will match it's Local Base. Derivative stress placement is also affected by syllable weight and stress status, as well as affix-specific propensities. Experiment 1 also yielded evidence that lexical characteristics of the Remote Base — its frequency and semantic similarity to the Local Base — play a role in Derivative formation.

However, it is important to explore possible alternative explanations for the data above. One possibility is that Steriade's findings, as well as the ones in Experiment 1, were a side-effect of borrowing and lexical structure, rather than the result of a process in the synchronic grammar. Most of the words in Steriade's study were part of the Latinate lexical stratum of English, and on that basis alone are more likely to have morphologically related words which differ in stress placement. Since speakers are sensitive to lexical-stratum-specific phonological generalizations (see Ito and Mester, 1999; Moreton and Amano, 1999; Hayes, 2014), it is possible that speakers could have been using their probabilistic knowledge about the differing behaviors of lexical strata rather than relying on the presence of a specific Remote Base when forming a Derivative. Speakers have inferred from phonotactic cues to Latinate status in a Local Base that any Derivative has a higher probability of stress shift, thus yielding more stress shifted Derivatives in words with Remote Bases without the specific Remote Bases actually playing a role.

I test this hypothesis by looking only at Local Bases that have Remote Bases (regardless of whether they are known to the participant). If the divergent behavior of Local Bases with a Remote Base is due to the confound of lexical stratum rather than the actual presence of the Remote Base in the mind of the participant, we expect to find no additional increase in likelihood of Derivative stress shift if a participant knows the Remote Base. I refit the model described in section 2.4.5.3 with this subset of the data, and found that knowledge of the Remote Base still increases the likelihood of stress shift: $\hat{\beta} = 0.55$, 95%CI $[-0.16, 1.26]$, $P\left(|\hat{\beta}| > 0\right) = 0.94$).

2.4.7 Prospects for Experiment 2

Another way to test for the role of the lexicon in forming Derivatives is to manipulate the resting activation of the Remote Base in the lexicon via priming, and observe whether Derivatives with primed Remote Bases pattern differently than those with unprimed Remote Bases. This acts as a more stringent test for role of the Remote Base in Derivative formation, and can tell us whether our model of the mechanisms underlying Lexical Conservatism needs to be sensitive to only static characteristics of the Remote Base (existence, as well as possibly long-run frequency and semantic similarity to the Local Base), or static *and* dynamic factors, such as the resting activation of the Remote Base in the lexicon in the moment the Derivative is formed. This, in turn, informs the structure of our phonological theory, as discussed in chapters 4 and 5.

2.5 Experiment 2

Experiment 2 was similar in structure to Experiment 1, with the additional manipulation that some Remote Bases were "primed" before participants completed the Lexical Conservatism task with the relevant Local Base. Experiment 2 also included a phonotactic judgment task to confirm the presence of *Lapse-avoidance in English phonotactics which is argued by Steriade to motivate the stress shift made possible by the presence of the Remote Base.

2.5.1 Methods

2.5.1.1 Participants

Participant recruitment was the same as in Experiment 1. 34 participants were recruited from the UCLA SONA Psychology Subject Pool and completed the experiment, and data from one participant was excluded because they had not been speaking English consistently in some context since before the age of seven. Data from three others were excluded due to technical errors, leaving data from 30 participants to be analyzed.

2.5.1.2 Materials for the Lexical Conservatism task

Local Bases were 40 disyllabic nouns of English, balanced for the weight of the target syllable, whether the target syllable bore secondary stress, and whether or not they had a Remote Base. Some of the Local Bases were also used in Experiment 1. All of the Local Bases were free-standing stems; that is, there was no need for participants to strip an affix such as *-ate* from the Local Base *illustrate* to access the appropriate morphological stem for the intended Derivative. Stimuli for Experiment 2 are listed in table 2.5.

Two affixes were selected — *-able* and *-ic* — and were fully crossed with Local Bases so that each participant saw each affix attached to each Local Base. This yielded 80 unique Local Base + affix pairs in the Lexical Conservatism task.

Local Base	Remote Base
ballot	—
bankrupt	—
blizzard	—
buzzard	—
carrot	—
cuckold	—
denim	—
diamond	—
fungus	—
granite	—
lumber	—
nylon	—
orange	—
plaster	—
resin	—
scaffold	—

Table 2.5 continued from previous page

Local Base	Remote Base
spandex	—
spinach	—
thermos	—
velvet	—
autumn	autumnal
commerce	commercial
courage	courageous
essence	essential
ether	ethereal
finance	financial
habit	habitual
insect	insecticide
labor	laborious
major	majority
mammal	mammalian
modern	modernity
moment	momentous
office	official
parent	parental
person	personify
proverb	proverbial
sequence	sequential
substance	substantial
tumult	tumultuous

Table 2.5 continued from previous page	
Local Base	Remote Base

Table 2.5: Local Bases for the Lexical Conservatism task in Experiment 2, with the Remote Base if any.

2.5.1.3 Materials for the phonotactic judgment task

I created 20 pairs of four-syllable CV.CV.CV.CVC nonwords of English, with each pair differing only in whether stress was on the preantepenultimate or the antepenultimate syllable. In order to avoid confounds of vowel quality in the acceptability of stress placement, the first two syllables had either [ɚ] or [ʌ] as nuclei, which are allowed in both stressed and unstressed positions. The segmental structure of the nonwords was also controlled to as to avoid sequences which resembled affixes of English, since it is well-known that pseudo-morphemic parses affect phonotactic acceptability of nonwords in English (Coleman and Pierrehumbert, 1997; Needle et al., 2020), and that morphological structure is additionally a strong determinant of stress in English (cf., ex., Pater, 2000). This yielded pairs like those shown in table 2.6.

IPA
[fʌlɚʃɪno͡ʊf]
[jɚmʌko͡ʊlo͡ɪp]
[bɚvʌt͡ʃo͡ɪso͡ʊd͡ʒ]
[kʌθɚsətib]
[dʌzɚθəd͡ʒuv]
[t͡ʃʌlʌpənɪm]
[hɚvʌlo͡ʊtæz]
[d͡ʒʌlɚʃumo͡ʊs]
[bʌfɚləriv]
[fɚlʌzəkl̩]

Table 2.6 continued from previous page

IPA
[lɚvʌθo͡ʊkɚθ]
[pɚjʌkɚmo͡ʊd͡ʒ]
[d͡ʒɚjɚbətut͡ʃ]
[dɚʃʌnət͡ʃo͡ʊv]
[kɚmʌfo͡ɪrɪp]
[pʌnɚzuvit]
[ʃɚfʌfəml̩]
[jɚmʌwisɪʃ]
[dʌnɚmərik]
[fɚmʌnɚgo͡ɪt]

Table 2.6: Nonce monomorphemes for auditory presentation in the phonotactic judgment task in Experiment 2. Note that since the stress placement was the manipulated quality in this task, primary stress is not marked, but fell on the preantepultimate and antepenultimate syllable in each trial.

Unlike Experiment 1, Experiment 2 used audio presentation of all stimuli to avoid the possible confound of orthography in influencing participants' responses. I recorded a production of each Local Base and the two variants of each of the nonce words used in the phonotactic judgment task in a sound-attenuated room using Praat (Boersma and Weenink, 2021), then normalized these recordings to 70 dB. To accommodate the priming intervention in the experiment, Remote Bases were divided into two groups at random for separate knowledge checks.

2.5.1.4 Procedure

Experiment 2 was conducted over the internet using the Experigen experimental platform (Becker and Levine, 2020), due to COVID-19 restrictions on in-person gatherings. Participants were encouraged to seat themselves in a quiet room and use headphones for the duration of the experiment. Instructions and practice trials were similar to Experiment 1.

Experiment 2 contained four phases: a pre-task knowledge check for all Local Bases and the half of the Remote Bases to prime them, the Lexical Conservatism task, a post-task knowledge check for the other half of the non-primed Remote Bases, and then the phonotactic judgment task. In the pre-task knowledge check, participants saw each Local Base and half of the Remote Bases in the experiment, one at a time and in a random order. On each knowledge check trial they were asked to read the word aloud, and indicate whether they knew it, using the same criteria for "knowledge of a word" as in Experiment 1. Participants' verbal productions were recorded using the microphone on their computer.[4] Participants then proceeded to the Lexical Conservatism task: on each trial they heard an audio recording of one of the Local Bases, accompanied by one of the four affixes presented orthographically on the screen. Participants were instructed to wait while they listened to the word, and then combine the word they had heard with the affix on the screen and speak the result out loud, repeating a few times if necessary. After completing the 80 experimental trials, participants completed a second knowledge check on the other half of the Remote Bases withheld from the pre-task knowledge check. Finally, participants indicated whether they had been speaking English in some context regularly since at least before the age of 7.

The base knowledge checks were distributed around the main trials for the following reasons: first, exposing participants to certain Remote Bases before being asked to perform a task which potentially involved them, such as forming a Derivative from a morphologically-related Local Base, should increase the resting activation of those Remote Bases in the lexicon, and make them

[4] Since the experiment was carried out over the internet, there was very little control over the recording quality and setup of each individual participant. In general the data quality was reasonable, but three participants had to be excluded because of idiosyncratic errors where the participant's computer did not record audio on any trial.

possibly more likely to exert an effect on the form of the Derivative. Second, in order to detect potential mismatches between participants' individual pronunciation of Local Bases and that of the experimenter, participants were asked to produce all Local Bases before hearing them in the experimental task so their unbiased pronunciation could be recorded.

Finally, participants completed the phonotactic judgment task. On each of 20 trials, participants heard a pair of nonwords differing only in stress placement, one with preantepenultimate stress and the other with antepenultimate stress (e.g. [ˈfələ˞ʃɪno͡ʊf] vs. [fəˈlə˞ʃɪno͡ʊf]). Participants were instructed to choose the one which sounded more English-like to them. After the phonotactic judgment task, participants completed a brief language background questionnaire. The experiment was entirely self-paced, and took approximately 40 minutes.

2.5.2 Data annotation

Each participants' recorded productions were manually coded by author for the location of the primary stress. As in Experiment 1, the stress placement in each Derivative was compared to that in the relevant Local and Remote bases, and coded either matching or mismatching the Local Base. In the case of multiple repetitions of the same Derivative recorded on the same trial, the last one was chosen.

2.5.3 Data exclusion and analysis

Data exclusion criteria was identical to that of Experiment 1, with the addition that the combinations of Local Bases *person* and *habit* with the affix *-able* were excluded because they were real words. Further, 160 trials were excluded because the participant did not report knowing the relevant Local Base, and 81 trials were excluded due to difficulty understanding the Derivative produced because of poor recording quality.

Because Experiment 2 gathered information about both individual subjects' propensity to shift stress rightward to satisfy *Lapse in the Derivative, as well as their preference for preantepenultimate vs. antepenultimate stress in nonwords, I used a Bayesian multivariate logistic regression model to analyze both subjects' responses to the Lexical Conservatism task as well as the phonotactic judgment task.

The model structure is as follows: for the Lexical Conservatism task, the dependent variable was whether the stress placement in the Derivative matched that of the Local Base (= 1) or the Remote Base (= 0). The model included as fixed effects the weight of the target syllable (*light* = 0 vs. *heavy* = 1), whether the target syllable bore secondary stress (*no* = 0 vs. *yes* = 1), Affix (*-able* = 0 vs. *-ic* = 1), and whether the subject knew the Remote Base (*no / none exists* = 0 vs. *yes* = 1). The model contained random intercepts for subject, Local Base, and Derivative (Local Base + Affix combination), with random slopes of all fixed effects by Subject, a random slope of affix and whether the Remote Base was known by Local Base, and a random slope of whether the Remote Base was known by Derivative. For the phonotactic judgment task, the dependent variable was whether the preferred stress placement was antepenultimate (= 0) or preantepenultimate (= 1). The model contained only random intercepts, one for subject, and the other for nonword pair. The random intercepts for subject across Lexical Conservatism and phonotactic judgment tasks were modeled as correlated, which allowed us to share information about possibly subject-specific correlation in responses across the sub-models, reducing the uncertainty in the estimates due to the individual subject variation. For simplicity's sake, the two dependent variables are reported and discussed here separately.

2.5.4 Results

2.5.4.1 Confirming Lexical Conservatism and phonological determinants of Derivative stress

The fixed effects pertaining to Lexical Conservatism are plotted in figure 2.5, and reported in table 2.7.

As in Experiment 1, the presence of the Remote Base in an individual participant's lexicon leads to a higher rate of stress shift. This basic finding of Lexical Conservatism is again gradient, not categorical, and sits alongside familiar phonological markedness avoidance effects and affix-

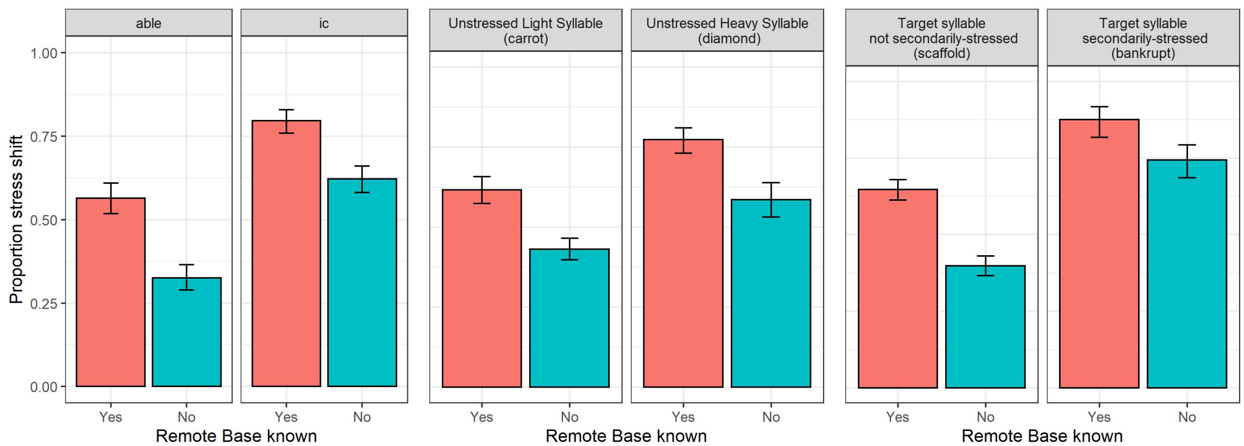

Figure 2.5: Mean and binomial confidence intervals from Experiment 2 of the proportion stress shifted Derivatives (vertical axis, all plots) by affix, target syllable weight, and target syllable secondary stress across facets, all divided on the horizontal axis according to whether the participant knew the Remote Base.

conditioned behavior, as in Experiment 1.

2.5.4.2 Results of the phonotactic judgment task

In the phonotactic judgment task, participants reliably preferred the antepenultimate stress placement (coded as 0) to preantepenultimate stress (coded as 1): $\hat{\beta} = -0.72$, 95%CI $[-1.28, -0.17]$, $P(|\hat{\beta}| > 0) \approx 1$. This finding is in line with long-understood principles of English stress, and is plotted in figure 2.6. This finding confirms the assumption made by Steriade that avoidance of long lapses, operationalized in the phonological analysis in chapter 4 by the constraint *ExtendedLapse, is a driving factor in Derivative formation.

2.5.4.3 Priming the Remote Base

To examine the effect of priming the Remote Base on Derivative stress placement, I fit a model to the subset of Local Bases from Experiment 2 for which the Remote Base was known to the participant. Predictors were the same as for Experiment 1 in section 2.4.5.3, with the addition of a fixed effect of Remote Base Priming (*no* = 0, *yes* = 1) and the interaction of Semantic Similarity

Parameter	*Median*	*95% CI*	*P* ($|\hat{\beta}| > 0$)
Intercept:			
Affix = *-able*			
Target Syllable Heavy = *no*			
Target Syllable Secondary Stress = *no*			
Know Remote Base = *no*	-1.43	[-1.98, -0.91]	
Affix = *-ic*	1.77	[1.23, 2.33]	≈ 1
Target Syllable Heavy = *yes*	0.47	[-0.18, 1.12]	0.93
Target Syllable Secondary Stress = *yes*	1.80	[0.99, 2.62]	≈ 1
Know Remote Base = *yes*	1.20	[0.67, 1.72]	≈ 1

Table 2.7: Model of Experiment 2, all Local Bases. Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

and Remote Base log-frequency, and random slopes of these three main effects and their two-way interactions by subject. The priming variable indicated whether a given Remote Base for a specific Local Base was primed by being presented in the pre-experiment knowledge check phase (rather than the post-experiment knowledge-check phase, as in Experiment 1). The results of this model are plotted in figure 2.7, and presented in table 2.8.

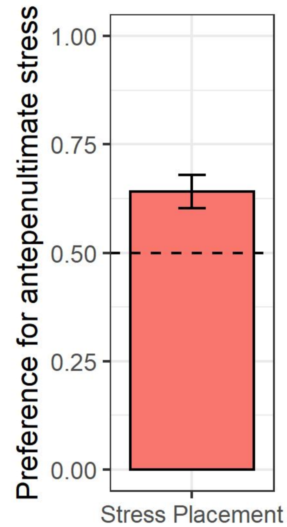

Figure 2.6: Mean and binomial confidence interval of the probability of preferring antepenultimate stress to preantepenultimate stress in the phonotactic judgment task of Experiment 2. The dotted line indicates chance (equal preference for both stress patterns).

Parameter	*Median*	*95% CI*	$P\,(\lvert\hat{\beta}\rvert > 0)$
Intercept:			
Target Syllable Heavy = *no*			
Target Syllable Secondary Stress = *no*			
Remote Base primed = *no*			
Semantic sim., Rem. freq. = *average values*			
Affix = *-able*	-1.06	[-1.92, -0.21]	
Target Syllable Heavy = *yes*	1.37	[0.49, 2.29]	0.99
Target Syllable Secondary Stress = *yes*	2.57	[1.13, 4.16]	0.99
Affix = *-ic*	1.87	[1.21, 2.56]	≈ 1
Remote Base primed = *yes*	0.60	[0.08, 1.19]	0.99
Semantic sim. (*scaled 1-unit increase*)	-0.18	[-0.67, 0.30]	0.78
Rem. freq. (*scaled 1-unit increase*)	-0.51	[-1.03, 0.00]	0.97
Remote Base freq. × Semantic sim.	-0.32	[-0.89, 0.22]	0.89

Table 2.8: Model of Experiment 2, Local Bases with Remote Bases known. Coefficients are in log-odds, with positive signs indicating an increase in probability of stress shift relative to the intercept.

The model clearly indicates that priming the Remote Base increases the log-odds of stress shift. We also find moderate evidence for an effect of semantic similarity, and also for its interaction with a strong main effect of Remote Base frequency. We can interpret this to mean that we have some evidence that semantically similar Remote Bases exert less of a pull on their Derivatives, but that this effect is moderated by Remote Base frequency. However, this moderation is opposite to the effect observed in Experiment 1: here, *low-frequency* Remote Bases escape the damping effect of semantic similarity, while high-frequency Remote Bases do not. Although the effect of semantic similarity is consistent with Experiment 1, the different interaction is puzzling; I speculate here that this may be due to differences in the stimulus set between the experiments. To test for this possibility, I carry out an analysis in appendix B of the combined data from Experiments 1, 2, and 3, and find that with a more diverse range of values for the lexical predictors and larger sample, we find no effect of Remote Base frequency nor an interaction with semantic similarity. This lends credence to the idea that the mismatch in the direction of the interaction of Remote Base frequency with semantic similarity between Experiments 1 and 2 may indeed be an artifact of the stimulus set.

2.5.5 Discussion

Experiment 2 built on Experiment 1 by asking whether the use of the Remote Base is driven by markedness-avoidance, and whether the Remote Base was accessed in the process of forming the Derivative. We found robust support for the hypothesis that it is the status of the Remote Base at the time of Derivative formation that exerts the influence on stress placement, not simply a

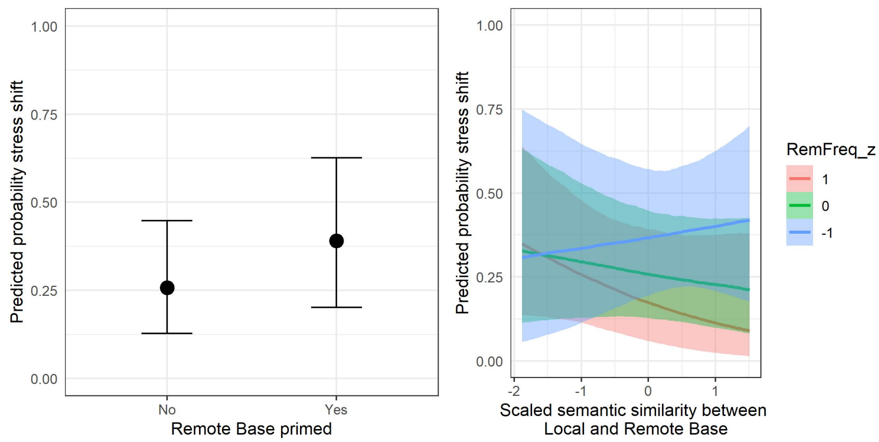

Figure 2.7: Predicted marginal effects of static (semantic similarity, Remote Base log frequency, right) and dynamic (priming, left) lexical factors on Derivative stress placement from Experiment 2. Solid points/lines indicate the mean of the posterior distribution of credible values for the marginal effect, with whiskers/shaded regions encompassing 95% of the credible values. As in Experiment 1, "RemFreq_z" indicates the continuous variable of scaled Remote Base log-frequency.

diacritic property of the Local Base. The implications of this finding for the phonological theory of Lexical Conservatism are wide-ranging, and are discussed in greater detail in chapters 4 and 5.

One possible alternative explanation for the priming effect we see is that speakers might have been re-learning Remote Bases during the pre-task knowledge check, rather than the check simply increasing the resting activation of existing lexical items. We can test this theory by examining the behavior of Derivatives formed to Local Bases whose Remote Bases were primed but not identified by subjects as being known, in comparison to the behavior of Derivatives to Local Bases with known, primed Remote Bases. If the primary effect of the pre-task knowledge check was to re-teach speakers Remote Bases, we should find Derivatives influenced by them behaving differently than those without primed Remote Bases regardless of whether the participant indicated they knew the Remote Base or not. To check this, I fit a univariate mixed-effects logistic regression model to Local Bases that have Remote Bases (whether or not they were known to the participant) with the same structure as the one directly above, and included the interaction of

2

priming with whether the Remote Base was known. I compared the posterior distribution for the effect of priming on stress shift when the Remote Base existed but was not known to the participant, and found that the distributions were highly overlapping, indicating no effect of priming for Remote Bases that were not known.

2.5.6 Prospects for Experiment 3

The results of Experiment 2 indicate that both phonological and lexical factors influence trial-by-trial Derivative formation. However, it is not yet clear what the main driving factor is that encourages similarity between Remote Bases and Derivatives. Steriade assumes it that Derivatives will only resemble the Remote Base if doing so decreases markedness. However, it is also possible that the existence of a Remote Base, regardless of its phonological characteristics, results in some pressure for Derivatives to resemble it, out of paradigm-uniformity principles (cf. Steriade, 2000:*et seq.*). We address this question by manipulating whether faithfulness to the Remote Base on on the part of the Derivative yields a phonologically-optimizing (markedness-reducing) result, or a phonologically-non-optimizing (markedness-increasing) result.

2.6 Experiment 3

Experiment 3 expanded the type of Local Bases by including disyllabic Local Bases with final stress, and Local Bases with three syllables. The goal of the first change was to determine the role of markedness-avoidance in driving the use of the Remote Base, rather than simply the availability of *an* alternative allomorph. We do this by using Local Bases with both benign Remote Bases (*paréntal* for the Local Base *párent*) and also malign Remote Bases (*résident* for the Local Base *resíde*). If we find that the probability of the Derivative being unfaithful to the Local Base does not significantly depend on whether the Remote Base is benign or malign, we can conclude that there is no meaningful role of markedness-avoidance in Lexical Conservatism, and that the results of Experiments 1 and 2 which appeared to support such a conclusion were due instead to the fact that the only morphologically-related forms the particular Local Bases possessed that had differing stress placement was one which happened to have stress shifted rightward and thus improve markedness. If, on the other hand, there is a lower probability of unfaithfulness in Derivatives with malign Remote Bases, we can conclude that the asymmetry is due to the avoidance of the marked structure that would be created by faithfulness to the malign Remote Base.

The goal of including trisyllabic Local Bases was to probe a more subtle question about the role of the Remote Base, that only makes itself available when considering Local Bases whose stem is longer than two syllables. For the most part in Experiment 1, and entirely in Experiment 2, the Local Base contained only one other viable target for stress placement, which to this point I have termed the *target syllable*. For example, the Local Base *cómpensate* has, when stripped of its affix *-ate*, only one alternative option for placing stress on the stem: *compéns-able*.[5] Thus, it has gone untested whether the existence of a benign Remote Base simply decreases the odds of the Derivative having stress placement matching the Local Base, or whether it specifically has an *attractive* force that increases the odds of the Derivative having stress placement that *matches* that Remote Base. For example, consider the Local Bases *ánalog* (Remote Base *análogous* with stress on the second syllable of the stem) and *vítriol* (Remote Base *vitriólic* with stress on the third syllable of the stem), both creating novel Derivatives in *-ist*, as was the case in Experiment 3 below. The first scenario predicts that both penult-stressed *análogist* and *vitríolist* should have equal probability, as should the finally-stressed *analógist* and *vitriólist*. The second possibility, that Remote Bases exert a specific attractive pull on the Derivative, predicts differing rates of probability, with *análogist* being more likely than *vitríolist*, and *vitriólist* being more likely than *analógist*. The answer to this question has major implications for phonological models of Lexical Conservatism, since the first corresponds to an analysis where Local Bases that have known Remote Bases actually have weaker faithfulness to the Local Base, whereas the second corresponds to an analysis where Remote Bases actually make faithfulness demands of their own directly on the Derivative. This discussion is taken up further in chapter 4.

[5] The logical possibility *còmpensáble* flies in the face of all phonological sense and was never observed in the experiment, so I do not consider it or its ilk here further.

Finally, I took the opportunity in Experiment 3 to select stimuli such that the canonical selectional frames for all affixes are observed; despite no apparent difficulty with innovative selectional pairings of affixes in Experiment 2, it is possible that participants may have been influenced by this factor.

2.6.1 Methods

2.6.1.1 Participants

54 participants were recruited from the UCLA SONA Psychology Subject Pool, and were compensated with course credit for their time. 15 were excluded for not having spoken English since before the age of seven consistently in some context (home, school, with certain family members, etc.), and 8 for technical problems relating to the sound quality, leaving 31 participants with data included in this study.

2.6.1.2 Materials for the Lexical Conservatism task

Materials for the Lexical Conservatism task fall into two broad categories. First is a set of 50 disyllabic Local Bases, 20 with initial stress (ex., *cárrot, coúrage, hábit*) and 30 with final stress (ex., *presérve, propóse, províde*). Within each of these stress-groups, half of the Local Bases have Remote Bases with stress placed on the other syllable of the Base: for example, 10 of the initially-stressed disyllabic Local Bases had Remote Bases with final stress (ex. *coúrage* ∼ *courágeous, hábit* ∼ *habítual*), and 15 of the finally-stressed disyllabic Local Bases had Remote Bases with initial stress (ex. *províde* ∼ *próvidence, resíde* ∼ *résident*). The purpose of these stimuli is to investigate the possible tug of malign Remote Bases like *próvidence* and *résident* on Derivative formation, in comparison to Local Bases with benign Remote Bases that were the sole focus of Experiments 1 and 2.

The second set of Local Bases are trisyllabic, all with initial stress, which were selected to investigate whether the presence of a benign Remote Base increases Derivative similarity to that Remote Base in particular, or simply decreases the odds that the Derivative is faithful to the Local

Base. These 45 Local Bases are divided evenly into 15 Local Bases with no Remote Bases (ex., *ábacus, céntipede*), 15 Local Bases with a Remote Base with penult stress (ex., *ánalog* ∼ *análogous, mónotone* ∼ *monótonous*), and 15 Local Bases with Remote Bases that have final stress (ex., *vítriol* ∼ *vitriólic, sénator* ∼ *senatórial*). Stimuli for Experiment 3 are listed in table 2.9.

Local Base	Remote Base	Affix	Sylls in Local Base	Local Base stress	Remote Base stress	Local Base Type
abuse	—	able	2	final	—	—
achieve	—	able	2	final	—	—
alert	—	able	2	final	—	—
appraise	—	able	2	final	—	—
approve	—	able	2	final	—	—
behave	—	able	2	final	—	—
bequeath	—	able	2	final	—	—
demote	—	able	2	final	—	—
diffuse	—	able	2	final	—	—
enclose	—	able	2	final	—	—
finesse	—	able	2	final	—	—
infuse	—	able	2	final	—	—
peruse	—	able	2	final	—	—
secede	—	able	2	final	—	—
traverse	—	able	2	final	—	—
accuse	accusation	able	2	final	initial	malign
compose	composition	able	2	final	initial	malign
confide	confidant	able	2	final	initial	malign
conserve	conservation	able	2	final	initial	malign
dispose	disposition	able	2	final	initial	malign
divide	dividend	able	2	final	initial	malign
expose	exposition	able	2	final	initial	malign

Table 2.9 continued from previous page

Local Base	Remote Base	Affix	Sylls in Local Base	Local Base stress	Remote Base stress	Local Base Type
impose	imposition	able	2	final	initial	malign
oppose	opposition	able	2	final	initial	malign
precede	precedence	able	2	final	initial	malign
preserve	preservation	able	2	final	initial	malign
propose	proposition	able	2	final	initial	malign
provide	providence	able	2	final	initial	malign
reserve	reservation	able	2	final	initial	malign
reside	residence	able	2	final	initial	malign
bankrupt	—	able	2	initial	—	—
cuckold	—	able	2	initial	—	—
plaster	—	able	2	initial	—	—
scaffold	—	able	2	initial	—	—
ballot	—	ist	2	initial	—	—
blizzard	—	ist	2	initial	—	—
buzzard	—	ist	2	initial	—	—
denim	—	ist	2	initial	—	—
granite	—	ist	2	initial	—	—
velvet	—	ist	2	initial	—	—
courage	courageous	ist	2	initial	final	benign
habit	habitual	ist	2	initial	final	benign
moment	momentous	ist	2	initial	final	benign
proverb	proverbial	ist	2	initial	final	benign
tumult	tumultuous	ist	2	initial	final	benign
finance	financial	able	2	initial	final	benign
labor	laborious	able	2	initial	final	benign

Table 2.9 continued from previous page

Local Base	Remote Base	Affix	Sylls in Local Base	Local Base stress	Remote Base stress	Local Base Type
major	majority	able	2	initial	final	benign
parent	parental	able	2	initial	final	benign
sequence	sequential	able	2	initial	final	benign
abacus	—	ist	3	initial	—	—
altitude	—	ist	3	initial	—	—
amplitude	—	ist	3	initial	—	—
amulet	—	ist	3	initial	—	—
anagram	—	ist	3	initial	—	—
antelope	—	ist	3	initial	—	—
apricot	—	ist	3	initial	—	—
centipede	—	ist	3	initial	—	—
doggerel	—	ist	3	initial	—	—
edifice	—	ist	3	initial	—	—
marathon	—	ist	3	initial	—	—
pilgrimage	—	ist	3	initial	—	—
stimulus	—	ist	3	initial	—	—
sycamore	—	ist	3	initial	—	—
uterus	—	ist	3	initial	—	—
anecdote	anecdotal	ist	3	initial	final	benign
attitude	attitudinal	ist	3	initial	final	benign
cartilage	cartilaginous	ist	3	initial	final	benign
Ecuador	Ecuadorian	ist	3	initial	final	benign
episode	episodic	ist	3	initial	final	benign
idiot	idiotic	ist	3	initial	final	benign
matriarch	matriarchal	ist	3	initial	final	benign

Table 2.9 continued from previous page

Local Base	Remote Base	Affix	Sylls in Local Base	Local Base stress	Remote Base stress	Local Base Type
patriot	patriotic	ist	3	initial	final	benign
pyramid	pyramidical	ist	3	initial	final	benign
regimen	regimental	ist	3	initial	final	benign
sacrilege	sacrilegious	ist	3	initial	final	benign
senator	senatorial	ist	3	initial	final	benign
uniform	uniformity	ist	3	initial	final	benign
universe	universal	ist	3	initial	final	benign
vitriol	vitriolic	ist	3	initial	final	benign
abdomen	abdominal	ist	3	initial	penult	benign
analogue	analogous	ist	3	initial	penult	benign
artisan	artisanal	ist	3	initial	penult	benign
carnivore	carnivorious	ist	3	initial	penult	benign
gelatin	gelatinous	ist	3	initial	penult	benign
heretic	heretical	ist	3	initial	penult	benign
hexagon	hexagonal	ist	3	initial	penult	benign
maniac	maniacal	ist	3	initial	penult	benign
medicine	medicinal	ist	3	initial	penult	benign
molecule	molecular	ist	3	initial	penult	benign
monotone	monotonous	ist	3	initial	penult	benign
octagon	octagonal	ist	3	initial	penult	benign
pseudonym	pseudonymous	ist	3	initial	penult	benign
synonym	synonymous	ist	3	initial	penult	benign
vestibule	vestibular	ist	3	initial	penult	benign

Table 2.9 continued from previous page

Local Base	Remote Base	Affix	Sylls in Local Base	Local Base stress	Remote Base stress	Local Base Type

Table 2.9: Stimuli for the Lexical Conservatism task in Experiment 3, listed with the affix they took in the experiment, their Remote Base (if any), as well as the stress placement in the Local and Remote bases, the number of syllables in the Local Base, and the type of Remote Base.

I selected two affixes, *-able* and *-ist*, based on the description in Marchand (1960) that the suffixes were not stressed nor obligatorily stress-attracting (see also Aronoff, 1976). To avoid possible confounds associated with non-standard selection frames in Experiments 1 and 2, *-ist* was paired with trisyllabic Local Bases, which were all nouns, while a mixture of the two affixes was paired with disyllabic Local Bases, depending on the lexical category (nouns or adjectives). This yielded 95 unique Local Base + affix pairs for the Lexical Conservatism task. Similar to Experiment 2, all Local Bases were recorded using Praat, and normalized to an intensity of 70 dB.

2.6.1.3 Materials for the phonotactic judgment task

Stimuli for the phonotactic judgment task were the same as for Experiment 2.

2.6.1.4 Procedure

Experiment 3 was conducted over the internet using the Labvanced experimental platform (Finger et al., 2017). Instructions and procedure were identical to that of Experiment 2. Due to an error in the configuration of the randomization measures for the trials, each participant only saw a randomly-selected subset of 80 out of the 95 unique Lexical Conservatism trials; vocabulary-check trials and phonotactic judgment task trials were not affected. Since the missing trials were distributed randomly among item types and subjects, I do not judge this to be a reason to believe the results of Experiment 3 should be biased; however it is likely that parameter estimates in statistical models fit to this data will have greater uncertainty.

Outside of this experimental execution error, the structure of Experiment 3 was identical to that of Experiment 3: first a knowledge check to prime alternating halves of the Remote Bases, then the Derivative-formation task, then a knowledge-check for the remaining Bases, then the phonotactic judgment task.

2.6.2 Data annotation

Data annotation procedure was identical to that of Experiment 2.

2.6.3 Data exclusion and analysis

Data exclusion criteria were similar to Experiment 1; 189 trials were excluded because participants did not identify that they knew the Local Base, 24 trials were excluded because a target Derivative, *opposable*, was not unattested, and a further 228 trials were excluded due to difficulty understanding the stress placement of the Derivative due to poor recording quality. This left 2,041 trials whose Derivatives were analyzed here.

Recall that Experiment 3 contained three sub-experiments: the phonotactic judgment task, and two sets of Lexical Conservatism stimuli which targeted different phonological questions. Unlike the models fit for Experiment 2, here two different sets of Lexical Conservatism stimuli had outcomes with different numbers of possible categories (Derivative stress on the first vs. second syllable in disyllabic Local Bases, and the first, second, or third syllable in trisyllabic Local Bases). Motivated by a desire to share information about subject-specific propensities across the two subsets of the Lexical Conservatism data, the model I fit was multivariate, with each subset of data having an outcome predicted by differing fixed effects, but sharing a correlated random intercept for subject with random slopes of all fixed effects, as well as uncorrelated random intercepts for the stimuli in the experiment (Local Bases and nonwords). Data from the phonotactic judgment task were modeled with an intercept only, while the Lexical Conservatism data were both predicted by a partially-overlapping set of main effects, described separately in the discussion of each sub-experiment below. The same approach (fitting a multivariate model jointly to all the data, but reporting the sub-experiments separately) was taken in analyzing the results of priming the Remote Base.

The models fit to data from Experiment 3 had slightly stronger (though generally still quite weak) priors on the coefficients, using a Normal distribution with mean 0 and standard deviation 10. This was necessary to aid model convergence since in certain cases, particularly in the models looking at the lexical determinants of Derivative stress placement for trisyllabic Local Bases, there was little or no data available in a given category, and the posterior was unidentified.

2.6.4 Results

2.6.4.1 Results for all disyllabic Local Bases

In this set of Local Bases, we're interested in whether speakers treat malign Remote Bases (ex., *résident*, a phonologically non-optimizing Remote Base for Local Base *resíde*) in the same way that they do benign ones (ex., *habítual*, a phonologically-optimizing Remote Base for Local Base *hábit*).

Local Bases with benign Remote Bases underwent stress shift at a rate higher than the baseline rate of unfaithfulness in Local Bases without any Remote Bases, while Local Bases with malign Remote Bases did not form Derivatives that were meaningfully different from Local Bases without any Remote Bases. This is plotted in in figure 2.8. Strikingly, out of 340 trials where Derivatives were formed to final-stressed disyllabic Local Bases — those with malign Remote Bases — only two were attested, *ópposist* and *ímposist*.

In the statistical model, the stress of Derivatives formed to disyllabic Local Bases was predicted by fixed effects of whether the target syllable (the second syllable of the Local Base, where stress would fall if it matched the Remote Base and/or was unfaithful to the Local Base) was heavy, secondarily stressed, and whether the Remote Base was known to the participant. Be-

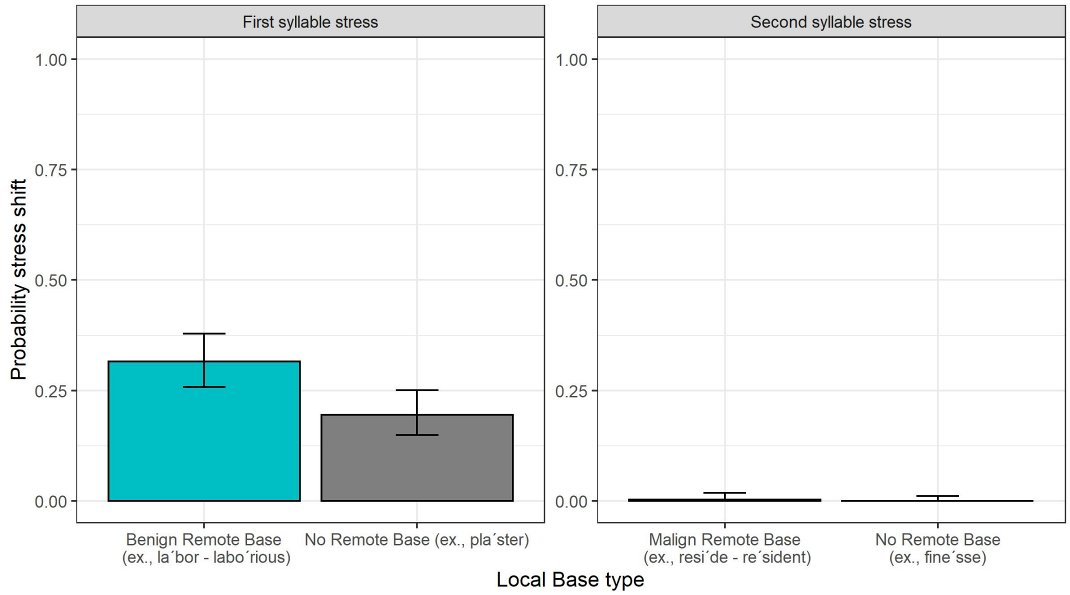

Figure 2.8: Results of the Lexical Conservatism task with disyllabic Local Bases from Experiment 3. The vertical axis plots the mean and binomial confidence interval of the proportion of stress shift in Derivatives, split by the stress of the Local Base (facets), and within each facet the horizontal axis plots the type of Local and Remote bases.

cause speakers treated Local Bases with benign and malign Remote Bases *very* differently, I fit the model only to those Derivatives formed to Local Bases with initial stress.

The statistical model fit to the data confirmed the observations made above, along with the consistent effects of syllable weight attracting stress, and secondary stress in Local Bases making better targets for primary stress in the Derivative. It is worth noting here that the presence of these well-known phonological effects in Local Bases with benign Remote Bases, but not in Local Bases with malign Remote Bases, constitutes a probabilistic conspiracy, enforcing the general the general drive for English stress to be antepenultimate except for words with heavy penults (Domahs et al., 2014; Olejarczuk and Kapatsinski, 2018; Moore-Cantwell, 2020). The aspects of these data relevant for phonological theory are discussed at greater length in chapter 4.

Lexically, these findings are in line with the traditional core tenet of Lexical Conservatism; the Remote Base only exerts a pull on Derivative formation when it is phonologically-optimizing to do so. This finding stands in marked contrast to the pattern observed in Spanish diphthon-

Parameter	*Median*	*95% CI*	*P* $(\lvert\hat{\beta}\rvert > 0)$
Intercept:			
Target Syllable Heavy = *no*			
Target Syllable Secondary Stress = *no*			
Know Remote Base = *no*	-4.02	[-5.66, -2.68]	
Target Syllable Heavy = *yes*	2.29	[0.43, 4.44]	0.99
Target Syllable Secondary Stress = *yes*	2.65	[0.16, 5.07]	0.98
Know Remote Base = *yes*	1.14	[-0.08, 3.01]	0.97

Table 2.10: Model of Experiment 3, all disyllabic Local Bases with initial stress. Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

gization in chapter 3, which is not able to be captured by the markedness-only model of Lexical Conservatism. We take up the discussion of these findings together again in chapter 4, where I propose a model where the two outcomes emerge as ends of a continuum of behavior derived from a single theory.

2.6.4.2 Results for disyllabic Local Bases with primed Remote Bases

To examine the effect of priming the Remote Base, the second model included only those disyllabic Local Bases with penult-stressed Remote Bases (of the type *hábit* $\sim$ *habítual*) where the Remote Base was extant, benign, and known to the participant. The relevant predictors are now the lexical factors of Remote Base log-frequency, Remote Base Priming (*no* $= 0$, *yes* $= 1$), and their interaction. Table 2.11 shows the result of the model for disyllabic Local Bases with benign Remote Bases.

Parameter	*Median*	*95% CI*	$P\,(|\hat{\beta}| > 0)$
Intercept:			
Target Syllable Heavy = *no*			
Target Syllable Secondary Stress = *no*			
Remote Base primed = *no*			
Remote freq., semantic sim. = *average values*	-7.28	[-13.45, -2.23]	
Target Syllable Heavy = *yes*	5.39	[-1.05, 13.02]	0.95
Target Syllable Secondary Stress = *yes*	11.18	[-3.45, 25.30]	0.94
Remote Base primed = *yes*	1.71	[-0.64, 4.58]	0.93
Remote freq. (*scaled 1-unit increase*)	-0.55	[-4.86, 4.60]	0.63
Semantic sim. (*scaled 1-unit increase*)	2.19	[-1.68, 6.33]	0.88
Remote Base freq. × semantic sim.	0.65	[-3.13, 5.52]	0.59

Table 2.11: Model of Experiment 3, all disyllabic Local Bases with known benign Remote Bases. Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

The results of priming Remote Bases for disyllabic Local Bases was largely in line with the results of Experiment 2: some evidence in favor of primed Remote Bases yielding more Derivatives with shifted stress, but here less strong evidence in favor of an interaction of semantic similarity and Remote Base log-frequency.

2.6.4.3 Results for all trisyllabic Local Bases

In this set of Local Bases, we are interested in whether Remote Bases encourage Derivatives to *match* their stress, or simply to be unfaithful to the Local Base without specifically matching the stress placement of their own Remote Base. We can examine this by plotting the probability of stress placement on each of the syllables of the stem of the Derivative divided by the type of Remote Base that exists for that participant, shown in figure 2.6.4.3.

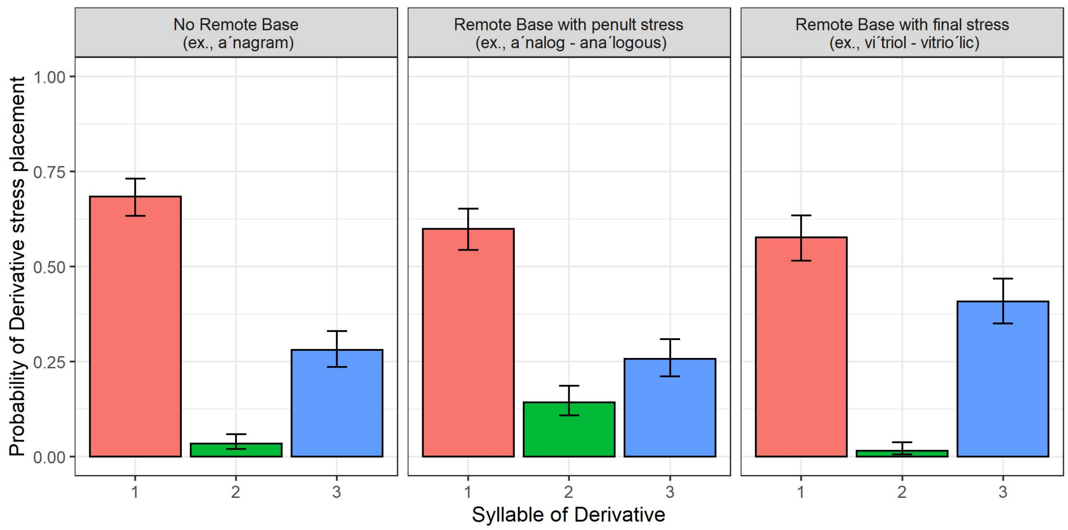

Figure 2.9: Results of the Lexical Conservatism task with trisyllabic Local Bases from Experiment 3. The vertical axis plots the mean and binomial confidence interval of the probability of the Derivative having stress on a given syllable of the Derivative; the syllable of the Derivative is plotted within each panel the horizontal axis. The panels divide the responses according to the stressed syllable in the Remote Base (if any).

Turning first to the lexically-isolated Remote Bases in the leftmost panel, we can observe what we can think of as the "default" behavior of the phonological grammar in the face of the affix *-ist* being attached to a trisyllabic, stress-initial, Local Base with no Remote Bases. Although the majority of the time the Derivative is faithful to the Local Base and retains initial stress, a substantial minority of cases have stem-final stress. This outcome is the best case of phonotactically-driven repair, allowing the amelioration of the long lapse in initially-stressed Derivatives, while retaining secondary stress on the initial syllable, and leaving the vowel qualities of the first and second syllables unchanged. In only a very small handful of cases do participants place primary stress on the second syllable, likely due to the violation of faithfulness constraints to vowel quality involved in "resurrecting" a full vowel from the schwa in the Local Base, rather than simply demoting primary stress to secondary and promoting secondary to primary, leaving vowel qualities intact (ex., preferring Derivatives in *-ist* formed to Local Base *ánagram* of the form [ˌænəˈgɹæmɪst] rather than those of the form [əˈnægɹəˌmɪst]).

Moving on to the center and right panels of figure 2.6.4.3, we find that, as predicted by Steriade's original conception of the role of the Remote Base, Derivatives resemble their respective Remote Base in terms of stress placement. That is, Derivatives to Local Bases with penult-stressed Remote Bases, like the Local-Remote pair *ánalog* ∼ *análogy*, have a greater proportion of stress on the corresponding, penultimate syllable of the Derivative than on the final syllable (more *análogist* than *analógist*). This makes sense from the point of view of the penult-stressed Derivative being supported by the presence of a Remote Base that shares its stress location. Correspondingly, Derivatives to Local Bases with finally-stressed Remote Bases have the dominant non-faithful stress placement on their final stem syllable (more *vitriólist* than *vítriolist*, for the Local-Remote Base pair *vítriol* ∼ *vitriólic*).

These effects are statistically robust, as described in table 2.12. In the model, stress placement in Derivatives formed to trisyllabic Local Bases was predicted by fixed effects of the stress pattern of the second two syllables of the Local Base, the weight pattern of the second two syllables of the Local Base, and whether the Remote Base was known to the participant. An idiosyncrasy of the way this component of the model is reported is that there are two sets of intercepts, one which governs the likelihood of stress falling on the first vs. the second syllable (*ánalogist* vs. *análogist*) and a second governing the likelihood of stress falling on the first vs. the third syllable (*ánalogist* vs. *analógist*). Because different Remote Base types (e.g., those with stress on the second vs. the third syllable) are expected to affect Derivative formation in different ways, I report and discuss these two intercepts separately.

Parameter	*Median*	*95% CI*	*P* ($\|\hat{\beta}\| > 0$)
Intercept (initial stress vs. penult stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Know Remote Base = *no*	-6.25	[-9.44, -4.17]	
Weight profile = *XLH*	-1.95	[-10.41, 1.95]	0.73
Weight profile = *XHH*	-0.22	[-13.34, 6.27]	0.59
Stress profile = *102*	1.02	[0.01, 2.63]	0.98
Know Remote Base with penult stress = *yes*	2.63	[0.11, 5.45]	0.98
Know Remote Base with final stress = *yes*	-1.95	[-8.77, 2.30]	0.78
Intercept (initial stress vs. final stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Know Remote Base = *no*	-2.54	[-3.42, -1.68]	
Weight profile = *XLH*	1.04	[-0.15, 2.25]	0.96
Weight profile = *XHH*	3.43	[-0.25, 12.12]	0.96
Stress profile = *102*	1.72	[0.99, 2.48]	≈ 1
Know Remote Base with penult stress = *yes*	0.09	[-0.64, 0.84]	0.59
Know Remote Base with final stress = *yes*	0.41	[-0.35, 1.31]	0.85

Table 2.12: Model of Experiment 3, all trisyllabic Local Bases. Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

Looking at the statistical model, we can see that knowledge of the Remote Base does meaningfully drive Derivative stress placement. We also observe various effects of stress and weight on stress placement: a heavy final syllable of the Local Base (as in *úniform*) increases the likelihood that stress in the Derivative will fall on this syllable, and the a heavy penult (as in *ánecdote*) does not seem to matter much. Above and beyond the effect of weight, secondary stress on the final syllable of the Local Base (as in *ántelòpe*) reliably attracts stress in the Derivative. I leave more detailed discussion of these phonological predictors of Derivative stress placement to chapter 4, where a MaxEnt grammar is fit to the combined results of all three experiments presented here, which admits clearer interpretation in the light of phonological theory.

2.6.4.4 Results for trisyllabic Local Bases with known Remote Bases

In the second model fit to only those Derivatives whose Remote Bases were known to participants, stress placement was additionally predicted by the stress placement in the Remote Base, whether the Remote Base was primed, and the interaction of log-frequency of the Remote Base with semantic similarity to the Local Base.

Because which type of Remote Base is primed (penult vs. final stress) is likely to impact both the different types of Local Base (those with penult-stressed Remote Bases, like *ánalo*g ∼ *análogy* and those with finally-stressed Remote Bases, like *sénator*l ∼ *senatórial*) as well as *where* the Derivative stress shifts to (penult or final syllable), I report the trisyllabic Derivatives in two separate tables. The first, table 2.13, contains results for only Derivatives formed to Local Bases with penult-stressed Remote Bases (such as *ánalog* ∼ *análogy*) and the second, in table2.14, contains results for Derivatives formed to Local Bases with final-stressed Remote Bases (as in *sénator* ∼ *senatórial.*

Parameter	*Median*	*95% CI*	$P(\lvert\hat{\beta}\rvert > 0)$
Intercept (initial stress vs. penult stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Remote freq., semantic sim. = *average values*			
Remote Base primed = *no*	-4.06	[-7.43, -1.30]	
Weight profile = *XLH*	-0.06	[-19.87, 19.68]	0.51
Weight profile = *XHH*	-0.28	[-20.67, 19.62]	0.50
Stress profile = *102*	0.35	[-2.28, 2.84]	0.63
Remote Base with penult stress primed = *yes*	-0.22	[-2.12, 1.26]	0.58
Remote freq. (*scaled 1-unit increase*)	0.03	[-0.99, 1.08]	0.53
Semantic sim. (*scaled 1-unit increase*)	-0.15	[-1.34, 1.08]	0.60
Remote Base freq. × Semantic sim.	0.86	[0.03, 2.08]	0.97
Intercept (initial stress vs. final stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Remote freq., semantic sim. = *average value*			
Remote Base primed = *no*	-3.52	[-5.90, -1.49]	
Weight profile = *XLH*	-0.09	[-19.58, 18.65]	0.51
Weight profile = *XHH*	-0.05	[-19.48, 19.14]	0.50
Stress profile = *102*	2.35	[0.37, 4.56]	0.99
Remote Base with penult stress primed = *yes*	0.12	[-0.91, 1.12]	0.60
Remote freq. (*scaled 1-unit increase*)	0.20	[-0.57, 1.25]	0.67
Semantic sim. (*scaled 1-unit increase*)	0.07	[-0.76, 0.97]	0.56
Remote Base freq. × Semantic sim.	-0.63	[-1.80, 0.16]	0.94

Table 2.13: Model of Experiment 3, trisyllabic Local Bases with known Remote Bases with penult stress (as in *ánalog* - *análogy*). Coefficients are in log-odds, with positive signs indicating an increase in the probability of stress shift relative to the intercept.

Parameter	*Median*	*95% CI*	*P* $(|\hat{\beta}| > 0)$
Intercept (initial stress vs. penult stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Remote freq., semantic sim. = *average value*			
Remote Base primed = *no*	-22.96	[-44.29, -8.81]	
Weight profile = *XLH*	3.48	[-7.40, 13.59]	0.76
Weight profile = *XHH*	6.83	[-7.38, 19.69]	0.86
Stress profile = *102*	4.89	[-8.15, 19.94]	0.75
Remote Base with final stress primed = *yes*	-0.33	[-7.57, 6.68]	0.53
Remote freq. (*scaled 1-unit increase*)	1.89	[-1.87, 6.92]	0.82
Semantic sim. (*scaled 1-unit increase*)	-1.60	[-7.95, 4.40]	0.572
Remote Base freq. × Semantic sim.	-4.41	[-11.28, 0.71]	0.96
Intercept (initial stress vs. final stress):			
Weight profile = *XLL*			
Stress profile = *100*			
Remote freq., semantic sim. = *average value*			
Remote Base primed = *no*	-5.38	[-9.15, -2.56]	
Weight profile = *XLH*	0.89	[-2.49, 4.70]	0.70
Weight profile = *XHH*	6.10	[0.32, 13.98]	0.98
Stress profile = *102*	5.39	[1.72, 9.81]	≈ 1
Remote Base with final stress primed = *yes*	0.53	[-0.51, 1.58]	0.84
Remote freq. (*scaled 1-unit increase*)	-1.16	[-2.43, -0.15]	0.99
Semantic sim. (*scaled 1-unit increase*)	-1.44	[-3.57, 0.34]	0.95
Remote Base freq. × Semantic sim.	-1.46	[-2.82, -0.42]	0.99

Table 2.14: Model of Experiment 3, trisyllabic Local Bases with known Remote Bases with final stress (as in *sénator* - *senatórial*). Coefficients are in log-odds, with positive signs indicating an increase in stress shift relative to the intercept.

The models fit to the trisyllabic Local Bases with known Remote Bases are quite complex, and difficult to interpret. Therefore, here I will focus primarily on the effect of Remote Base stress location and priming, leaving an in-depth discussion of the phonological determinants of stress placement to chapter 4, as I noted above. The primary take-away is that a primed Remote Base leads to greater preference for the Derivative to match its stress placement than when it is unprimed: for penult-stressed Local Bases, a primed Remote Base leads to a greater preference for penult-stressed Derivatives, and vice versa for final-stressed Local and Remote Bases, although there is non-negligible uncertainty associated with the estimates in the statistical model, likely due to the small number of stimuli in each category. Turning to the role of Remote Base frequency and its interaction with semantic similarity, we see largely similar patterns as in Experiments 1, and 2; I do not discuss this further here, since it seems unwise to draw strong conclusions from such a complex model with so few data points. I return to the topic of lexical effects in English in chapter 5 and appendix B.

To test whether the priming effect could be better explained as participants re-learning Remote Bases in the pre-task knowledge check, I refit the models described for Experiment 3 with Remote Bases known (disyllables and triyllables separately) and included an interaction of priming with whether the Remote Base was identified as known to the speaker or not. The results indicated that Derivatives formed to Local Bases with primed but not known Remote Bases were no more likely to stress shift than those whose Remote Bases were not primed.

2.6.4.5 Results of the phonotactic judgment task

Finally, we turn to the results of the phonotactic judgment task, and its relationship with baseline rates of phonotactically-driven repair in the Lexical Conservatism task. Figure 2.10 displays the results of the phonotactic judgment task. As in Experiment 2, participants exhibit a robust preference for the antepenultimate-stressed form of the nonword ([bəˈfɚləɹiv]) over the preantepenultimate-stressed form ([ˈbʌfɚləɹiv]): $\hat{\beta}$ = -0.67, 95% CI [-1.14, -0.19], $p(|\hat{\beta}|)>0=0.99$.

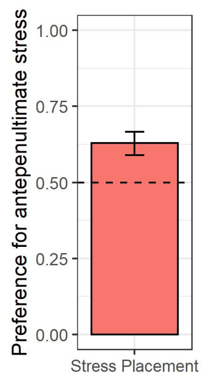

Figure 2.10: Mean and binomial confidence interval of the probability of preferring antepenultimate stress to preantepenultimate stress in the phonotactic judgment task of Experiment 3. The dotted line indicates chance (equal preference for both stress patterns).

2.7 Conclusion

This chapter set out to replicate and extend the results of Steriade (1997), with an eye to precisely identifying what role the grammar and the lexicon play in the apparent Lexical Conservatism in English stress. In Experiment 1, I found that the core generalization Steriade advanced holds, but is probabilistic with counter-examples in both directions: sometimes speakers match the Local Base's stress placement in the Derivative despite the presence of a benign Remote Base in their lexicon, and at others speakers shift stress in their Derivative despite no such advantageous Remote Base. Examining the other conditions on this variation, I find evidence for an independent role of phonological markedness avoidance, alongside some of the lexical effects that Steriade discusses, semantic similarity and the frequency of the Remote Base.

Experiment 2 sought to probe the role of the lexicon more directly using a priming manipulation. I found that priming the Remote Base increases the likelihood of the Local Base being unfaithful to it. I take this as evidence that the phonological grammar actively "recruits" benign Remote Bases from the lexicon in real time, with both Local and Remote Bases being co-present in the creation of the Derivative. Further details on this process are taken up in chapters 4 and 5.

Experiment 3 probed two further aspects of Lexical Conservatism in English: whether *any Remote Base at all* exerted an effect, and whether the presence of benign Remote Bases increased the likelihood that the Derivative would resemble them in stress placement, or rather that the presence of a Remote Base made *any* unfaithfulness to the Local Base more likely, without a connection to the specific stress placement of the Remote Base. I found that malign Remote Bases in English exerted almost zero effect on Derivative formation; as we will see in chapter 3, this stands in contrast to malign Remote Bases in Spanish. I take this up in chapter 4, as part of the discussion and phonological model synthesizing the evidence from the two sets of experiments. I also found that benign Remote Bases do specifically cause Derivatives to resemble them in stress placement, rather than simply yielding greater unfaithfulness to the Local Base. The evidence for priming was slightly weaker in Experiment 3, likely due to the lower number of trials per subject than intended, but still was in the expected direction and generally robust; Remote Base log-frequency also had weak effects, generally in line with Experiments 1 and 2. Experiment 3 also replicates the results of the phonotactic well-formedness task in Experiment 2.

CHAPTER 3

Lexical Conservatism in Spanish diphthongs

3.1 Introduction

The second case of Lexical Conservatism in this dissertation comes from the distribution of mid-vowels *e* [e] and *o* [o], and their diphthongal counterparts *ie* [je] and *ue* [we], in Spanish. In two experiments, I examine the contexts under which Spanish speakers *monophthongize* a diphthong when the licensing stress is moved off of it. I take advantage of the asymmetric distributions of alternating mid-vowels in derivational paradigms in the language to probe whether speakers are sensitive to the presence of a Remote Base when asked to form novel Derivatives with the stress-shifting affix *-oso*. Further, because there are both alternating and non-alternating diphthongs in the language, I can examine whether phonologically non-optimizing Remote Bases also influence Derivative formation, further testing the assumption of Lexical Conservatism that it is strictly markedness-improving.

3.2 Background on Spanish diphthongization

All dialects of Spanish exhibit an alternation which affects the diphthongs <ie>[je] and <ue>[we], yielding alternation with corresponding monophthongs <e>[e] and <o>[o]. The alternation is unpredictable, however, and has long been studied as an "old chestnut" of exceptionful phonology, with numerous analyses proposed focusing on different ways of encoding the distinction between alternating and non-alternating roots (Harris, 1969; Hooper, 1976; Carlson and Gerfen, 2011:among many others). This unpredictable alternation is the result of a historical merger between low-mid *[ɛ, ɔ], which exhibited exceptionless alternation between stressed *[je, we] and unstressed *[ɛ, ɔ], and high-mid vowels *[e, o] which did not alternate with stress (Penny, 2002). This yielded the synchronic state of affairs, where where some mid-vowels [e, o] alternate with diphthongs under stress (as in *sentámos* ∼ *siénto*, "I sit / we sit"), while others don't (as in *rentámos* ∼ *rénto*, "I rent / we rent", example from Albright et al. (2001)). Stress is (and has been) mobile throughout the inflectional and derivational paradigms of Spanish, and thus the alternation is extensive. The inflectional paradigms for person and number in verbs contain frequent alternation, for example between the first person singular and plural, as in *truéno*∼*tronár* "thunder / to thunder", as do the derivational paradigms of many nouns and adjectives formed using a range of derivational affixes, such as *viéjo* ∼ *vejéz* "old / age".

Because of the markedness-reducing neutralization of diphthongs and mid-vowels in unstressed positions, it is not always clear to speakers which mid-vowels alternate in this way, and which do not. This has lead to further remodeling and analogical change in the paradigms, and has given rise to etymologically-informed but synchronically-arbitrary alternation which exhibits type-level variation at the level of variation of the individual root with different affixes (ex., for the base *puébl-o* "town", both *pueblíto* "small town" and *población* "population"), as well as token-level variation within roots (ex., *cientóso* ∼ *centóso* "muddy"). This leads to a situation where both roots and affixes exhibit lexical propensities to alternate when the appropriate phonological conditions are met, yielding a complex landscape of cross-cutting conditioning factors.

A small but intriguing body of experimental work has examined how speakers extend these lexical generalizations to novel words. Eddington (1996, 1998) conducts two experiments in which speakers of Iberian Spanish were asked to attach 10 stress-attracting affixes to novel bases with a stressed diphthong. He recorded the rate at which the affixes induced monophthongization, and found rates of monophthongization varying from 4.7% for the diminutive *-(c)íllo,* to 86.2% for the adjectivizing *-óso*, indicating that speakers have internalized affix-specific propensity information about the contents of their lexicon. Carlson and Gerfen (2011) examines similar data on lexically-specific affix behavior, and finds evidence for a relation between the productivity of the affix and its propensity to trigger alternation. Further, Albright et al. (2001) advanced evidence demonstrating that speakers are use segmental information in the environment of unstressed mid-vowels to predict whether they will alternate with diphthongs under stress.

3.3 Contexts for Lexical Conservatism

Before moving forward, it is important to be clear on why I am looking at *monophthongization* of existing diphthongs, rather than looking at the diphthongization of existing monophthongs, which has been more common in the literature. I take this approach because, unlike English, the suffixes of Spanish are almost always tonic, and so it is very difficult to find a context where affixation moves stress onto an unstressed monophthong that is part of the root. However, there are many cases where stressed diphthongs in roots have stress removed under affixation, enabling the current study.

Since unstressed diphthongs are generally taken to be phonotactically marked, we can ask how do speakers treat the newly-unstressed diphthong when asked to attached a stress-attracting suffix like *-óso* to form a Derivative. Words with a stressed diphthong that don't have any morphological relatives with differing stress, like *siniéstro* "sinister" or *ungüénto* "ointment", constitute a base case where the behavior of the phonological grammar can be observed in isolation — these are the base case, where we can examine the "normal" rate of repair arising from the conflict of markedness and faithfulness, without the interference of paradigm structure.

Local Bases that have morphological relatives with differing stress placement can be further divided into those where the corresponding vowel is monophthongized, which I term *benign* Remote Bases, as in *niébla* $\sim$ *neblína* "fog / mist" or *muéble* $\sim$ *moblár* "furniture / to furnish", which admit classical Lexical Conservatism), or left unrepaired as in *malign* Remote Bases, such as *ambiénte* $\sim$ *ambientál* "environment / environmental" or *juérga* $\sim$ *juerguísta* "spree / reveler"). Lexical Conservatism predicts that they have the option of relying on the stem allomorph of Remote Bases that have an unstressed mononphthong to ease the penalty for monophthongizing the Local Base or tolerating the unstressed diphthong. The alternation also provides the context for the presence of a malign Remote Base — a paradigm-member having an unstressed diphthong — to influence the odds of repairing the newly-unstressed diphthong; this outcome, however, is not markedness-improving, and not predicted by classical theories of Lexical Conservatism.

I summarise the types of Local Bases and the relevant aspects of their paradigm structure in table 3.1 below for clarity (repeated from chapter 1).

Local Base	Benign Remote Base	Malign Remote Base	Derivative
ungüénto, siniéstro	-	-	*ungüentóso ∼ungontóso,* *siniestróso ∼sinestróso*
muéble, niébla	*moblár, neblína*	-	*mueblóso ∼moblóso,* *nieblóso ∼neblóso*
juérga, ambiénte	-	*juergísta, ambientál*	*juergoso ∼jorgoso,* *ambientóso ∼ambentóso*

Table 3.1: Demonstration of the paradigmatic structure and relations relevant to the current study of Spanish monophthongization.

3.4 Experiment 4

The fact that instances of each type can be found in the Spanish lexicon is suggestive of a relationship in the grammar between Local and Remote Bases of the type described by Lexical Conservatism. To verify that this relationship is in fact encoded in speakers' grammars and generalized to novel forms, I carried out an experiment with speakers of Mexican Spanish, wherein speakers were asked to create novel morphologically-complex words by affixing the adjectivizing suffix *-óso* to existing nouns, and also complete a phonotactic judgment task to assess the markedness of unstressed diphthongs.

The *wug*-test also includes a priming manipulation, with alternating halves of the Remote Bases primed by being included in the pre-task *knowledge check*, counterbalanced across participants. Following the English results in chapter 2, I expect that primed benign Remote Base will lead to Derivatives with more monophthongs compared to a unprimed Remote Base, and that a primed malign Remote Base will lead to an even smaller fraction of monophthongal Derivatives compared to a Local Base with an unprimed malign Remote Base.

Turning to the *blick*-test, we expect to find that unstressed diphthongs are dispreferred relative to unstressed monophthongs, following the assumption in the literature on alternating diphthongs in Spanish. Pilot results from a brief informal survey of native speaker linguists who were involved in vetting the stimuli suggest also that there may be an effect of vowel quality, with unstressed front diphthongs (*ie*) being judged impressionistically as more marked than unstressed back diphthongs (*ue*). I do not expect this potential difference to interact with the possible Lexical Conservatism effect, however.

3.4.1 Methods

3.4.1.1 Participants

30 native speakers of Mexican Spanish were recruited using the Prolific online subject pool[1]. Recruitment was subject to the restrictions that participants have no self-reported reading difficulties, were born in and resided in Mexico at the time of the study, and identified Spanish as their first language. Participants were paid approximately $9 for their time.

3.4.1.2 Stimulus selection

90 Local Bases were selected for the study through the use of the *Diccionario de la Lengua Española (DLE)* and the assistance of a linguistically-trained native speaker. 45 Local Bases contained a stressed front-diphthong *ié*, and 45 contained a stressed back-diphthong *ué*. Within each diphthong set of 45, 15 Local Bases had no Remote Bases, 15 had benign Remote Bases, and 15 had malign Remote Bases. This yielded stimuli distributed according to table 3.2 below.

[1] www.prolific.com

Local Base (ie)	Remote Base (ie)	Local Base (ue)	Remote Base (ue)	Class
audiencia	—	ungüento	—	*(none)*
sapiencia	—	güecho	—	*(none)*
pierna	—	güemul	—	*(none)*
biela	—	atuendo	—	*(none)*
adviento	—	duende	—	*(none)*
priesa	—	elocuencia	—	*(none)*
siesta	—	hueco	—	*(none)*
nieto	—	pirueta	—	*(none)*
mies	—	buega	—	*(none)*
siniestro	—	sabueso	—	*(none)*
aliciente	—	silueta	—	*(none)*
Viena	—	suela	—	*(none)*
noviembre	—	cruento	—	*(none)*
vieira	—	güeña	—	*(none)*
viernes	—	sueco	—	*(none)*
ariete	arietar	dueño	adueñarse	*malign*
lienzo	liencillo	consecuente	consecuentemente	*malign*
ambiente	ambiental	cruel	crueldad	*malign*
cielo	cielito	deshueso	deshuesadao	*malign*
ciencia	cienciólogo	juete	juetazo	*malign*
experiencia	experiencial	encuesta	encuestada	*malign*
cliente	clientela	juerga	juergista	*malign*
conciencia	concienciar	huevo	huevón	*malign*
oriente	oriental	secuencia	secuencial	*malign*
paciencia	impacientar	secuestro	secuestrador	*malign*
dieta	dietético	suegra	suegrastro	*malign*

Table 3.2 continued from previous page

Local Base (ie)	Remote Base (ie)	Local Base (ue)	Remote Base (ue)	Remote Base type
higiene	higienista	güero	güerito	*malign*
riel	rielero	delincuente	delincuentemente	*malign*
ciemo	aciemar	huebra	huebrero	*malign*
rienda	riendazo	buey	bueyero	*malign*
acierto	acertar	compuesta	compostura	*benign*
fiebre	febril	mueble	moblar	*benign*
asiento	asentar	escuela	escolar	*benign*
niebla	neblar	grueso	grosor	*benign*
cierna	cerner	muerte	mortero	*benign*
obediencia	obedecer	rueda	rodar	*benign*
sosiego	sosegar	apuesta	apostar	*benign*
tienda	tender	ruego	rogar	*benign*
viejo	vejez	cuento	contar	*benign*
incienso	incensar	almuerzo	almorzar	*benign*
cierre	cerrar	encuentro	encontrar	*benign*
ciego	cegar	acuerdo	accordar	*benign*
aprieto	apretar	vuelo	volar	*benign*
entierro	enterrar	trueno	tronar	*benign*
friega	fregar	consuelo	consolar	*benign*

Table 3.2: Stimuli for the *wug*-test in Experiment 4.

A single derivational affix *-óso* was chosen for the study, and Local Bases were selected such that none of the Derivatives formed through their combination with *-óso* were listed in the DLE, in an effort to ensure that as many as possible of the Derivatives in the study would be nonce-forms to the participants.

One small further nuance to note comes from the fact that Spanish is a language that has thematic vowels that generally mark grammatical or gender, as in *entierro* or *tienda*. These vowels regularly and obligatorily delete before vowel-initial suffixes, so throughout I assume that viable Derivative candidates are, for example, the forms *tiendóso* or *tendóso*, but never **tiendaóso* or **tendaóso*. Indeed, such forms were never produced in Experiment 4, and so I do not consider this topic further.

Stimuli for the phonotactic judgment task consisted of 60 pairs of trisyllabic nonwords with penultimate stress. In the first member of each pair, the firsts syllable was a diphthong (30 *ie* and 30 *ue*), and the second member was identical except for the diphthong was replaced by its corresponding monophthong (*e* or *o*). All of the monophthongal pair-members were judged natural by a native speaker consultant naïve to the purpose of the task. Stimuli for the phonotactic judgment task are displayed in table 3.3 below.

Front nonce		*Back nonce*	
Diphthong	Monophthong	Diphthong	Monophthong
drienolfo	drenolfo	truemorse	tromorse
liepropo	lepropo	nuegenme	nogenme
fielofo	felofo	luezarga	lozarga
giesorge	gesorge	nuerange	norange
blienimno	blenimno	fuejagla	fojagla
fiesurla	fesurla	gruemelza	gromelza
dieleldre	deleldre	truequirmo	troquirmo
mieruncre	meruncre	fuetromsa	fotromsa
tiequemfo	tequemfo	pluegilzo	plogilzo
gieblenta	geblenta	ruedurta	rodurta
miepincla	mepincla	suenimpro	sonimpro
nielambla	nelambla	juegefa	jogefa
clieronfe	cleronfe	truelenlo	trolenlo

Table 3.3 continued from previous page

Front nonce		*Back nonce*	
liebrumno	lebrumno	cluelumdre	clolumdre
siemilfo	semilfo	pluenidre	plonidre
pieplolla	peplolla	muezumtra	mozumtra
nierufa	nerufa	lueglermo	loglermo
driedolma	dredolma	suesumjo	sosumjo
grielimla	grelimla	lueninge	loninge
gliemelfa	glemelfa	suefemne	sofemne
briejarro	brejarro	muebremtra	mobremtra
mienomle	menomle	pruelolno	prololno
fiefalo	fefalo	luenonpro	lononpro
lierunza	lerunza	cuelimjo	colimjo
fiedromdo	fedromdo	nueplerfa	noplerfa
pliemilna	plemilna	puegitra	pogitra
priesumcre	presumcre	nueleja	noleja
gietriplo	getriplo	duelulja	dolulja
sieplomo	seplomo	gluegifa	glogifa
driedarta	dredarta	suetrollo	sotrollo

Table 3.3: Nonce monomorphemes from Experiment 4, presented in pseudo-Spanish orthography.

A phonetically-trained female native speaker of Mexican Spanish recorded each of the Local Bases, as well as both variants of the nonwords for the phonotactic judgment task, in a quiet room. The recordings were then normalized to 70 dB.

3.4.1.3 Procedure

The experiment was conducted over the internet using the Experigen in-browser platform (Becker and Levine, 2020), with instructions in Spanish. Participants were instructed to find a quiet place in their environment to sit, and that they would need to wear headphones for the experiment. Participants consented to having their voices recorded and analyzed anonymously.

The flow of the experiment was as follows. First, participants completed a pre-task *knowledge check*, in which they were presented with stimuli one at a time. They were asked to use the in-experiment interface to record themselves saying the word aloud, and then to indicate whether they felt that they knew the word well enough that they would not need to ask what it meant if they heard it in conversation (response options *yes / no*). This pre-task knowledge-check included all 90 of the Local Bases, and a randomly-selected half of the 60 Remote Bases, half benign and half malign, intended to prime the lexical entries of the Remote Bases.

After completing these 120 trials, participants completed the Derivative formation task: on each of 90 trials, participants were asked to press a button to hear a recording of a randomly-selected Local Base. Participants were then instructed on the screen to combine the world they heard with the ending *-óso* and say the result aloud, whereupon their responses were recorded. After completing the task, participants completed a second knowledge check task which contained the remaining half of the Remote Bases not shown in the pre-experiment knowledge check.

Participants then completed 60 trials of the phonotactic judgment task. On each trial, participants heard two variants of a novel nonword, and were asked to indicate which one sounded more Spanish-like using a 5-point Likert scale. I chose a rating system instead of a binary choice task in the hopes of being able to capture potentially subtle distinctions in markedness, since prior literature reviewed above had lead me to believe that the diphthongization alternation is quite lexically-specific and idiosyncratic, and thus might not be strongly markedness-driven, unlike, for example, English stress placement. Finally, participants completed a short language background questionnaire. The entire experiment took approximately an hour.

3.4.2 Data analysis

Derivatives produced on each trial of the Lexical Conservatism task were annotated impressionistically for whether the vowel they contained was an unstressed diphthong or monophthong; there were no cases where participants did not shift stress to the penult of the Derivative, nor any instances where the theme vowel was not truncated. In cases where a participant gave more than one response, I considered the last one produced as their response for that trial. In cases where it was not clear whether the participant produced a monophthong or diphthong, a phonetically-trained native speaker of Spanish was consulted. Each Derivative was annotated for whether the speaker knew the Local Base and, if extant, the Remote Base.

3.4.3 Data exclusion

Trials where the response was unintelligible or absent from the recording were excluded from analysis ($n = 60$). Responses to the stimulus *priesa* "(a) rush", a lexically isolated Local Base with a front diphthong, were also excluded, since it came to my attention after the experiment had been completed that this was simply an archaic spelling of the modern *prisa* (n $= 30$). Further, Derivatives for which the participant did not know the Local Base were excluded (n $= 410$), leaving 2,200 Derivatives for analysis. No trials were discarded from the phonotactic judgment task.

3.4.4 Statistical analysis

Participant responses were analyzed in R (R Core Team, 2021) using Bayesian hierarchical logistic regression models implemented in *brms* (Bürkner et al., 2017). All models were run for 10,000 iterations in each of four chains, with the first 1,000 iterations discarded from each chain for warm-up. Default weakly-informative priors and sampler settings were used, and all analyses reported here passed diagnostics based on effective sample size and $\hat{R}$.

3.4.5 Results

3.4.5.1 *Wug*-test results: evidence for Lexical Conservatism

The first question in this study is whether participants were sensitive to the presence of a Remote Base, and whether the status of the Remote Base (benign or malign) influenced their production of Derivatives. Figure 3.1 plots the proportion of Derivatives containing a monophthong according to the type of Local Base, and what vowel they contained.

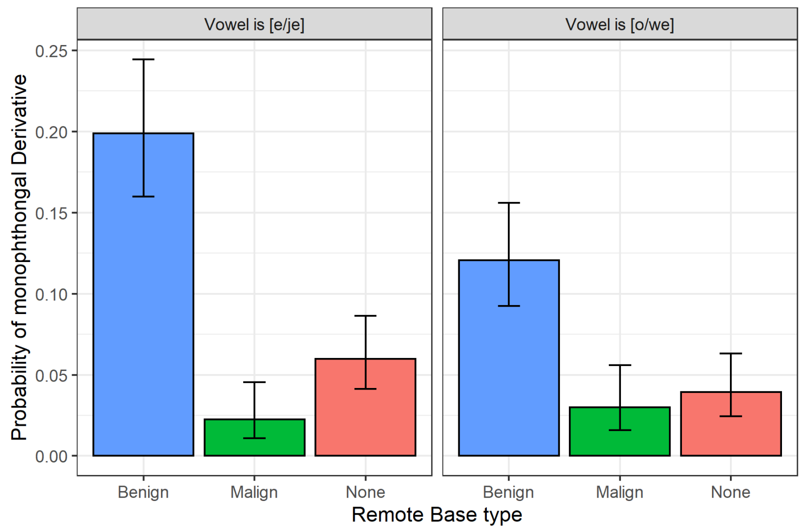

Figure 3.1: Results of the lexical conservatism task in Experiment 4. Vertical axis plots the proportion (mean and binomial confidence interval) of monophthongal Derivatives formed for each type of local base (horizontal axis), and whether the diphthong in the Local Base was *ié* (left facet) or *ué* (right facet). Examples are as follows: Local Base with no Remote Base - *biéla* (front diphthong) and *huéco* (back diphthong), Local Base with malign Remote Base - *ciélo* ∼ *cielíto* (front diphthong) and *huévo* ∼ *huevón* (back diphthong), Local Base with benign Remote Base - *ciégo* ∼ *cegár* (front diphthong) and *truéno* ∼ *tronár* (back diphthong).

As can be seen, the overall rate of monophthong production in the study is quite low; for all categories of Local Base below twenty percent, and in most well below ten percent. This finding is puzzling given how extensive the stress-conditioned alternation of diphthongs is throughout the language, but is in line with previous experimental work on the topic, which found that the phenomenon was often difficult to elicit (Bybee and Pardo, 1981; Albright et al., 2001). Impressionistically, it seems that there is a clear effect of knowing a benign Remote Base, since participants exhibit much more monophthongization than the lexically isolated Local Bases. This is the canonical Lexical Conservatism effect described by Steriade and others in the literature, and is common to both vowel qualities.

Turning now to the Local Bases with malign Remote Bases, we see that there is numerically less diphthongization than in the Local Bases without Remote Bases. From the point of view of Steriade's original theory of Lexical Conservatism, where avoidance of markedness is the only force capable of compelling speakers to deviate from faithfulness to their Local Base, this is unexpected. We return to it in section 3.4.6.1 below.

Finally, it seems that there is overall a higher rate of monophthongization in the Local Bases with *ié*, compared to those with *ué*. This reflects the intuition of my native speaker consultants that unstressed front-diphthongs are more phonotactically marked than unstressed back-diphthongs. This leads to a scenario where there is more willingness to tolerate an unrepaired back diphthong in the Derivative, leading to lower rates of repair in monophthongization, compared to front diphthongs. In section 3.4.5.2 below, the results of the *blick*-test support the asymmetric markedness of unstressed diphthongs.

To confirm the statistical robustness of these findings, I fit a multivariate Bayesian mixed-effects logistic regression model to the results of Experiment 4. The model is *multivariate* in that it uses some of the same predictors to model participants' responses on both the *wug*-test and the *blick*-test, and, because it is hierarchical in structure, allows for sharing of information at the level of the individual subject's performance between these two tasks. I discuss the two dependent variables separately, and the results for each section can be interpreted similarly to univariate models with only one dependent variable.

In the model of the *wug*-test, the Derivative vowel was the dependent variable (*diphthong* = *0*, *monophthong* = *1*). The model contained a nominal fixed effect of vowel quality of the Local Base (*ié* = 0, *ué* = 1), a three-level categorical variable of Remote Base type (*none, malign, benign*), and the interaction between these factors. The model also contained random intercepts for subject and Local Base, with a random slope of the interaction of the two fixed effects by subject. The results of the model are displayed in table 3.4.

Parameter	*Median*	*95% CI*	*P* ($|\hat{\beta}| > 0$)
Intercept:			
Vowel = *ié*			
Remote Base = *none*	-3.74	[-4.71, -2.84]	
Vowel = *ué*	-1.62	[-2.42, -0.26]	0.99
Remote Base = *malign*	-1.12	[-2.44 -0.04]	0.98
Remote Base = *benign*	1.16	[0.28, 2.04]	0.99

Table 3.4: Model of Experiment 4. Coefficients are in log-odds, with positive signs indicating an increase in probability of monophthongization relative to the intercept.

3.4.5.2 *Blick*-test results

In the phonotactic well-formedness task, participants generally preferred unstressed monophthongs to unstressed diphthongs; this dispreference was stronger for unstressed *ie* than for unstressed *ue*. This aligns with the results of the *wug*-test presented above, where participants were more likely to repair an unstressed front diphthong to its monophthongal counterpart, compared to an unstressed back diphthong. Figure 3.2 plots the proportion of ratings for both types of stimulus.

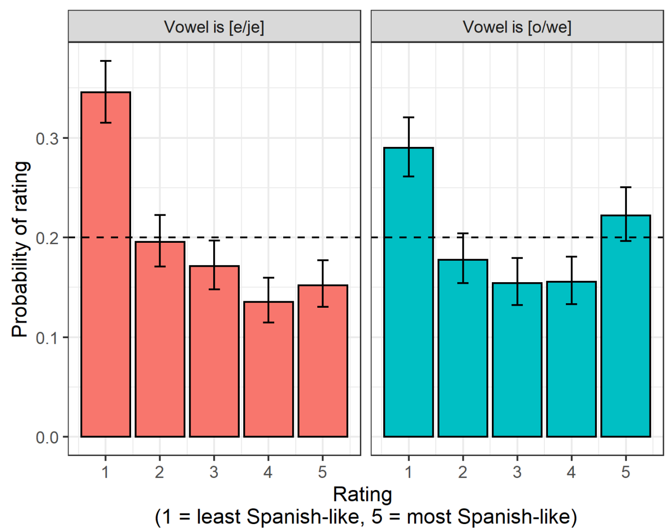

Figure 3.2: Results (mean and binomial confidence interval) of the *blick*-test in Experiment 4. The vertical axis plots the proportion of ratings that fell into each of the five ordinal rating categories which are plotted on the horizontal axis in each of the two facets, which correspond to the quality of the unstressed vowel. The dotted horizontal line represents at-chance distribution of ratings.

We can examine the dependent variable of Rating on the *blick*-test in the multivariate model described above to verify the statistical robustness of the findings. The model found that the responses to unstressed *ie* were left-skewed compared to chance, and that stimuli with unstressed *ue* were rated as more well-formed ($\hat{\beta} = 0.4$ [0.0, 0.7], $P(|\hat{\beta}| > 0) = 0.98$.

3.4.5.3 Priming of the Remote Base

To assess whether priming the Remote Base affected the realization of Derivatives, I fit a second pair of univariate models containing only Local Bases with Remote Bases known to the participant. One model contained only Local Bases with known malign Remote Bases, and the other contained only Local Bases with known benign Remote Bases. My reason for separating the two cases is that, just as we expect priming to interact with what type of Remote Base a Derivative has, we expect lexical characteristics like Remote Base log-frequency and semantic similarity to influence the role that Remote Base has on the Derivative, creating a complex three-way interaction structure of Remote Base type, Local-Remote Base similarity, and Remote Base log-frequency. Therefore, I partition the data into separate models to ease the interpretability of the results, although splitting the data in half does decrease our statistical power.

In both models, the dependent variable was whether the Derivative contained a diphthong (= 0) or monophthong (= 1), and the independent variables were the primed status of the Remote Base (*unprimed* = 0, *primed* = 1), vowel quality (*ié / e* = 0, *ué / o* = 1), and the interaction of the centered and scaled Remote Base log-frequency (extracted from the NOW section of the BYU *Corpus del Español*) and the centered and scaled coefficient for semantic similarity between the Local and Remote Bases extracted from the survey reported in appendix A. The model contained random intercepts for participant and Local Base, with a random slope of priming by Local Base, and random slopes of all fixed effects by participant.

In both models, the critical question we're interested in is whether Local Bases whose Remote Bases were primed form Derivatives in a way that is different from those whose Remote Bases are not, and also about what, if any, role the frequency of the Remote Base and its semantic similarity to the Local Base play in Derivative formation.

I turn first to the model of Derivatives formed to Local Bases with benign Remote Bases, presented in table 3.5

Parameter	*Median*	*95% CI*	*P* $(\lvert\hat{\beta}\rvert > 0)$
Intercept:			
Vowel = *ié*			
Remote Base = *unprimed*			
Semantic sim. = *average value*			
Remote freq. = *average value*	-2.22	[-3.47, -1.09]	
Vowel = *ué*	-1.67	[3.36, -0.30]	0.99
Remote Base = *primed*	-0.57	[-1.54, 0.29]	0.90
Semantic sim. (*scaled 1-unit increase*)	0.28	[-0.64, 1.30]	0.73
Remote freq. (*scaled 1-unit increase*)	0.22	[-0.62, 1.05]	0.71
Semantic sim. × Remote freq.	-0.10	[-2.05, 1.73]	0.54

Table 3.5: Model of Experiment 4 with only known Local and benign Remote Bases. Coefficients are in log-odds, with positive signs indicating an increase in probability of monophthongization relative to the intercept.

The results of the same model fit to Derivatives to Local Bases with known malign Remote Bases are in table 3.6.

Parameter	*Median*	*95% CI*	*P* ($\lvert\hat{\beta}\rvert > 0$)
Intercept:			
Vowel = *ié*			
Remote Base = *unprimed*			
Semantic sim. = *average value*			
Remote freq. = *average value*	-8.60	[-16.87, -4.32]	
Vowel = *ué*	-2.00	[-9.89, 3.67]	0.72
Remote Base = *primed*	-3.11	[-8.68, 0.13]	0.97
Semantic sim. (*scaled 1-unit increase*)	-1.73	[-5.03, 0.76]	0.92
Remote freq. (*scaled 1-unit increase*)	2.88	[0.19, 7.67]	0.98
Semantic sim. × Remote freq.	-2.74	[-7.45, 0.06]	0.97

Table 3.6: Model of Experiment 4 with only Derivatives of Local Bases with known malign Remote Bases. Coefficients are in log-odds, with positive signs indicating an increase in probability of monophthongization relative to the intercept.

Looking at the evidence in its totality, there appears to be qualitatively stronger effects of the lexical characteristics of the Remote Base on Derivatives to Local Bases with malign Remote Bases. Priming a malign Remote Base decreases the odds of monophthongization, as anticipated in section 3.4, and the interaction of semantic similarity and Remote Base frequency mirrors that seen in some of the experiments in chapter 2, with high-frequency malign Remote Bases having their influence on the Derivative inhibited by high similarity to the Local Base, but not low-frequency malign Remote Bases. In comparison, there is much less evidence for any meaningful effect of priming benign Remote Bases, and similarly the other lexical effects are weak. It remains for future research whether this asymmetry is due to the particular characteristics of the stimulus set at hand, or whether there is a more systematic difference between the ways benign and malign Remote Bases interact with Derivative formation via their lexical characteristics.

3.4.6 Local discussion

Experiment 4 revealed that the opportunity for lexically-conservative behavior provided by the lexicon, discussed in section 3.3, is also represented in the grammars of individual speakers. Speakers show an increased willingness of monophthongize a newly-unstressed diphthong if, for that Local Base, there exists a Remote Base in which the corresponding unstressed vowel is a monophthong. Further, we find evidence for unexpected malign Remote Base activity: Local Bases with an unstressed diphthong in the corresponding Remote Base vowel are *even less* likely to form monophthongal Derivatives compared to Local Bases with no Remote Bases. Crosscutting this behavior of Local Bases, we find that there is an effect of differential markedness: in the *blick*-task, participants found unstressed *ie* more marked than unstressed *ue*, and this difference was reflected in the *wug*-test results, with Local Bases containing front diphthongs being more likely to undergo repair than those with back diphthongs.

Turning to the effects of lexical characteristics, find that the malign Remote Bases mirror the Remote Bases of English in their lexical effects, but benign Remote Bases do not have similar strong effects; further work is needed to probe whether this difference is systematic, or related to incidental qualities of the current stimulus set.

To check whether the priming effect documented here is in fact better explained as participants re-learning Remote Bases during the pre-task knowledge check, as discussed in chapter 2, I refit both univariate models to described above to the full set of Derivatives to Local Bases with Remote Bases, regardless of whether the participant indicated they knew the Remote Base, and included a main effect and interaction with priming of whether the participant knew the Remote Base. In both models, I found no evidence that in any of the cases where speakers did not know the Remote Base did the primed Remote Bases (the ones that were asked about before the experiment, rather than after) the primed Remote Base was more likely to have a related monophthongal Derivative compared to the unprimed one.

3.4.6.1 On the role of markedness in Lexical Conservatism

The fact that we find malign Remote Bases exerting a force on the Derivative, rendering them even less likely to contain a monophthong than Local Bases with no Remote Bases, is unexpected from the traditional point of view of Lexical Conservatism, since it flies in the face of the assumed markedness-reducing goal of the phenomenon. Because markedness-driven Lexical Conservatism is observed in English (that is, benign but *not* malign Remote Bases influence the Derivative), this suggests that the markedness of unstressed diphthongs may be somewhat weak, a conclusion compatible with the significant but not overwhelming dispreference for unstressed diphthongs on the phonotactic judgment task. This apparent contradiction is addressed in chapter 4, where I propose a phonological model that is able to accommodate (and indeed, in certain contexts *requires*) the coexistence of weak markedness with an attractive effect of the malign Remote Base.

3.5 Experiment 5

Because the overall rate of monophthongal Derivatives in Experiment 4 raise was extremely low (on average only a little less than 6 monophthongal Derivatives per individual), the goal of Experiment 5 was primarily to replicate the results of Experiment 4 using a different dependent variable: rating the relative well-formedness of two different options for the Derivative, rather than asking participants to produce the Derivative aloud. The hope was that this measure would be more sensitive to speakers' intuitions about well-formedness, and so we would observe a more distributed range of responses compared to the highly skewed results of Experiment 4 (Kawahara, 2015).

3.5.1 Methods

30 native speakers of Mexican Spanish were recruited and compensated in the same manner as in Experiment 4. The stimuli for the Derivative creation task were the same as for Experiment 4, with the exception that the lexically isolated Local Base *priesa*, an archaic spelling of *prisa*

included in Experiment 4 in error, was replaced by the proper name *Daniel*, which is also a Local Base with no Remote Base containing a front diphthong. Further, generic carrier phrases were created for each Local Base. As an example of a phrase, the Local Base *audiéncia* was presented in the context of the sentence *"Un evento con una grand audiencia se podría llamar ___"*, "An event with a large audience could be called ___". Instead of the written form of the Local Base, participants were prompted to click a button to play the Local Base aloud. Similarly, participants were prompted to click a second button to play the two choices *audiencioso* and *audencioso* aloud at the set of underscores.

The procedure for Experiment 5 was the same as for Experiment 4, except that on the *wug*-test response trials, participants were shown the carrier phrase orthographically on the screen, with the Local Base replaced by an button which, when clicked, played the recording of the Local Base, and the Derivative replaced with a button which, when clicked, played both forms of the Derivative (monophthongal and diphthongal) one after another. Participants were then asked to choose which Derivative form they thought sounded more natural, using a 5-point Likert scale, where 1 = unstressed monophthong sounds most natural, and 5 = unstressed mdiphthong sounds most natural.

Data analysis and statistics followed Experiment 4, with no trials excluded from the *wug*- or *blick*- test tasks.

3.5.2 Results

3.5.2.1 Wug-test results

Turning first to the results of the *wug*-test, we can see that the 5-point ratings (in figure 3.3 below) largely mirror the results of Experiment 4. Local Bases without Remote Bases have a preference for unstressed diphthongs which is greater than that of Local Bases with benign Remote Bases, but less than that of Local Bases with malign Remote Bases. We can also see that there is no visually striking difference between the behavior of Local Bases with front vs. back diphthongs; this point is taken up again in section 3.5.3 in conjunction with the discussion of priming.

To verify these observations, I fit a multivariate Bayesian hierarchical regression model with a cumulative link function to the results of the *wug*-test and *blick*-test, with the same specification as that fit to data from Experiment 4. Table 3.7 displays the results for the *wug*-test portion of the model.

Parameter	*Median*	*95% CI*	*P* ($\|\hat{\beta}\| > 0$)
Intercepts:			
Vowel = *ié*			
Remote Base = *none*			
Rating < 2	-2.64	[-3.31, -2.00]	
Rating < 3	-1.83	[-2.48, -1.18]	
Rating < 4	-1.36	[-2.01, -0.71]	
Rating < 5	-0.53	[-1.18, 0.11]	
Vowel = *ué*	0.52	[-0.92, 0.38]	0.62
Remote Base = *malign*	0.50	[0.05, 0.99]	0.99
Remote Base = *benign*	-1.40	[-1.89, -0.93]	≈ 1

Table 3.7: Model of Experiment 5, *wug*-test. Coefficients are in log-odds, with positive signs indicating an increased rating of a Derivative with an unstressed diphthong, relative to the intercept.

The *wug*-test response variable in the model supports the observations made above that unstressed diphthongs in Derivatives to Local Bases with malign Remote Bases are rated less well-formed than those built to Local Bases without Remote Bases, and unstressed diphthongs in Derivatives to Local Bases with benign Remote Bases are rated more well-formed than those built to Local Bases with no Remote Bases. This aligns with the results of Experiment 4. Unlike Experiment 4, and again in line with the qualitative discussion of results directly above, there is little to no evidence that participants find unstressed front diphthongs more marked than unstressed back diphthongs. As we will see below, this lack of evidence for a markedness asymmetry in the *wug*-test is also anomalous in context of the *blick*-test results from Experiment 5, which mirror Experiment 4 in showing that in nonce monomorphemes, unstressed *ie* is dispreferred to unstressed *ue*.

3.5.2.2 Blick-test results

The results of the *blick*-test are displayed below in figure 3.4, and display the same type of asymmetry in favor of unstressed *ue* as in the *blick*-test results from Experiment 4.

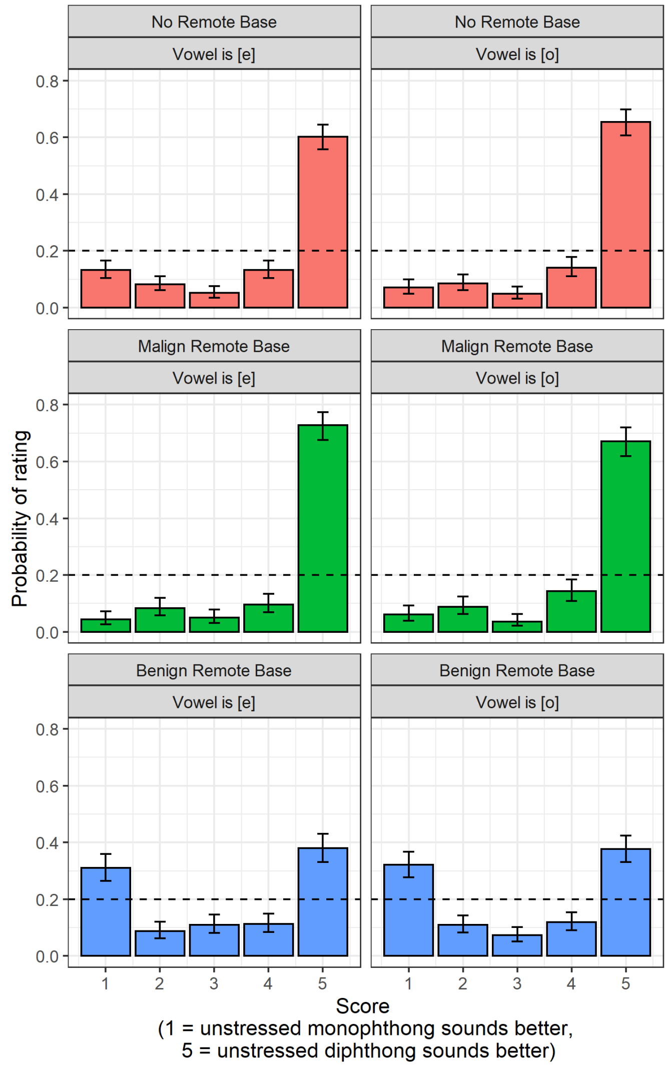

Figure 3.3: Results (mean and binomial confidence interval) of the lexical conservatism task in Experiment 5. Vertical axis plots the proportion of ratings for at each score value (1 indicates a strong preference for unstressed monophthongs, 5 a strong preference for unstressed diphthongs). Vertical panels divide the Derivatives by type of Local Base (horizontal axis), divided by whether the diphthong in the Local Base was *ié* (left facet) or *ué* (right facet). Examples are as follows: Local Base with no Remote Base - *biéla* (front diphthong) and *huéco* (back diphthong), Local Base with malign Remote Base - *cie|4lo* ∼ *cielíto* (front diphthong) and *huévo* ∼ *huevón* (back diphthong), Local Base with benign Remote Base - *ciégo* ∼ *cegár* (front diphthong) and *truéno* ∼ *tronár* (back diphthong). The horizontal dashed line represents an at-chance distribution of ratings.

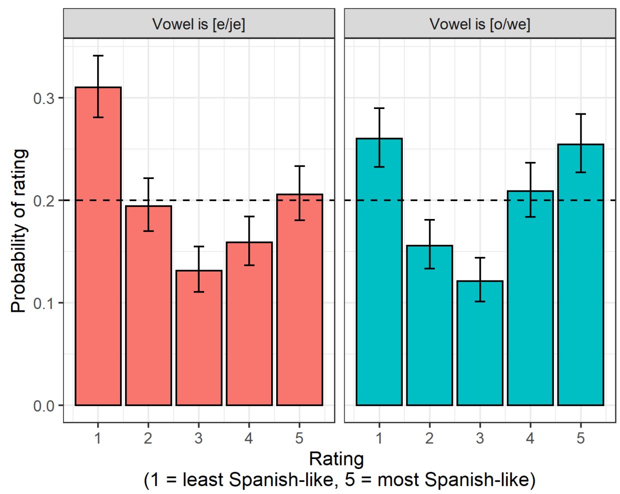

Figure 3.4: Results (mean and binomial confidence interval) of the *blick*-test in Experiment 5. The vertical axis plots the proportion of ratings that fell into each of the five ordinal rating categories which are plotted on the horizontal axis in each of the two facets, which correspond to the quality of the unstressed vowel. The dotted horizontal line represents at-chance distribution of ratings.

Turning to the *blick*-test response variable in the multivariate model, we find that this observation is borne out; unstressed *ue* is associated with a higher rating compared to unstressed *ie*: $\hat{\beta} = 0.40$ [-0.0, 0.83], P($|\hat{\beta}|$) $> 0 = 0.97$.

3.5.2.3 Priming the Remote Base

As in Experiment 4, I fit a pair of univariate model to the responses for Local Bases with malign and benign Remote Bases from the *wug*-test in Experiment 5, modeling Derivatives with malign and benign Remote Bases separately. The models had the same structure as those in section 3.4.5.3. The results of the model fit to Derivatives with benign Remote Bases is in table 3.8 below.

Parameter	*Median*	*95% CI*	*P* $(\lvert\hat{\beta}\rvert > 0)$
Intercepts:			
Vowel = *ié*			
Remote Base = *unprimed*			
Remote freq. = *average value*			
Semantic sim. = *average value*			
Rating < 2	-1.03	[-1.67, -0.38]	
Rating < 3	-0.47	[-1.11, 0.17]	
Rating < 4	0.00	[-0.63, 0.65]	
Rating < 5	0.61	[-0.03, 1.27]	
Vowel = *ué*	-0.18	[-0.88, 0.61]	0.64
Remote Base = *primed*	0.10	[-0.26, 0.45]	0.72
Remote freq. (*scaled 1-unit increase*)	-0.02	[-0.44, 0.39]	0.54
Semantic sim. (*scaled 1-unit increase*)	-0.07	[-0.56, 0.43]	0.62
Remote freq. × Semantic sim.	-0.30	[-1.04, 0.46]	0.79

Table 3.8: Model of Experiment 5 with only Derivatives of Local Bases with known benign Remote Bases. Coefficients are in log-odds, with positive signs indicating an increased rating of a Derivative with a diphthong, relative to the intercept.

The results of the univariate model fit to Derivatives of Local Bases with malign Remote Bases is in table 3.9 below.

Parameter	*Median*	*95% CI*	*P* ($|\hat{\beta}| > 0$)
Intercepts:			
Vowel = *ié*			
Remote Base =´*unprimed*			
Remote freq. = *average value*			
Semantic sim. = *average value*			
Rating < 2	-4.45	[-5.58, -3.39]	
Rating < 3	-2.65	[-3.70, -1.67]	
Rating < 4	-2.06	[-3.10, -1.08]	
Rating < 5	-0.94	[-1.97, 0.03]	
Vowel = *ué*	-0.09	[-0.77, 0.59]	0.61
Remote Base = *primed*	-0.07	[-0.51, 0.38]	0.60
Remote freq. (*scaled 1-unit increase*)	-0.15	[-0.52, 0.21]	0.80
Semantic sim. (*scaled 1-unit increase*)	0.35	[-0.03, 0.77]	0.97
Remote freq. × Semantic sim.	0.32	[-0.02, 0.68]	0.97

Table 3.9: Model of Experiment 5 with only Derivatives of Local Bases with known malign Remote Bases. Coefficients are in log-odds, with positive signs indicating an increased rating of a Derivative with a diphthong, relative to the intercept.

As in Experiment 4, the effect of lexical characteristics — priming, and the interaction of semantic similarity with Remote Base log-frequency — are driven primarily by the Derivatives with malign Remote Bases. The notable difference is that the effect of vowel quality — with *ié* undergoing more monophthongization than *ué*, is absent from both models. I take this point up in section 3.5.3 below.

As with Experiment 4, it is important to check whether any effect of priming could be due to participants "re-learning" the Remote Bases during the pre-task vocabulary check. To this end, I reran the two univariate models with a slightly larger set of data — all Derivatives with a Remote Base, regardless of whether the speaker identified it as known or not. I added a main effect corresponding to whether the speaker identified the Remote Base as known during the vocabulary check, and also the interaction of this factor with whether or not the Remote Base was primed. In both the models, the estimate for the interaction centered on zero, indicating that any priming effect was likely not due to speakers re-learning the Remote Bases during the experiment.

3.5.3 Local discussion

Experiment 5 sought to replicate the findings of Experiment 4 with a different, potentially more sensitive, dependent variable (rating of two options, compared to production in Experiment 4). The results support the three-way split in behavior of Derivatives based on whether there is no Remote Base, a benign Remote Base, or a malign Remote Base, replicating the results of Experiment 4. Again similar to Experiment 4, the lexical effects were largely driven by the malign Remote Bases. However Experiment 5 diverges from Experiment 4 in that there is little evidence of a markedness asymmetry in diphthongs in the results of the *wug*-test in Experiment 5, despite its presence in the *blick*-test. This outcome might have been due to the change in dependent variable to a more passive rating task, compared to a more involved production task: recent findings (Moore-Cantwell *in progress*) on work in English stress has found that whether the experimental task involves a forced-choice among multiple presented options changes the sensitivity of speakers to different types of markedness. Although in the case of Moore-Cantwell the task involving the forced-choice yielded responses which displayed *more* sensitivity to phonological characteristics of the stimuli, it is still possible that the change in task type was responsible for the lack of effect.

3.6 Discussion

The two experiments on Spanish diphthongization presented here demonstrated that the distribution of Remote Bases observed in the lexicon instantiates a pattern which is psycholinguistically real in the grammars of speakers of Mexican Spanish. The primary finding emerging from both experiments is that both malign and benign Remote Bases are active in influencing the form of the Derivative in Spanish. There is evidence, from the *blick*-test in both Experiments, as well as the *wug*-test in Experiment 4, that unstressed diphthongs have a marked status in the grammar of the speakers who completed both experiments, but the markedness of unstressed diphthongs is outweighed in both experiments by the pull of the Remote Base, as evidenced by the lower rate of monophthongization in Derivatives to Local Bases with malign Remote Bases, compared to ones with no Remote Base. Further, we find that there are strong effects of priming and lexical effects, but only for malign Remote Bases, with the interaction of semantic similarity and Remote Base frequency reminiscent of some of the findings in Experiments 1-3 on English. Looking forward to chapter 4, we find that the comparatively strong role of the Remote Base in Spanish compared to English falls out from the relative strength of markedness in the languages. In chapter 5 I discuss some possible ways to understand the unexpected role of semantic similarity in moderating the influence of Remote Bases on Derivative formation.

CHAPTER 4

Modeling the phonological system

4.1 Introduction

This chapter begins with a brief summary of the findings from the experiments presented in chapters 2 and 3, with an emphasis on qualitative characteristics which can inform and constrain our theoretical model of Lexical Conservatism. This summary motivates a new phonological model of the phenomenon that is able to capture the effect of both the benign and malign Remote Bases in Spanish, taking advantage of the cumulative influence of multiple Remote Bases to capture data that is problematic for other theories. I then move on to a discussion of the place of English and its malign Remote Bases in the proposed theory, demonstrating that both the Spanish-like system with influential malign and benign Remote Bases, and the English system where only benign Remote Bases influence the Derivative, fall out of different weighting conditions of the same underlying theory.

4.2 Review of Experiments 1-5

The findings of chapters 2 and 3 break down into two broad categories: phonological influences on Derivative formation, and lexical influences on Derivative formation.

4.2.1 Phonological conditions on Derivative formation

Experiments on both English and Spanish show robust evidence for avoidance of the marked structure that is argued to drive the use of the Remote Base. In English, all three experiments found an effect of lapse avoidance, such that Local Bases without any Remote Base underwent some occasional rightward stress shift (ex., *bállot* + *-able* → *ballótable*), and Local Bases with benign Remote Bases underwent rightwards stress shift more often (*lábor* + *-able* → *labórable*). This independent existence of lapse avoidance as a phonotactic principle was verified using a phonotactic judgment task. We also found an avoidance of posttonic secondary stresses preceding a lapse (as in *bánkrùptable*), a dispreference for forms that would create an unstressed posttonic heavy syllable (as in *séquenceable*), and a resistance to violating faithfulness to the vowel quality of an unstressed schwa so as not need to "invent" a stressed vowel quality for the form (ex., *vélvet*→*velvétable* /ˈvɛlvət + əbl̩/ →[?vəlˈvɛɾəbl̩, ??vəlˈvɪɾəbl̩]).

In Spanish, two experiments gave evidence for a baseline avoidance of unstressed diphthongs, which were occasionally repaired via monophthongization in Local Bases without Remote Bases (ex. *ambiénte* "environment" + *-óso* → *ambentóso* "with much to do with the environment"), with Local Bases that had benign Remote Bases being the site of even more frequent repair (ex., *aliciénte* "incentive" + *-oso* → *alicentóso* "with much incentives.") We also observed that the propensity to undergo repair was moderated by diphthong type, with unstressed front diphthongs (*aliciente*) undergoing monophthongization more frequently than unstressed back diphthongs (*duende* "elf"). The robustness of the dispreference for unstressed diphthongs, as well as its differentiation by vowel quality, was confirmed using a phonotactic acceptability task.

While English and Spanish patterned alike in the behavior of Local Bases that had either no Remote Base or a benign one, the languages diverged the influence that malign Remote Bases exerted on Derivatives. In English, malign Remote Bases such as *résident* for Local Base *resíde*, counterproductive with respect to lapse avoidance, exerted no influence on Derivatives — I term these types of Remote Bases here *toxic* malign Remote Bases. In Spanish the malign Remote Bases, such as *juergísta* "reveller" to the Local Base *juérga* "spree", are not actually markedness-increasing, but only encourage the Derivative to be as marked as the unrepaired, faithful candidate — I term these *nontoxic* malign Remote Bases. Such Remote Bases in Spanish formed Derivatives that resembled their Remote Base to a greater extent than those those without Remote Bases, operating against the grain of markedness.

The non-categorical nature of the phenomenon suggests that we must employ a probabilistic phonological framework: repair is not obligatory, and is attested even in the absence of a Remote Base. Further, the fact that the form of the Derivative is jointly conditioned by multiple phonological factors in both English and Spanish suggests that a weighted-constraint model which derives constraint cumulativity by default is appropriate. I use the Maximum Entropy Harmonic Grammar framework (Smolensky, 1986; Goldwater and Johnson, 2003) to implement the analysis proposed in this chapter, although in principle an analysis using the Noisy Harmonic Grammar framework (Boersma and Pater, 2016) might also be possible.

In brief, a Maximum Entropy Harmonic Grammar (henceforth a "MaxEnt" grammar) is a type of constraint-based phonological framework which has gained prominence for its ability to model non-categorical phonological phenomena (see the cases in Hayes and Wilson, 2008; Linzen et al., 2013; Zuraw and Hayes, 2017; Hughto et al., 2019), and also because of its close connection to statistical models of data-analysis including multinomial logistic regression (cf. Jurafsky and Martin, 2009:ch. 5), which permits it to be fit to data algorithmically and enter into mathematically explicit theory comparison. Like other species of Harmonic Grammar (Hayes, 2017), MaxEnt exhibits constraint cumulativity (cf., ex., Jäger and Rosenbach, 2006:for an overview of the terminology and concepts at stake), which follows from its use of weighted constraints. Thus, each candidate's Harmony score (H) is a weighted sum of its violations, which is passed through a nonlinear transformation to form part of a distribution where the probability of a given candidate is related both to its own Harmony score and the fitness of its fellow candidates (Smolensky, 1986; Goldwater and Johnson, 2003; Hayes, 2020). Common gradient-based optimization techniques can be used to work backwards from an empirical distribution over attested forms to the weights that best match it, yielding along the way a predictive model, and a likelihood score embodying how well that phonological theory (e.g., the choice of constraints and candidates) fits the data at hand. Here, the primary purpose of MaxEnt is to allow us to work backwards from the experimental data in chapters 2 and 3 to evaluate different theories which have been proposed to give rise to it, which are richer and more abstract than the inferential statistical analyses performed in the experimental chapters.

4.2.2 Lexical conditions on Derivative formation

The hallmark of Lexical Conservatism is that the presence of a Remote Base in the lexicon of the speaker influences the phonological shape of the Derivative. In the five experiments presented in chapters 2 and 3, I demonstrated not only that the presence of the Remote Base in the individual lexicon of the speaker changes how that speaker creates Derivatives, but also that priming the Remote Base generally increases the odds of the Derivative resembling it.

Evidence for the role of Remote Base log-frequency and semantic similarity are elusive, and while some evidence supporting them is found, particularly in the English data, I do not weight them heavily in considering the characteristics of the model of lexicon-grammar interaction I propose in section 4.3, although we will see that such factors are able to be accommodated by the proposed model without difficulty. Further targeted experimental work is necessary to draw conclusions with greater confidence about their (lack of) involvement in Derivative formation.

4.3 A new model of Lexical Conservatism

I propose a model of Lexical Conservatism where each listed allomorph gets a say in how the Derivative is realized, regardless of its status with respect to markedness (optimizing (benign), non-optimizing (nontoxic malign), or anti-optimizing (toxic malign)). This is operationalized via multiple faithfulness constraints, each enforcing identity between the Derivative and a different listed allomorph, scaled by the combined effect of the different characteristics of these Bases in the lexicon. Alongside the effects of faithfulness, markedness constraints penalize marked structures in the Derivative. Below, I detail how this system can give rise to the data patterns in English and Spanish, and the predictions it makes for other types of base-driven effects such as paradigm uniformity. In chapter 5, I explore how the lexical scaling mentioned above can be used to incorporate the effects of priming or semantic similarity into Derivative formation.

I use an extended schematic example to illustrate the core workings of the model. First, let us consider a single Local Base with no Remote Bases, with two candidates, one that undergoes a markedness-improving alternation (the *changed candidate*) and the other which does not (the *faithful candidate*). There are two constraints, Faith-Local, that is violated by the changed candidate, and Markedness, which is violated by the faithful candidate. This scenario is demonstrated in table 4.1 below.

/Local Base/ Weight:	Faith-Local 4	Markedness 3
a. *faithful*		1
b. *changed*	1	

Table 4.1: A tableau illustrating the schematic violation profile of a Derivative to a Local Base with no Remote Bases.

In this scenario, we can note that although there are two constraint weights to set, it is only the difference between the two that is critical (this will change later on). The graph below in figure 4.1 demonstrates that as the weight of Markedness changes with Faith-Local held constant, the probability of the changed candidate likewise differs, from low when Markedness is below Faith-Local, to medium when the two weights are equal (that is, the difference is zero), to high when the weight of Markedness exceeds that of Faith-Local.

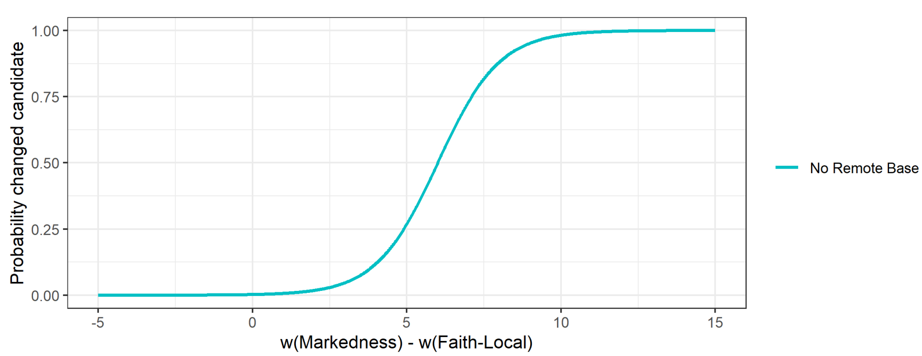

Figure 4.1: Schematic change in probability of the changed candidate based on the difference between the weight of Markedness and Faith-Local.

I illustrate the principle innovation of my model — adding Faith-Remote as an additional force acting on the Derivative — in table 4.2 below. This tableau, where there is a Local Base with a benign Remote Base, demonstrates that we can capture the core of Lexical Conservatism: the presence of a benign Remote Base increasing the odds of Derivatives resembling it. Here, the faithful candidate violates not only Markedness, but also Faith-Remote, a constraint enforcing faithfulness to the benign Remote Base. The degree to which Faith-Remote is less than Faith-Local governs the strength of attraction of the Remote Base (in this running schematic example, the difference is 1). This is implemented in the tableau in figure 4.2. I take up the question of how a learner would learn the weight of these constraints, as well as how lexical factors like priming can be integrated into this model, in chapter 5.

/Local Base/ Weight:	Faith-Local 4	Markedness 3
a. *faithful*		1
b. *changed*	1	

/Local/, /Benign Remote/ Weight:	Faith-Local 4	Faith-Remote 3	Markedness 3
a. *faithful*		1	1
b. *changed*	1		

Table 4.2: Tableaux illustrating the schematic violation profile of a Derivative to a Local Base with no Remote Base (top) and a benign Remote Base (bottom).

We can add the probability of the changed candidate with a benign Remote Base to the graph in figure 4.2. By design, it is consistently higher (greater probability) than the changed candidate with no Remote Base.

We can also add lines for the different types of malign Remote Base. First let us consider the nontoxic malign Remote Base, where the Remote Base has the same markedness as the faithful candidate. This is seen in the tableau below.

For any vertical position on the horizontal axis, the line for the changed candidate is consistently below (less probable than) the changed candidate for the Local Base with no Remote Base.

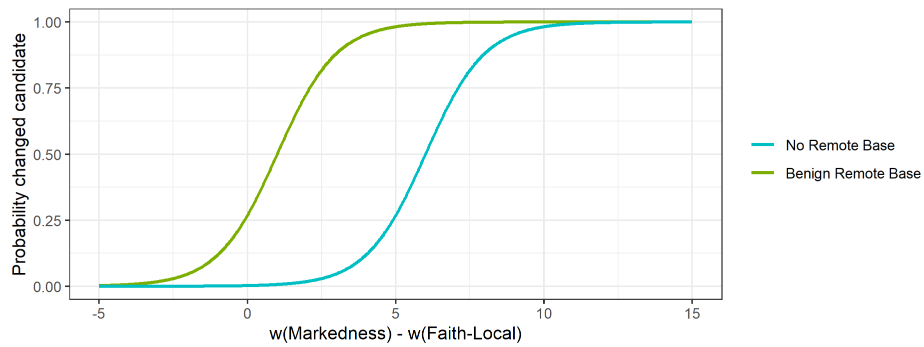

Figure 4.2: Schematic change in probability of the changed candidate based on the difference between the weight of MARKEDNESS and FAITH-LOCAL, for a Local Base with a benign Remote Base and for a Local Base with no Remote Base.

/Local Base/ Weight:	FAITH-LOCAL 4	MARKEDNESS 3
a. *faithful*		1
b. *changed*	1	

/Local/, /Benign Remote/ Weight:	FAITH-LOCAL 4	FAITH-REMOTE 3	MARKEDNESS 3
a. *faithful*		1	1
b. *changed*	1		

/Local/, /Nontoxic malign Remote/ Weight:	FAITH-LOCAL 4	FAITH-REMOTE 3	MARKEDNESS 3
a. *faithful*			1
b. *changed*	1	1	

Table 4.3: Tableaux illustrating the schematic violation profile of a Derivative to a Local Base with no Remote Base (top), a benign Remote Base (center), and a nontoxic malign Remote Base (bottom).

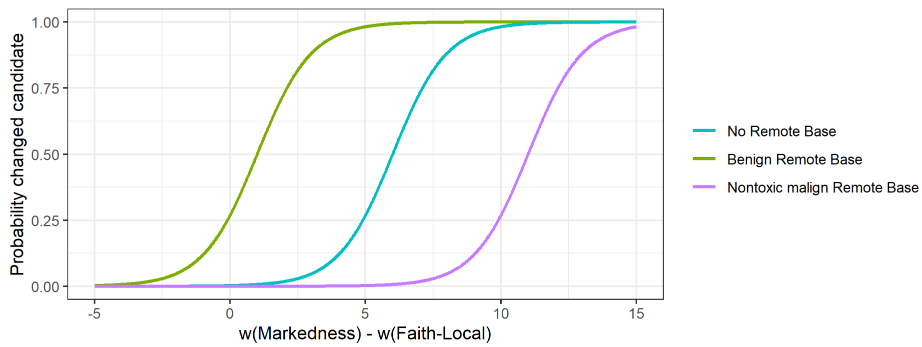

Figure 4.3: Schematic change in probability of the changed candidate based on the difference between the weight of Markedness and Faith-Local, for a Local Base with a benign Remote Base, a Local Base with no Remote Base, and a Local Base with a nontoxic malign Remote Base.

We are now in a position to apply the model to the Spanish data, where the effects of the malign and benign Remote Bases are symmetric in probability space.

4.3.1 Evaluation on Spanish data

In this section I model the data from Experiment 4 on Spanish. I do not combine the data from Experiments 4 and 5 for the same reason that I did not combine data from experiments 2 and 3 with data from experiment 1: the dependent variable for experiments 1 and 5 was not a free-response production task. The development of linking hypotheses between these sorts of tasks (reading aloud words of known segmental content but unknown stress, in English, or rating words presented auditorily, as in Spanish) and the model of Lexical Conservatism I propose here is left to future work.

4.3.1.1 Constraints used in analyzing data from Experiment 4

The constraint set used follows the principles of the voting theory outlined above. Markedness constraints penalize unstressed diphthongs in candidates, and the influence of each Base is handled by multiple faithfulness constraints. The markedness constraints are the following:

- ***Unstressed *-ie-*:** Assign one violation for each unstressed front diphthong *-ie-* in a candidate.

This constraint is violated in *ambientál* "environmental" and *dietético* "dietitian" forms. This constraint is employed because both phonotactic acceptability tasks in Experiments 4 and 5 showed that speakers treated unstressed front diphthongs as more marked than unstressed back diphthongs.

- ***Unstressed -ue-:*** Assign one violation for each unstressed front diphthong *-ue-* in a candidate.

This constraint is the back counterpart of *Unstressed *-ie-*, and is violated in the forms *crueldád* "cruelty" and *suegrástra* "stepmother-in-law".

As discussed in section 4.3, faithfulness constraints play a special role in the analysis of Lexical Conservatism: rather than enforcing identity between a single UR and corresponding segments in a range of candidates, they embody the analogical pull of paradigm members, with each Base having its own Faithfulness constraint acting on each candidate. Faithfulness constraints used in this analysis are the following:

- **Id-V-Local:** Assign one violation for each vowel in the Local Base that is not identical to its corresponding vowel in the candidate

Violations of this constraint are found in the UR-SR pairs /mwebloso/ → [moblóso] meaning "full of furniture", where the Local Base is *muéble* "furniture", and /djetoso/ → [detóso] "pertaining to a diet" where the Local Base is *diéta* "diet".

- **Id-V-Remote:** Assign one violation for each vowel in a primed Remote Base that is not identical to its corresponding vowel in the candidate.

Violations of this constraint are found in the UR-SR pairs /apwestoso/ → [apwestóso] "dashing, daring" where the Local Base *apostár* "to bet" is primed, and /wevoso/ → [ovóso] "eggy" where the Remote Base *huevón* "a lazy person" (slang, literally "a big egg") is primed.

4.3.1.2 Model fitting and evaluation

I fit a MaxEnt model using Excel's *Solver* utility (Fylstra et al., 1998), with a Gaussian prior on weights with a mean of 0 and standard deviation of 100. The goal of using a prior was to endow the model with a preference for lower constraint weights, which can be overcome with a sufficient amount of data. For each Local Base there were two candidates, one having one having an unstressed diphthong and the other an unstressed monophthong. The fitted weights are displayed in table 4.4.

Constraint	Weight
*Unstressed -*ie*-	0.45
*Unstressed -*ue*-	0.00
Id-V-Local	3.04
Id-V-Remote	1.09

Table 4.4: Constraint weights of model fit to data from Experiment 4, on Spanish.

I test the model against one that does not involve Remote Bases (forcing weights for faithfulness constraints referring to them to be zero), and one that does not allow the lexicon to scale faithfulness based on resting activation (forcing weights to be equal for all faithfulness constraints). Both significantly underperform my proposed model (ΔLoglikelihood $= 46$, $p < 0.001$, with two degrees of freedom; and ΔLoglikelihood $= 211.5$, $p < 0.001$, with two degrees of freedom, respectively), again a demonstration of support.

Turning to the weights themselves, we can see that Local Bases have a stronger role in shaping the Derivative than Remote ones. Further, only the more severe of the markedness constraints get appreciable weight, since the other one is acting as a "baseline" level of violation. Quantitatively, the R^2 was 0.25, and the fit between predicted and observed data is displayed in figure 4.4 below.

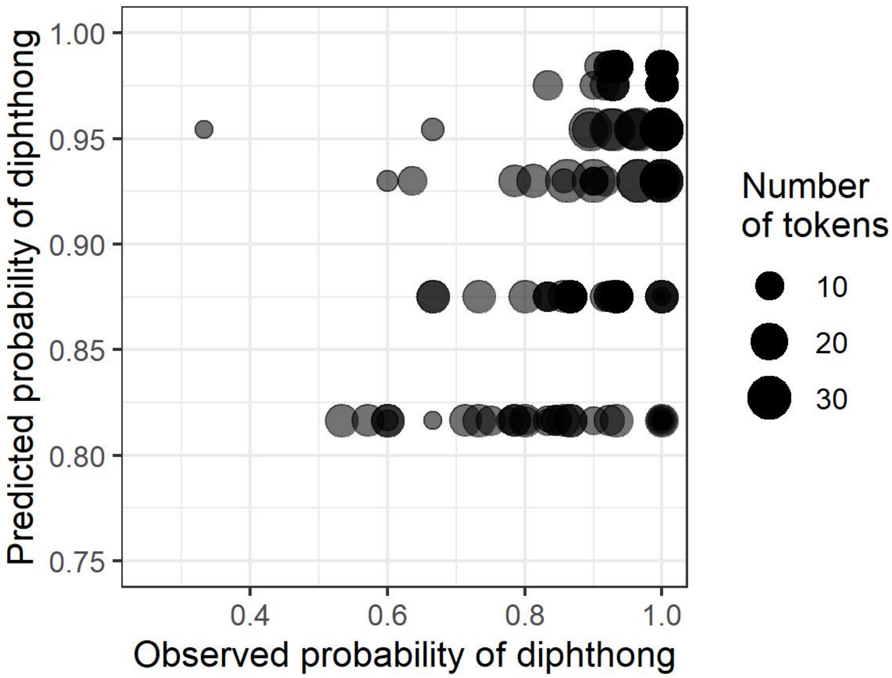

Figure 4.4: Predicted vs. observed fit to data from Experiment 4, on Spanish

I note that an alternative analysis could have made the distinction between diphthong qualities part of the faithfulness constraints, rather than the markedness constraints. This would reflect the P-map-based intuition that the phonetic distance between [we] and [o] is more salient than [je] and [e] (Steriade, 2001). This route is not pursued here because doing so introduces a much larger number of constraints into the analysis than we have enough data to meaningfully attribute weight to on the basis of more than a very small handful of Derivative types, making interpretation of the predicted stringency relationship between them difficult. Future work could profitably employ such an analysis with a larger and more phonologically diverse dataset of Derivatives.

We can see where the Spanish data fit into the predicted typology of the model, in figure 4.5. Note that the finding that the benign Remote Base exerts a stronger effect in probability space than the nontoxic malign Remote Base does falls out automatically as a consequence of the model; the difference between the teal line and the green line is greater than between the teal line and the purple line, even though the difference in weight between Faith-Local and Faith-Remote is identical in the model.

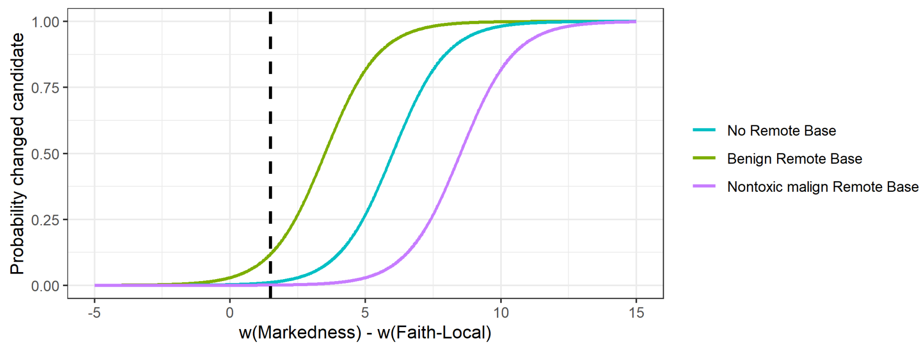

Figure 4.5: Schematic place of the Spanish data in the predicted typology of my model.

4.3.2 Comparison to alternative models

In this section I discuss two alternative formal analyses, one based on the approach taken by Steriade in her original 1997 work, and the other based on the route pursued by Steriade and Stanton (2020). I demonstrate that neither method of analysis is able to capture the fact that in Experiments 4 and 5, the nontoxic malign Remote Base exerted an attractive force on the Derivative, admitting even *less* monophthongization than Local Bases without Remote Bases.

4.3.2.1 Steriade (1997)'s analysis: quantifying over bases

The original model proposed to account for the data from English Level Two affixation in *-able* and for French liaison in Steriade (1997) uses a mechanism that differs from the one I propose in that it puts the emphasis on the role of the lexicon in *licensing* candidates that don't resemble the Local Base, rather than enforcing faithfulness between specific Bases and candidates. The style of analysis can be thought of as involving a quantification over Bases: as long as there is *some* Base in the lexicon that the Derivative can resemble, there is no penalty. The tableaux in figure 4.6 below demonstrates this analysis in action:

In Table 4.6, the constraint Lex [±stress] is violated if, for a given syllable in the candidate, the corresponding syllable in *some* base does not also have the same stress specification. The con-

(16) a.listed allomorphs: include *rémedy, remédi-* in *remédial*

	Lex [±stress]	*Lapse σσσ
i. √ remédiable	√	√
ii. rémediable	√	*!

b.listed allomorphs: include *párody,* not *paródial*

	Lex [±stress]	*Lapse σσσ
i. √ párodiable	√	*
ii. paródiable [pərodiəbl̩]	*!	√

Figure 4.6: An example of the quantification over Bases in the lexicon when licensing a Derivative candidate, taken from Steriade (1997:p. 16).

straint *Lapse$\sigma\sigma\sigma$ serves the same motivating markedness function as the constraint *ExtendedLapse in my model in section 4.4.1. The check marks both indicate non-violation of constraints and also the winning candidate (*remédiable* in the first tableau, *párodiable* in the second).

This model is unable to distinguish rates of monophthongization in Derivatives that show an influence of a nontoxic malign Remote Base from those that have no Remote Base, as demonstrated in table 4.3.2.1 below.

Since the Lex-Vowel constraint does not *encourage* identity between Bases and candidates, and instead simply licenses the possible existence of candidates that resemble any Base in the lexicon, the fact that the Remote Base resembles the Local Base makes no difference in how probability is allotted to forms.

4.3.2.2 Steriade and Stanton (2020)'s analysis: one Base per candidate

The model of Lexical Conservatism proposed in Steriade and Stanton (2020); Steriade (2018), is very similar to the one I propose in section 4.3, with a small difference: they assume that each candidate Derivative stands in correspondence to a single Base - Local or Remote - that is in the input to the tableau. An example of this type of analysis is in table 4.7.

In the figure below, the constraint BD IdStress - referencing the Base-Dependent relationship

/wéco/ Weight:	Lex-Vowel 1	*Unstressed *-ue-* 1	H	*p*
a. [wekóso]		1	1	.5
b. [okóso]	1		1	.5

/mwéble/, /mobl-/ Weight:	Lex-Vowel 1	*Unstressed *-ue-* 1	H	*p*
a. [mweblóso]		1	1	.26
b. [moblóso]			0	.73

/xwérga/, /xwerg-/ Weight:	Lex-Vowel 1	*Unstressed *-ue-* 1	H	*p*
a. [xwergóso]		1	1	.5
b. [xorgóso]	1		1	.5

Table 4.5: A schematic example demonstrating that an analysis in the style of Steriade (1997) fails to capture the influence of the nontoxic malign Remote Base. Lex-Vowel is violated if, a for a given syllable in the candidate, the corresponding syllable in *some* base does not also have the same vowel quality.

(5)	B^L: gélatin B^R: gelátin-ous	100 010-0	BD IdStress	*Lapse$_{LAT}$	C-Containment
☞a.	gelátin^R-òid	0102			*
b.	gélatin^L-òid	1002		*	
c.	gelátin^L-òid	0102	*!*		

Figure 4.7: An example of single-correspondence between Derivative candidates and Bases, taken from Steriade and Stanton (2020:p. 3).

defined by the indexation of the candidates to the Bases in the input (L(ocal) or R(emote)) - is violated if the stressed syllable in the candidate does not correspond to the stressed syllable in the Base it depends on. *Lapse$_{\text{LAT}}$ is the motivating markedness constraint, doing the job of *ExtendedLapse in the model I propose in section 4.4.1, except that it is indexed to the Latinate stratum of Bases; this detail doesn't bear on the suitability of this style of analysis to model the Spanish data, but I return to a discussion of lexical strata in section 4.5.1. Their constraint C-Containment is violated if the candidate is in correspondence to a non-Local base (that is, one which would force a candidate to violate the cyclic containment of the Local Base within the Derivative). In this model, satisfaction of the markedness constraint *Lapse$_{\text{LAT}}$ is achieved by candidate (a), which is faithful to the Remote Base at the expense of faithfulness to the Local Base. Candidate (b) satisfies faithfulness to the Base it depends on (the Local one), but violates markedness in doing so, and thus is ruled out. Candidate (c) is in correspondence with the Local Base but violates faithfulness to it.

Below I demonstrate that, like the model put forward by Steriade (1997), it cannot accounting for cases where a nontoxic malign Remote Base exerts a role in shaping the Derivative: there is no weight of faithfulness and markedness that allows for the Local Base with a nontoxic malign Remote Base, here *juérga* "spree" $\sim$ *juergísta* "reveller", to have a rate of monophthongization which differs from that of the Local Base without any Remote Base, like *huéco* "gap". This follows from Steriade's assumption about the markedness-improving role of the Remote Base, and is evident in the example in table 4.6 below.

Because there is no markedness-improving reason for the Derivative to be more faithful to the nontoxic malign Remote Base, the model cannot distinguish the rates of repair for Local Bases with no Remote Base, and those with nontoxic malign Remote Bases.

4.3.2.3 Model comparison

To measure the degree of misfit the inability to capture the effect of malign Remote Bases in Spanish induces in the two alternative analyses reviewed above, I fit them both to the data from Experiment 4 treated in section 4.3.1, and examined the evidence ratio (Burnham and Anderson, 2002; Anderson and Burnham, 2002; Burnham and Anderson, 2004) for each of the two alternative analyses to the one I proposed in section 4.3; this is displayed in table 4.7 below.

/wéco/$_L$ Weight:	BD Id-V 1	*Unstressed -*ue*- 1	C-Containment 1	H	*p*
a. [wekóso]$_L$		1		1	.5
b. [okóso]$_L$	1			1	.5

/mwéble/$_L$, /mobl-/$_R$ Weight:	BD Id-V 1	*Unstressed -*ue*- 1	C-Containment 1	H	*p*	sum *p*
a. [mweblóso]$_L$		1		1	.31	.36
b. [mweblóso]$_R$	1	1	1	3	.04	
c. [moblóso]$_L$	1			1	.31	.63
d. [moblóso]$_R$			1	1	.31	

/xwérga/$_L$, /xwerg-/$_R$ Weight:	BD Id-V 1	*Unstressed -*ue*- 1	C-Containment 1	H	*p*	sum *p*
a. [xwergóso]$_L$		1		1	.36	.5
b. [xwergóso]$_R$		1	1	2	.13	
c. [xorgóso]$_L$	1			1	.36	.5
d. [xorgóso]$_R$	1		1	2	.13	

Table 4.6: A schematic example demonstrating that an analysis in the style of Steriade and Stanton (2020) fails to capture the influence of the nontoxic malign Remote Base.

Model	*LL*	*ΔAICc*	*Evidence ratio favoring the first model*
Voting model (this dissertation)	-562.24		
Steriade (1997), positive weights	-765.41	404.35	$6.84 \times 10^{87} : 1$
Steriade (1997), any weights	-567.08	7.68	46 : 1
Steriade & Stanton (2020)	-567.08	9.68	126 : 1

Table 4.7: Statistical measures of model fit and comparison for the voting theory of Remote Bases proposed in section 4.3, the quantification-based theory of Steriade (1997), and the one-Base-at-a-time theory of Steriade and Stanton (2020). Note that to give the model a better chance of being able to be a contender in fitting the data, I include the analysis in Steriade (1997) with strictly positive constraint weights (as is the case for all other models in the table) as well as one with both positive and negative weights permitted.

We can see that the inability to distinguish between Derivatives with and without a non-optimizing Remote Base leads for the weight of evidence to favor the voting theory.

4.4 On toxic malign Remote Bases

So far, we have examined the interaction of Local Bases with no Remote Base, benign Remote Bases, and nontoxic malign Remote Bases. Here, we take up toxic malign Remote Bases — cases where, if the Remote Base were adopted in the Derivative, the changed candidate would actually be *more* marked than the faithful candidate.

Adding the probability of the changed candidate to yield the graph in figure 4.8, we can see that the changed candidate for the Derivative of a Local Base with a toxic malign Remote Base is only likely when the weight of Faith-Local is high relative to Markedness, and even then is somewhat marginal.

We are now in the position to fit a model based on the voting theory of Remote Bases to the English data.

/Local Base/ Weight:	FAITH-LOCAL 4	MARKEDNESS 3
a. *faithful*		1
b. *changed*	1	

/Local/, /Benign Remote/ Weight:	FAITH-LOCAL 4	FAITH-REMOTE 3	MARKEDNESS 3
a. *faithful*		1	1
b. *changed*	1		

/Local/, /Toxic malign Remote/ Weight:	FAITH-LOCAL 4	FAITH-REMOTE 3	MARKEDNESS 3
a. *faithful*		1	
b. *changed*	1		1

Table 4.8: Tableaux illustrating the schematic violation profile of a Derivative to a Local Base with no Remote Base (top), a benign Remote Base (center), and a toxic malign Remote Base (bottom).

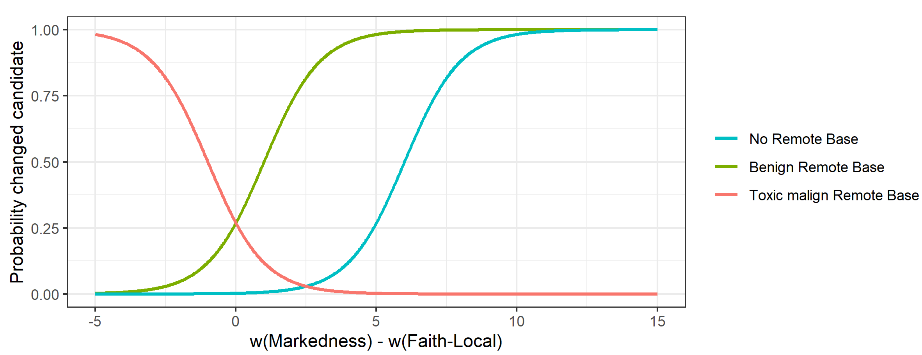

Figure 4.8: Schematic change in probability of the changed candidate based on the difference between the weight of MARKEDNESS and FAITH-LOCAL, for a Local Base with a benign Remote Base, a Local Base with no Remote Base, and a Local Base with a toxic malign Remote Base.

4.4.1 Evaluation on English data

In this section I discuss the application of the model architecture proposed above to the data gathered in Experiments 2-3. To aid in a unified phonological analysis, I aggregate the data across experiments; I do not include data from Experiment 1 because this study used written stimuli where the *-ate* suffix of many of Steriade's original Local Bases was pre-removed in the presentation of the Derivative (ex., the Derivative that participants were asked to produce for Local Base *inundate* was *inundable* not *inundatable*). This process restricted subjects' spontaneous responses to only those where the *-ate* had been dropped; in pilot work using a fill-in-the-blank task, *-ate*-dropping was almost never observed spontaneously. I also do not pursue the option of including just those stimuli which were newly selected for Experiment 1 to test the generality of Steriade's claims, since although they do not suffer the complication of *-ate*-dropping, they differ from the data from Experiments 2 and 3 in that they are the result of a reading-aloud task, rather than a spontaneous production task, and thus may be subject to different unmodeled pressures that would introduce confounds into the analysis. Future work in this vein might extend the current analysis to data where the relevant phonological candidates include differences in morphological structure — the presence or absence of *-ate* — rather than simply whether or not they resemble to the Local Base in some specific characteristic.

4.4.1.1 Constraints used in analyzing data from Experiments 2 and 3

The constraints employed in this analysis are quite traditional in the context of the literature on English stress, with the exception that faithfulness constraints are differentiated based on the status of the Base that they are enforcing faithfulness to.

The markedness constraints employed in the analysis are the following:

- *EXTENDEDLAPSE: Assign one violation for each string of three unstressed syllables in the Derivative.

This constraint is violated in forms such as *bállotable* and *láborable*, and obeyed in shifted candidates like *ballótable* and *labórable*. This constraint can be thought of as one of the driving forces of the use of the phonologically-advantageous Remote Base, and the reason why analogical pressures from faithfulness to toxic malign Remote Bases do not influence the Derivative in English. For precedents, see Gordon (2002); Stanton (2016); see also Steriade and Stanton (2020) for use in the analysis of cases of Lexical Conservatism in English stress.

- ***WeakFinalTernary:** Assign one violation for each sequence of two unstressed, word-final syllables directly preceded by a syllable bearing secondary stress.

This constraint is violated in forms such as *bánkrùptable* and *cúckòldabḷ*. Speaking in terms of SPE stress numbering Chomsky and Halle (1968), it forbids the sequence *200#*. This principle of English metrical structure can be found described in Pater (2000), where it was cast as a ban on non-right-aligned main stress (assuming final-syllable extrametricality), and much work before and since has found this principle emergent from comprehensive analyses of English stress.

- **Pre-stress *-ic*:** Assign one violation if syllable directly preceding the suffix *-ic* does not bear primary stress.

This constraint is violated in forms such as *lúmberic* and *résinic*. Although analyses of the stress preferences of English affixes broadly construed generally make use of a distinction between Level 1 and Level 2 affixes to regulate this behavior, for the simpler present case I use a "brute force" constraint like this one to model the degree to which *-ic* prefers to be pre-stressed (cf., for instance, Chomsky and Halle, 1968:who posit an affix-specific rule).

- ***WeakHeavy:** Assign one violation when a posttonic heavy syllable in the Derivative does not also bear stress (primary or secondary).

This constraint is violated in forms such as *séquencable*. This constraint enforces one aspect of the stress-to-weight principle, a typological propensity for heavy syllables to attract stress (see Ryan, 2016:for an overview of the literature), and of the Latin Stress Rule of English (Chomsky and Halle, 1968; Liberman and Prince, 1977:et seq.).

The faithfulness constraints included in the analysis are listed below. Note that the faithfulness constraints are split into primed and non-primed versions; this is a mere notational variant for a scaling factor discussed in chapter 5. For local purposes, it acts just like any other faithfulness constraint.

- **ID-[STRESS]-LOCAL:** Assign one violation if the primary stressed syllable in the Local Base does not correspond to the primary stressed syllable in the candidate.

Violating UR-SR pairs include /sénator/ → [senátorist] and /sénator/ → [sènatórist].

- **ID-[STRESS]-REMOTE-PRIMED:** Assign one violation if the primary stressed syllable in a primed Remote Base does not correspond to the primary stressed syllable in the candidate.

Violating UR-SR pairs include /túmult/→ [túmultist] if *tumúltuous* is primed, /próverb/ → [próverbist] if *provérbial* is primed.

- **ID-[STRESS]-REMOTE-UNPRIMED:** Assign one violation if the primary stressed syllable in an unprimed Remote Base does not correspond to the primary stressed syllable in the candidate.

Violating UR-SR pairs include /túmult/→ [túmultist] if *tumúltuous* is not primed, /próverb/ → [próverbist] if *provérbial* is not primed.

- ***MAP-/ə/-FULL-LOCAL:** Assign one violation for each schwa in a Local Base that corresponds to a full vowel in a candidate.

This constraint is violated in UR-SR pairs such as *vélvet*→ *velvétable*, /ˈvɛlvet/ → [vəlˈvɛɾəbl̩], where the underlying schwa needs to be given a non-schwa quality, but not in forms such as *lúmber* → *lumbérable*, [ˈlʌmbɚ] → [ləmˈbɚəbl̩], where the [ɚ] vowel does not change quality under stress alternation. The rationale behind the inclusion of this constraint is intuition that, for example, in the case of Steriade's *parody* + *-able*, a considerable part of the ill-formedness of the candidate Derivative *paródiable* (?[pəˈɹo͡ʊɾiəbl̩, ??pəˈɹaɾiəbl̩]) as the Derivative stems from having to "invent" or "resurrect" a full vowel quality for the underlyingly reduced vowel (to satisfy a highly-weighted, not-included constraint banning stressed schwas). See Zhang (2021) for a further recent look at the complex relationship between stress and vowel quality in English (nominal) paradigms. I use *MAP constraints (Zuraw, 2013) rather than traditional IDENT constraints because of the intuition that the *direction* matters: reducing a vowel to a schwa is commonplace in English, but inventing a new vowel quality from nothing is rare.

- ***MAP-/ə/-FULL-REMOTE-PRIMED:** Assign one violation for each schwa in a primed Remote Base that corresponds to a full vowel in a candidate.

This constraint is violated in UR-SR pairs such as *córage* → *courágeous*, /ˈkɚɹəd͡ʒ/ → [ˈkɚɹəd͡ʒəbl̩] when *courágeous* /kɚˈɹe͡ɪd͡ʒəs] is primed.

- ***MAP-/ə/-FULL-REMOTE-UNPRIMED:** Assign one violation for each schwa in an unprimed Remote Base that corresponds to a full vowel in a candidate.

This constraint is violated in UR-SR pairs such as *córage* → *courágeous*, /ˈkɚɹəd͡ʒ/ → [ˈkɚɹəd͡ʒəbl̩] when *courágeous* /kɚˈɹe͡ɪd͡ʒəs] is not primed.

4.4.1.2 Model fitting and evaluation

I fit a Maximum Entropy model to the combined data from Experiments 2 and 3 using Microsoft Excel's *solver* function. For each sub-tableau governing an individual type of Derivative formation, inputs were all Bases (Local, benign Remote, and toxic malign Remote), and candidates were two productions with stress matching the Local Base or Remote Base. An example of the Local Base *lábor* with Remote Base *labórious* is below in table 4.9.

Although there was some between-speaker variation in the precise phonetic implementation of secondary stress, vowel reduction, and vowel resurrection that accompanied non-Local-Base-matching stress placement, the counts I report here correspond to what I perceived as the intended

/ˈle͡ɪbɚ/$_L$, /ləˈbɔɹ-/$_R$	*ExtendedLapse	*WeakFinalTernary	Pre-stress -*ic*	*WeakHeavy	Id-[stress]-Local	Id-[stress]-Remote-primed	Id-[stress]-Remote-unprimed	*Map-/ə/-full-Local	*Map-/ə/-full-Remote-primed	*Map-/ə/-full-Remote-unprimed
a. [ˈle͡ɪbɚəbl̩]	1					1			1	
b. [ləˈbɔrəbl̩]					1					

Table 4.9: A sample candidate and violation set from a tableau where the Remote Base *laborious* is known and primed.

target; future work exploring the exact phonetic and phonological variability of pronunciation of novel nonwords could widen the candidate set further, and might uncover novel findings.

The model included a Gaussian prior on constraint weights (Goldwater and Johnson, 2003), with a mean of zero and standard deviation of 100. The weights allotted to the above constraints are listed in table 4.10.

Constraint	Weight
*ExtendedLapse	0.54
*WeakFinalTernary	2.01
Pre-stress -*ic*	2.17
*WeakHeavy	0.54
Id-[stress]-Local	1.49
Id-[stress]-Remote-primed	0.98
Id-[stress]-Remote-unprimed	0.65

Table 4.10 continued from previous page

Constraint	Weight
*Map-/ə/-full-Local	0.69
*Map-/ə/-full-Remote-primed	0.00
*Map-/ə/-full-Remote-unprimed	0.00

Table 4.10: Constraint weights for model fit to data from Experiments 2 and 3, on English.

I do not carry out significance testing on a constraint-by-constraint basis, because many of the narrower effects have been more rigorously assessed in their context (chapter 2) using inferential statistics. However, I do test the model against two alternative models that embody different theoretical claims, which do not correspond to any previous statistical test done on the data. First, I compare the full model to one where the lexicon plays no role in scaling accessibility of Bases cashed out as differing weights of Faithfulness constraints. This model does not allow faithfulness constraints to have different weights based on whether they refer to Local and Remote Bases; it significantly underperforms my proposed model (ΔLoglikelihood $= 148.7$, $p < 0.001$, with four degrees of freedom). The second model is one that denies a role for Remote bases to play in generating the data all together, so the weights of faithfulness to Remote Bases are forced to zero; this model also significantly underperforms (ΔLoglikelihood $= 66.7$, $p < 0.001$, with four degrees of freedom). I take these findings as points in favor of a general model of Lexical Conservatism that relies on Remote Bases, and further allows the lexicon to scale access to them (discussion of which is taken up in the next chapter.)

4.4.1.3 Discussion

Qualitatively examining the weights given to the constraints in table 4.10 above, it seems that the markedness constraints generally are in line with what one might expect from an experimental test of the principles of English metrical phonology: there is a prominent effect of matching weight to stress, as well as the avoidance of long lapses. Turning to faithfulness constraints, we find that the status of the Base in the lexicon is reflected directly in the weights, both for the segmental and metrical faithfulness constraints. Most prominent is the Local Base, which exerts a strong influence on the Derivative, both in terms of stress location and also segmental faithfulness. Remote Bases have lower weights of faithfulness, with metrical faithfulness reflecting a distinction of priming such that primed Remote Bases are more influential on the Derivative than unprimed ones.

In quantitative terms, the model achieves a reasonable fit to the data, with an R^2 of 0.67; the model predictions are plotted below in figure 4.9.

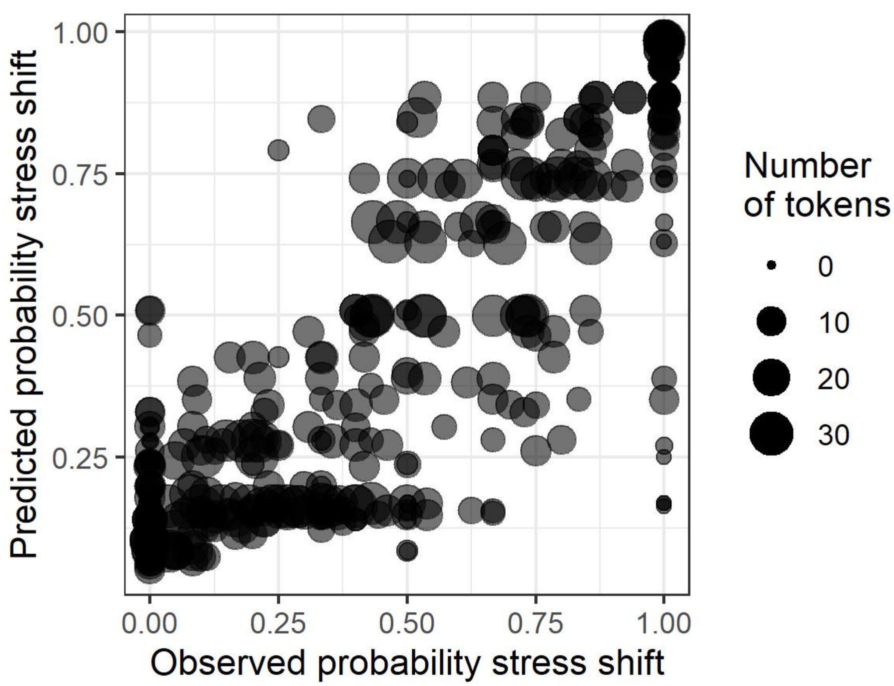

Figure 4.9: Predicted vs. observed fit to data from Experiments 2 and 3, on English.

The most notable success of the model, in my view, is that the hierarchy of influences from the different Bases emerge naturally in the weights of Faithfulness, and that the model achieves its empirical success in matching the data using a relatively small number of constraints (10, of which two get zero weight) relative to the unique violation profiles of Derivatives it makes predictions about (411).

Finally, we can approximately locate the effects observed in English on the typology graph, as in figure 4.10 below. Note that this is not a quantitative estimate (doing so would involve converting the more articulated markedness constraint structure summarized in table 4.10 to a three-parameter scenario), but simply a visual aid to the intuition about where the English data lie in the typology of Base effects that my model predicts. In English, we find that there is some baseline repair in Local Bases without Remote Bases, and more stress shift if there is a benign Remote Base. However, we see hardly any stress shift (two productions total, out of several thousand in Experiment 3) that resemble the malign Remote Base.

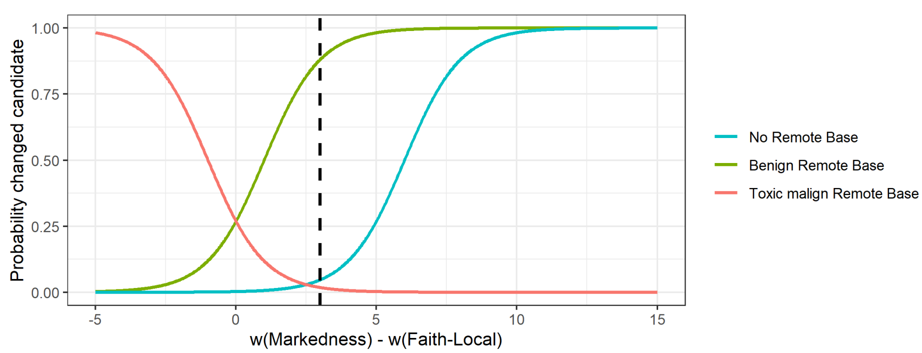

Figure 4.10: Schematic place of the English data in the predicted typology of my model (note that we only have English data from Experiments 1-3 corresponding to the “No Remote Base”, “Benign Remote Base”, and “Toxic malign Remote Base” lines.

4.5 Discussion

4.5.1 Why Lexical Conservatism is not ubiquitous: “Goldilocks” conditions

Based on the voting theory of Bases, which relies on a language-general proposal about the way Base competition in the lexicon interacts with the phonological grammar, it is important to dis-

3

cuss why Lexical Conservatism and other Base effects are not more widespread. Aside from the reasonable possibility that such effects might be more widespread than generally assumed and phonological description has not caught up with this reality yet, I argue that the voting mechanism, while putatively language-general, will allow Remote Bases to yield noticeable effects on Derivative formation only under certain conditions.

As a concrete example of this point, let us consider other English affixes: there is no reason why Lexical Conservatism should only observed in certain affixes of English, although indeed that is is the case. Why do we not see Lexical Conservatism behavior for other affixes in English, like *-ness*?[1] I argue this is because the voting mechanism crucially depends on the degree to which stress shift is required in these affixes. In this reasoning, I follow Steriade and Stanton (2020) who use two lexical-stratum-specific versions of *Lapse — indexed to the Latinate stratum, and a generic version — with different rankings to accommodate this same difference. The Latinate lapse constraint is not violated by *-ness* and therefore the speaker gains no advantage by violating faithfulness to the Local Base. Thus I argue that whether a specific affix will evoke lexically-conservative behavior in its stem allomorphs is a matter of the broader markedness structure of the language, rather than anything to do with the actual mechanisms underpinning Lexical Conservatism itself.[2] The regions where the voting model predicts vanishingly small effects of the Remote Base is illustrated by the vertical dashed lines on the graph in figure 4.11 below.

4.5.2 Further predictions of the model

Finally, I note that it may be the case that the voting theory can account for Paradigm Uniformity effects, as well as Lexical Conservatism. In figure 4.12 below, the vertical line marks a weighting

[1] The fact of the matter is that because I didn't test this affix, the possibility remains open that in fact it does. However, the absolute absence of lexically-listed forms like *líquid* $\sim$ *liquídness* despite the existence of *liquídity*, and the fact that *-ness* is canonically a stress-neutral affix, leads me to judge it extremely unlikely for Local Bases affixed with *-ness* to show the same Lexically Conservative behavior as those affixed with, for example, *-able* or *-ist*.

[2] The same effect could be achieved with high Output-Output faithfulness (Benua, 2000) invoked by the affix on its Base; either way, the absolute value of the difference between markedness and faithfulness is high, and so the effect of the Remote Base predicted by the model is minuscule.

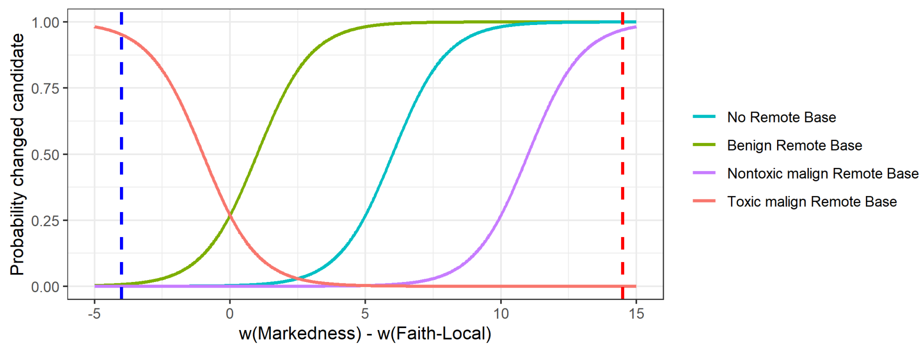

Figure 4.11: Schematic example where Remote Base activity is suppressed at extreme values of markedness or faithfulness; strong faithfulness to the left, and strong markedness to the right.

configuration where Local Bases with no Remote Bases, as well as those with benign Remote Bases, obligatorily undergo a markedness-driven alternation; however, Local Bases that have a malign Remote Base form Derivatives that allow the Remote Base to resist the markedness-driven change and result in a persistent, marked structure, supported by the existence of other surface members of the paradigm.

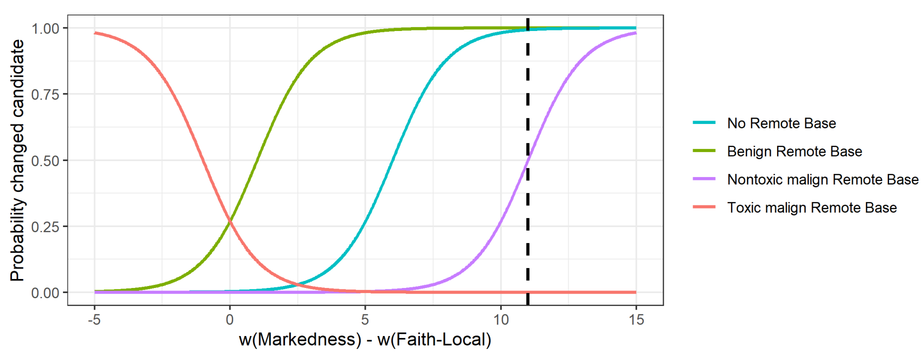

Figure 4.12: Schematic place of paradigm uniformity in the predicted typology of the voting model.

Further, by adjusting the amount by which the weight of Faith-Remote is lower than Faith-Local, we can see that the degree to which the Remote Bases behave differently from the Local Bases differs (figure 4.13 below.) Note that in my theory there is nothing *in principle* to stop the weight of Faith-Remote from being higher than that of Faith-Local, except that this scenario would likely be rare in naturalistic settings and also very difficult to experimentally construct, and thus rarely corresponds to reality.

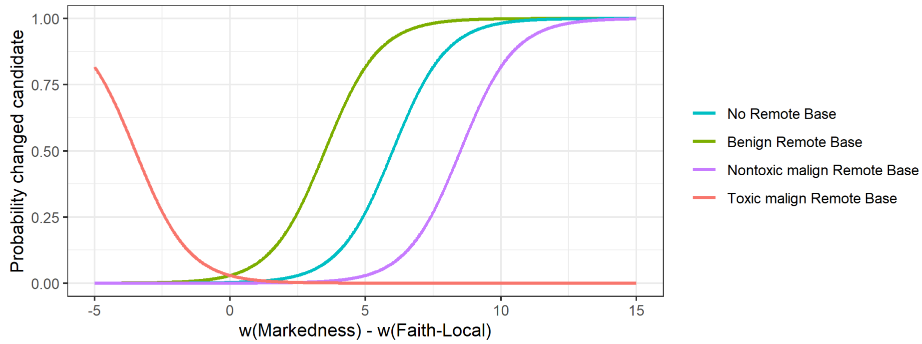

Figure 4.13: Schematic change in probability of the changed candidate based on the difference between the weight of Markedness and Faith-Local with a smaller weight of Faith-Remote (here, 1), for a Local Base with a benign Remote Base, a Local Base with no Remote Base, a Local Base with a toxic malign Remote Base, and a Local Base with a nontoxic malign Remote Base.

When considering the predicted typology of the theory, it is important to remember that while the above graphs were intended to give the idea of the expressive power of the system, any given language occupies only one vertical "slice" of these graphs, determined by its three free parameters: the weight of Faith-Local, the amount by which Faith-Remote is less than it, and the amount by which Markedness and Faith-Local differ. How these parameters are set, though, is not arbitrary: the weight of Faith-Local and Markedness are grammar-wide characteristics, and while it is an open question whether the weight of Faith-Remote is also able to be learned from the lexicon, it depends critically on the amount of evidence for Lexically Conservative behavior the learner encounters. Additionally, the perturbation to the violations of these constraints on the basis of the lexicon (discussed in chapter 5) are likewise set in response to data — here the learners' local and global experience processing her language, an issue to which we now turn.

CHAPTER 5

Learning and processing

5.1 Introduction

In this chapter I discuss the way the voting theory of Lexical Conservatism from chapter 4 fits into the broader context of the phonological grammar and language processing system. Preliminary evidence suggests that the weight of Faith-Remote may be learnable from the lexicon, but it is less clear whether the broader architecture of the voting theory proposed might be learned, especially given that much of the parts of the system are already motivated by other psycholinguistic findings. I also outline a way that the voting theory of Lexical Conservatism can interact with both existing theories of phonology-lexicon interaction, and with processing-level factors in speech production.

5.2 Learning

A question that has not been addressed so far is what role learning might play in enabling speakers to exhibit the phonological and lexical influences on Derivative formation characteristic of Lexical Conservatism. I consider this question in three parts: first, narrowly, whether there is evidence in the learners' input to set the weight of Faith-Remote on a language-specific basis; and second more broadly, whether the architecture assumed by the voting Bases theory might be learned or whether it is better thought of as a manifestation of independently-motivated lexical structures. Lastly I consider the role of processing in biasing the outcomes of the learned grammatical system.

5.2.1 Setting the weight of Faith-Remote

We can contrast several scenarios that might appropriately characterize the acquisition problem with respect to the weight of Faith-Remote. First, it could be the case that its weight is learned independently from that of Faith-Local from the learning data in the lexicon; I pursue a pilot analysis along these lines below. The alternative would be that the weight of Faith-Remote is actually identical to that of Faith-Local — implying that there is only one relevant notion of "Base faithfulness" in that language — and that any observed differences between the influence of Local and Remote Bases in experimental data is due to the the down-scaling of the influence of the Remote Base by lexical characteristics via resting activation.[1]

To see how far it might be possible to get in learning the weight of Faith-Remote from lexical data, I used the English dictionary employed in Moore-Cantwell (2020), created by augmenting the list of words from the CMU pronouncing dictionary (Weide, 1998) with frequency information from the SUBTLEX-US database (Brysbaert and New, 2009), as well as via manual annotation. I used the phonemic transcription to extract all forms ending in [əbl̩][2], which yielded 159 forms. Of these, 118 were judged to have a polysyllabic Local Base (following similar criteria to the ones used by Steriade (1997:p. 18)), and of these, 44 were judged to have a Remote Base, which I annotated as being benign or toxic malign. Finally, I noted for each Derivative with both Local and Remote bases, which one its stress matched. Table 5.1 below summarizes this data.

[1] I do not take asymmetries of lexical counts as evidence for the synchronic grammar, since the learner does not re-generate her lexicon upon learning it, but rather takes what is presented to her and extracts information from it.

[2] The ARPABET transcription represented syllabic coda /l/ as the digraph AH0 L representing the string [əl], somewhat inconsistent with the IPA convention I've been using in this dissertation. This difference, however, is purely notational.

Markedness	Motivating Remote Base	Derivative stress shift	Count	Shift rate	Effect of Remote Base	Local Base	Remote Base	Derivative
increase	yes	yes	8	0.24	0.18	*admire*	*admiration*	*admirable*
increase	yes	no	25			*adore*	*adoration*	*adorable*
increase	no	yes	2	0.06		*compare*		*comparable*
increase	no	no	34			*deduct*		*deductible*
decrease	yes	yes	4	0.36	0.28	*demonstrate*	*demonstrative*	*demonstrable*
decrease	yes	no	7			*memory*	*memorial*	*memorable*
decrease	no	yes	3	0.08		*explicate*		*explicable*
decrease	no	no	35			*charity*		*charitable*

Figure 5.1: Summary of lexical search conducted on English *-able* Derivatives.

We can see that if we compare the numerical effect of having a Remote Base on the propensity for a given Local Base to undergo stress shift (regardless of whether the shift is markedness-decreasing or markedness-increasing), we find that the rate of shift in Derivatives to Local Bases with a benign Remote Base is higher (28%) than in those with a toxic malign Remote Base (18%). This asymmetry is suggestive of the one exhibited by speakers in the experimental data. I fit a MaxEnt grammar to this data, with schematic constraints Faith-Local, Faith-Remote, and Markedness in table 5.2 below.

			Id-Local	Id-Remote	*Lapse
Input	*Candidates*	*Counts*	2.8	2.4	0.6
Final-stress Local Base + able, malign Remote Base	Faithful (ex., adórable)	25		1	
	Changed (ex., ádmirable)	8	1		1
Final-stress Local Base + able, no Remote Base	Faithful (ex., dedúctible)	34			
	Changed (ex., cómparable)	2	1		1
Initial-stress Local Base + able, benign Remote Base	Faithful (ex., mémorable)	7	1		
	Changed (ex., demónstrable)	4		1	1
Initial-stress Local Base + able, no Remote Base	Faithful (ex., explícable)	3	1		
	Changed (ex., cháritable)	35			1

Figure 5.2: MaxEnt grammar summary fit to data from table 5.1.

Strikingly, the weight of Faith-Local and Faith-Remote are rather similar - model comparison using the Likelihood Ratio test to a model where the weights of the two constraints were forced to be identical was not significant (ΔLoglikelihood $= 0.59$ with 1 degree of freedom, $p = 0.27$) while the same test against a model where the weight of Faith-Remote was forced to be zero was significant (ΔLoglikelihood $= 9.06$ with 1 degree of freedom, $p < 0.001$). Thus, by this simple and preliminary pilot analysis, it appears that while there is certainly evidence to learn the weight of Faith-Remote from the lexicon, it is not clear that the data supports a weight of Faith-Remote that is different from that of Faith-Local. Further study (for example, with the Oxford English Dictionary, which lists approx. 3,700 *-able* or *-ible*-final forms) would be needed to provide more extensive evidence that might be obtainable from extremely low-frequency forms about asymmetries in the lexicon that are not striking in the smaller corpus consulted in this analysis.

5.2.2 Voting Bases and the contents of the lexicon

The voting theory of Lexical Conservatism relies on the lexicon containing semantically-grouped, listed stem allomorphs; the existence of traditional markedness and faithfulness constraints to Local Bases; and the ability for the phonological grammar to be influenced by the lexical characteristics (frequency, priming, semantic similarity, etc.) of the stem allomorphs.

The existence of generic faithfulness and markedness constraints which do not make reference to Remote Bases I take as a given for the purposes of the current discussion of learnability. The lexical structure that enables Lexical Conservatism, I argue here, is independently motivated based on existing psycholinguistic data, a fact which was recognized in Steriade (1997). She argued that "[a]ny non-nonce word, any non-hapax form is, I assume, accessible as a base of affixation for the creation of a novel form. In other terms, I assume that any non-nonce form is lexically recorded…". In the decades since, this position has been largely vindicated by psycholinguistic research. Evidence for whole-sale listing comes from the work of Bybee and Pardo (1981); Hay (2003); Hay and Baayen (2005:and others), and there is also evidence that the lexicon contains robust amounts of word-specific phonetic detail (see evidence summarized in Pierrehumbert, 2016). Indeed, Lexical Conservatism is not the only phenomenon to make reference to the structure of the lexicon in explaining phonological variation: outside the domain of running speech, theories of phonological variation in morphologically-complex forms have relied on evidence supporting both on-line composition and lexical listing of morphologically-complex forms (Baroni, 2001; Zuraw, 2007; Zuraw and Peperkamp, 2015; Zuraw et al., 2020; Wurm, 1997; Caramazza et al., 1988). The question of whether all aspects of this knowledge are *used* for phonological computation remains open (see discussion in Embick et al., 2020; Pierrehumbert, 2016), but the presence of listed polymorphemic words in the lexicon (and indeed, of multi-word sequences as well, (cf. Arnon and Snider, 2010; Snider and Arnon, 2012; Arnon and Cohen Priva, 2013)) is not a subject of dispute. Further, the ability to carry out morphological parsing of lexicalized forms, even without meaning present, is well-established (see evidence reviewed in Rastle et al., 2004; Oh et al., 2020; Needle et al., 2020; Hay et al., 2004; Embick et al., 2020). Thus, I argue that the assumptions made here about the phonological contents of the lexical entry — a semantically-grouped, morphologically-related set of allomorphs — is on solid footing (see also the data and models presented in Connine and Pinnow, 2006; Ranbom and Connine, 2007).

This evidence in hand, it seems that the question of architectural learnability boils down to whether the the ability of Remote Bases to exert an analogical influence on Derivatives is something that is "automatically on" as part of a language-general property (and thus all that a learner needs to do is set the weight of Faith-Remote, a set of challenges discussed directly above in section 5.2.1), or whether the learner needs to discover that appealing to a Remote Base is an option in the first place. I do not have data to address this question in this dissertation, and so leave it unresolved.

However, one possible avenue of evidence might come from find a language where despite a configuration of paradigm structure and a weight of markedness and faithfulness that should give rise to Lexical Conservatism under the model proposed in chapter 4, speakers show no sensitivity to the Remote Bases in Derivative-formation tasks, and further the lexicon gives the learner no information to set a nonzero weight of Faith-Remote. This would indicate that it is the distribution of Derivatives in the lexicon that allows the learner to discover the utility of making reference to non-Local Bases, and against the view that the influence of the Remote Base is "always on".

This thread of research is left for future work.

5.3 Processing

Turning now to the effects of processing factors on Derivative formation, I do not propose that it is necessary to learn the way in which the phonological grammar can be influenced by the lexical characteristics of the stem allomorphs in the input. First, however, I review the evidence for lexical influences on Derivative formation.

5.3.1 Evidence for the influence of lexical characteristics on the Derivative

In Experiments 2 and 3, we observed that priming the Remote Base increased the likelihood of the Derivative resembling it; similarly, in Experiments 1-3 and in the combined analysis in appendix B, we observed that semantic similarity of the Local and Remote Bases played a role in influencing whether the Remote Base had an effect on the Derivative in question, albeit one in a direction opposite to the one Steriade anticipated (Steriade, 1997:p. 19). Further afield outside this dissertation, Eddington (2006); Kim (2021); Breiss et al. (2021a) have observed that the token frequency of nonlocal output forms conditions variability in Paradigm Uniformity. Thus in general, it seems that when a lexical item is more salient or active in the lexicon, it can influence the output of the grammar. How are we to capture this non-phonological influence on phonological outcomes?

5.3.2 Resting activation

I argue that the intuitive notion of "salience" motivated above can be captured using the psycholinguistic construct of *resting activation* (Morton, 1970). Resting activation is influenced by static and dynamic lexical factors, and is thought to be a largely unconscious quantity, computed by the processing system quasi-deterministically on the basis of the speakers' language experience. For present purposes, I suggest that priming the Remote Base can raise the resting activation of the stem allomorph that it contains, and that high-frequency Remote Bases have long-run higher resting activations than low-frequency ones.

I propose that we can model the influence of resting activation on the phonological grammar by treating it as a scaling factor that can change the impact of violating faithfulness to a Base. This leads to a scenario where there is a grammar-wide weight of FAITH-REMOTE, and on each occasion of Derivative formation the violations of that constraint for a given candidate are multiplied by the scaling factor associated with the resting activation of the corresponding Base allomorph to yield a modified, lexically-scaled penalty for being unfaithful to the Remote Base. This scenario is mathematically equivalent to treating each individual Remote Base as having its own indexed FAITH-REMOTE constraint, but allows for a simpler phonological grammar with one weight of FAITH-REMOTE that is influenced by processing at an unconscious level.

With this connection in hand, we can try to explain the puzzling but persistent finding that increased semantic similarity between the Local and Remote Bases inhibits, rather than facilitates, the creation of Derivatives which resemble the Remote Base. I argue, following Wheeldon and Monsell (1994); Wheeldon (2003), that we can understand the role of semantic similarity as one that does not influence resting activation itself, but rather modulates connections between lexical representations (here, of allomorphs of a Base), and thus how much "spill-over" in resting activation there is from one to another. Further, based on evidence from Harley (1993) that in production of a given target word, highly activated related words undergo "suppression" of their resting activation, to minimize competition and allow the correct word to be uttered (Rahman and Aristei, 2010). This is one possible mechanism that could underlie the findings for semantic similarity: because of its close semantic relation, a Remote Base would be a source of interference for the participant seeking to speak the Derivative, and so their language processing system might require more suppression to access the Base in producing the Derivative. A less semantically-similar Remote Base would not be as strong a source of interference and so would not be suppressed as much, allowing it to have an influence on the Derivative-formation process. This account as presented here is highly speculative and post-hoc, but is in line with established psycholinguistic findings about the nature of semantic interference and resting activation suppression in speech production. More work is required to further probe the role of semantic similarity between the Local and Remote Bases; for now, however, we take it as evidence for lexical characteristics asserting an influence on the Derivative, even though its exact origin is not entirely clear at present.

5.3.3 Lexical Conservatism in the context of existing theories of lexicon-grammar interaction in phonology

Returning to phonological theories of the lexicon and grammar, it is interesting to note that although the influence of lexical and grammatical factors on Derivative shape is the defining feature of Lexical Conservatism, this data is of a different type than those handled by existing theories of lexicon-grammar interaction. Here I highlight these differences, and argue that the voting theory of Bases should be thought of as an addition to, not a substitution for, the existing set of theoretical tools for handling lexicon-phonology interaction.

Most existing theories of phonology-lexicon interaction were developed to account for cases where the phonological behavior of particular words or morphemes is difficult to motivate using phonological means alone. For example, affixes that have similar phonological characteristics can exhibit divergent propensities to trigger or undergo a phonological alternation; one such case is palatalization in Slovenian, where phonologically-similar suffixes /-ina/ and /-it͡ʃ/ both trigger palatalization of their base, but at strikingly different rates ($\sim$ 99% for /-ina/, but $\sim$ 62% for /-it͡ʃ/ (see Jurgec, 2016; Zymet, 2018)). These types of data, explored in depth in Zuraw and Hayes (2017), have lead to theories which posit the existence of specific constraints that are either exceptionally indexed to particular lexical items, as in Indexed Constraint Theory (Pater, 2000; Moore-Cantwell and Pater, 2016), or form a part of a hierarchy of constraints of varying generality that regulates both item-specific and grammar-wide behavior, as in Mixed Effects Harmonic Grammar (Zymet, 2019). Other theories, particularly those seeking to explain exceptional resistance to otherwise-regular phonological processes or phonotactic restrictions, posit a competition between a lexically stored morphologically-complex item and one composed on-line, as in the Dual Route theory advanced by Zuraw (2000, 2007); Zuraw et al. (2020); Zuraw and Peperkamp (2015); Hay (2003); Hay and Baayen (2005), or where only certain unpredictable aspects of the underlying representation are stored in the lexicon, as in Representational Strength Theory (Moore-Cantwell, *in prep.*). Put another way, many existing phonological theories that reference the lexicon seek to explain phonologically-unmotivated or otherwise odd behavior using non-phonological means, typically some form of lexical listing or exceptionality for individual items.

By contrast, Lexical Conservatism is part of a different class of effects that rely on the existence of specific items in the lexicon to enable phonologically-*natural* behavior — reduction of markedness — which would otherwise be blocked by the phonological grammar.[3] In the case of English stress, the presence of the Remote Base in the lexicon is what gives license to the phonological grammar to do what it otherwise would not: diverge from faithfulness to the Local Base and better avoid a long lapse of unstressed syllables at the Derivative's right edge.

One might think that the tools used to account for, for example, lexically-specific phonology might also be employed to model Lexical Conservatism. However, I suggest here that this enterprise is unlikely to be successful. For example, constraints indexed to specific lexical items could capture the difference in behavior between Local Bases that have a Remote Base and those that don't, but would have to couch this difference in terms of across-the-board faithfulness differences.[4] Instead, I propose that whatever lexically-specific phonology might be at work in individual Local Bases can operate as normal, and that the additional of the Faith-Remote constraint, and its lexical scaling, is simply another addition to the set of conditioning factors on Derivative formation.

[3] Although in certain cases a non-phonologically-optimizing Remote Base exerts an influence on the Derivative, we saw that this scenario only occurs when the markedness penalty incurred for doing so is quite weak relative to faithfulness.

[4] Note that even though in my formal analysis in chapter 4 I use faithfulness constraints to model the differential influence of resting activation on Remote Bases in the lexicon, this is implementational short-hand for a bias on the accessibility of lexical items, rather than a statement about the nature of phonological faithfulness itself.

5.3.4 Fitting the phonological grammar into a model of processing in speech production

This work is not the first to propose that online processing is a mediating force between the lexicon and grammar, and can influences phonological variation in meaningful ways. In this section I discuss the way that processing in speech production could provide insight into the voting theory of Bases and its interface with the lexicon.

A robust research tradition explores the role of speech planning in conditioning on-line variants of different phonological forms, and modulating the application of cross-word phonological processes or phrasal sandhi (Wagner, 2012; Kilbourn-Ceron, 2017; Kilbourn-Ceron and Sonderegger, 2018; Kilbourn-Ceron et al., 2016; Tamminga, 2018; Bailey, 2019; Kilbourn-Ceron, 2017; MacKenzie, 2016; Kilbourn-Ceron et al., 2020; Lamontagne and Torreira, 2017; Seyfarth and Garellek, 2020; Kilbourn-Ceron and Goldrick, 2021; Bürki, 2018). In the domain of intonation and prosody, working memory constraints have been argued to be a determinant of phonological phrasing, again underpinned by a mechanism which takes speech planning to be at its core (Bishop and Intlekofer, 2020).

These phenomena are typically discussed in the context of a model of speech production where the utterance is incrementally planned, and as information about upcoming words becomes available it provides the context to condition the application of phonological processes. This incremental-availability perspective on phonological process application is compatible with multiple models of speech planning and production, including those reviewed in Keating and Shattuck-Hufnagel (2002), which focus on long-range planning of prosody and just-in-time planning of segmental material. However, since in Lexical Conservatism the phonological variation is mediated by access to existing lexical items, rather than uncertainty about the upcoming word, I couch the following discussion in terms of models which articulate the timecourse of production of the individual word, such as the Weaver++ model of Levelt et al. (1999). This model, though certainly not incompatible with a continuous process of speech-planning and production involving uncertainty about upcoming words, was developed to account for the timecourse of individual word production when the target is known, as is the case with Lexical Conservatism, and thus focuses on the interplay of phonological processing and lexical retrieval in the timecourse of the single-word utterance.

With this context, we can now theorize about how the lexicon and grammar might interact in the formation of a Derivative in an experiment like those in chapters 2 or 3. Unlike in running speech, there is no time-pressure to preserve fluency, and the content of the utterance is known, since the participant is prompted with the Local Base and affix to attach to it. The focus here is on the contents of the lexicon: since the Derivatives are novel and there is no listed form to retrieve, Lexical Conservatism emerges in the interplay of the dynamics of lexical retrieval and phonological well-formedness.

At the level of the individual trial, the Derivative outcomes attested in Experiments 1-5 are compatible with a scenario in which all allomorphs associated with a lexical entry are retrieved on each trial, ending up as the contents of the "input" cell of a tableau). [5] The lexicon then scales the influence of each of these forms on the Derivative according to their resting activation, implemented in the voting theory as a scaling factor on violations. This ability for the lexicon to act as a "prior" over allomorphs and the attractive force they exert on the Derivative is the distinguishing feature of my proposed model, which enables the lexicon and phonological grammar to jointly influence the Derivative via the mediating mechanism of processing and retrieval.

Beyond this level of specification of what is happening at the individual trial level, we do not have the data to further distinguish some other possibilities. For example, it might be the case that although all allomorphs are retrieved on a given trial, some are accessible temporally before others and have an advantage in the race process underpinning the Weaver++ model (Levelt et al., 1999). This model conceives of speech production as a "race" between different candidate productions of the target utterance, with each possible outcome speeded by lexical frequency and slowed by segmental unfamiliarity (see Levelt, 1993; Wheeldon et al., 2013:for further details). Such a competition would lead to differences in reaction time that would not occur if the lexical scaling of the allomorphs' influence on the phonological grammar was accomplished at a

[5] David Embick (p. c.) raises the possibility that morphosyntactic properties associated with each of the allomorphs may also moderate their accessibility. This idea is intriguing, but not pursued here — future more targeted experimental work will likely be needed to provide robust supporting or refuting evidence.

more abstract level; this process might be profitably addressed using experimental methods that assess early stages of processing, rather than the final outcome and associated latency. Future work pursuing the joint analysis of Derivative production and response time data would also enable the development of more robust linking hypotheses between response time and quantities of phonological interest such as markedenss and faithfulness violations, opening the door to a clearer understanding of the mechanisms by which the different allomorphs are weighted in their influence of the Derivative.

5.4 Universals and Grammar

5.4.1 Is Lexical Conservatism part of Universal Grammar?

Because the proposed mechanism of lexical scaling is putatively automatic and an unlearned side-effect of speakers having a language processing system, the question arises as to whether it should be considered part of Universal Grammar (UG). I argue that under a conceptualization of Universal Grammar which is concerned solely in behaviors of the learner that are not shaped by external data or informed by any material grounding or substance related to physical or cognition-general properties of the learner or the physical world, the lexical scaling of faithfulness violations is not part of UG. However, if we take a more colloquial definition of UG as whatever biases the learner brings to the table that lead to non-veridical learning or other behavior unmotivated by specific distributional evidence in their learning data, I propose that the processing-based modulation of the interaction between the lexicon and grammar that I have presented here does belong in this category; in this way it is similar to a bias in speech production towards articulatory ease that influences learning and typology, except the mechanism resides in the speaker's processing system.

A slightly different question of universality relates to whether consulting the Remote Base at all is a learned behavior, as discussed in section 5.2.2. While the burden of proving its *un*-learnability rests on future researchers, I note that if it were also to be demonstrated to be a universal, unlearned, and "always on" property of the phonological grammar, it would likewise fall into the bucket of universal linguistic properties with a basis in processing, as the lexically-based scaling is argued to be above.

5.4.2 Implications for theories of word-formation

The theory articulated here and in chapter 4 requires some rethinking of other assumptions about the roots of alleged universals in word-formation and other domains of the grammar, as long acknowledged by Steriade (Steriade, 1997, 2018; Steriade and Stanton, 2020, 2021). Specifically, theories that make cyclic inheritance a core, automatic, or "universal" aspect of their process of word-formation, including most contemporary syntax-based theories of word-formation like Distributed Morphology (see the overview in Bobaljik, 2017) and Nanosyntax (see the overview in Baunaz et al., 2018), are undermined by cases like Lexical Conservatism where surface forms make reference to non-local members of the morphological paradigm. The facts about Lexical Conservatism, rather, support model of word-formation where the structure of the morphological paradigm, combined with language-specific strength of markedness and lexical characteristics, are the driving factors in novel word formation, such as the one advanced here, in which "cyclic" inheritance of features of the Local Base by Derivatives is the norm, but also allowing the emergence of non-cyclic behavior — typologically rare but not at all unattested — as an automatic outcome of specific relations between the structure of the lexicon and markedness.

5.5 Conclusion

This chapter has discussed how learnable different aspects of Lexical Conservatism might be, and how much of the mechanisms supporting the voting model of Bases in chapter 4 are already motivated by independent psycholinguistic evidence in the literature. I also summarized the evidence for lexical influences on Derivative formation, and outlined a proposal for modeling this type of lexicon-grammar relationship in a traditional constraint-based phonological model, using traditional markedness and faithfulness scaled based on resting activation to allow the lexical characteristics of different Bases in the lexicon to exert an influence on the phonological computation of the Derivative. This model also fits well into a consensus model of speech production, linking phonological theory and psycholinguistic data, and opens pathways which can connect phonological theory to the time-course of speech latency in *wug*-tests. Much work remains to be done in implementing this proposal computationally and testing it experimentally in a wide range of languages.

CHAPTER 6

Conclusion

6.1 Summary of findings

This dissertation presented a series of experimental and computational studies of Lexical Conservatism, a theory about the relationship between paradigm structure and the phonological shape of novel words formed to existing paradigm members.

6.1.1 Empirical findings

With five *wug*-tests of speakers of English and Spanish, I found that the effect of a Remote Base on novel word formation proposed by Steriade (1997) is in fact robust. Further, it is probabilistic, and exceptionful in both directions across both languages. In English, the effect of Remote Base knowledge was cross-cut by expected phonological factors, including the preference to stress heavy syllables, a dispreference for lapses, and a dispreference for promoting an underlying schwa to full vowel status. In Spanish, I demonstrated a novel case of Lexical Conservatism, created by the distribution of alternating vs. non-alternating mid-vowels throughout derivational paradigms. I demonstrated that in this case, both malign and benign Remote Bases play a role in shaping the Derivative, alongside the expected avoidance of unstressed diphthongs. In English I found strong evidence for both long-term and trial-by-trial influences of the lexical characteristics of the Remote Base, suggesting a role for real-time processing in mediating the interaction between grammar and lexicon.

6.1.2 Theoretical findings

I provided an analysis of the data from a subset of the experiments in a MaxEnt grammar formalism (Smolensky, 1986; Goldwater and Johnson, 2003), implementing a novel theoretical proposal in which markedness considerations in the phonological grammar compete with faithfulness constraints via which each Base in the lexicon competes to influence the Derivative, subject to scaling based on lexical factors of that Base. This model is able to capture both the English data (classical Lexical Conservatism, with only benign Remote Bases exerting appreciable influence on Derivative formation) and Spanish data (where both benign and malign Remote Bases influence the form of the Derivative), with the difference between the two arising from the strength of markedness. I demonstrated that the Spanish data in particular are difficult for other theories of Lexical Conservatism to model, including both Steriade's original 1997 formulation, as well as the more recent model by Steriade and Stanton (2020).

I also discussed the prospects for the role of learning in leading participants to exhibit Lexical Conservatism. I argued on the basis of a small corpus study of English *-able* forms that while there is sufficient evidence in the lexicon to learn a nonzero weight of FAITH-REMOTE, it is not entirely clear whether this provides evidence for speakers learning the effect, since the weight of FAITH-REMOTE did not differ statistically from that of FAITH-LOCAL, suggesting that perhaps one general weight of faithfulness is all that is required, and the diminution of Remote Base effects is due entirely to lexical scaling. I also addressed the question of whether the speaker's ability to appeal to a Remote Base at all is itself learned, and concluded that while the burden remains on the party arguing for innateness that it *cannot* be learned, it is not immediately clear how one might go about learning this fact, suggesting a possible origin in functional factors such as processing.

6.2 Future directions

Many more questions remain. Here, I first suggest future experiments, i.e., further empirical work that could help further specify and constrain the proposed theory of Lexical Conservatism, shoring up some of the free parameters latent in the theoretical model I proposed in chapter 4. Second, I suggest further avenues of inquiry that have the potential to expand and extend our understanding of the phonological grammar, its relationship to the contents of the lexicon, and how this relationship is moderated by processing factors.

6.2.1 Future experiments

The following questions could be addressed using experimental methods and theoretical tools broadly similar to those used in this dissertation.

6.2.1.1 Syntactic constraints on Remote Base accessibility

One also wonders about productivity of rule in forming the Remote Base, and in particular the role of semantic compositionality, which have often been at the heart of traditional discussions of derivational morphology. While I did not find strong evidence to suggest that speakers are very constrained by these factors, future work probing this question more directly, and also incorporating them into a learning model, is certainly desirable.

On this point, David Embick (p. c.) raises the possibility that (morpho)syntactic characteristics of Remote Bases might influence whether or not they are accessible on-line to the speaker and thus able to exert an influence on the Derivative. A targeted set of experimental stimuli, contrasting Remote Bases with one particular, well-motivated syntactic relation to the Local Base, with those having a different relationship that predicts it will be more or less accessible, would be of use in addressing this question. The answer would give us insight into the structure of the lexical entry itself, and further specify the set of factors which can modulate the influence of the Remote Base on the Derivative.

6.2.1.2 The role of *potential* Remote Bases

Steriade (1997:p. 3) raises the possibility that Derivative formation might be influenced not only by Remote Bases that the participant knows and form part of their linguistic experience, but also by the stem allomorphs in potential, highly-predictable but non-attested Remote Bases whose existence is "guaranteed by principles of word formation". The example she gives is of the relationship between initial-stress, disyllabic *-id*-final forms (ex., *morbid, vapid, ...*) and affixed forms in *-ity* (*morbidity, vapidity, ...*). She argues that because this is a highly productive pattern of affixation, a speaker might assume that despite not having encountered an *-ity*-affixed form of a given *-id*-final Local Base (ex., *languid*), they might simply assume it must exist in the lexicon of English and that they simply haven't encountered it yet, and treat that Local Base as though it had a Remote Base with a final-stress stem allomorph (here, *languíd-*, as in potential *languídity* or *languídify*).

Although she does not elaborate this point further, and neither does this dissertation, investigating the status of "possible" Remote Bases would be revealing about exactly what kind of operations speakers are doing when producing novel Derivatives. One way to bring data to bear on this question would be to contrast the rates of stress shift in Derivatives formed to two types of Local Bases that end in *-id*, those like *languid* that don't have a commonly-known *-ity* formation, and those that do, like *rapid* ∼ *rapidity*. As a control, it would be important to have a comparison set of Local Bases which end in another nominal formative, such as *-ment*,[1] half of which had a Remote Base with stem-final stress such as *moment* ∼ *momentous*, and half that didn't, like *raiment*. Most importantly, the lexical characteristics of the existing Remote Bases should be matched, as well as those of the Local Bases without listed Remote Bases. If speakers are making reference to *potential* Remote Bases when forming the Derivative, they should be more willing to stress shift in the *-id* forms that have no (dictionary-listed) Remote Base in *-ity*, like *languídify*, relative to those Local Bases in *-ment* that have no dictionary-listed Remote Bases, like *raiméntify*

6.2.1.3 Adversarial Remote Bases as a test of priming

One possible objection to my interpretation of the priming data presented in this dissertation it had nothing in particular to do with the testing activation of existing lexical items, but rather than being asked to verify whether they knew a Remote Base before using the Local Base in the

[1] Though the choice of affix would have to be carefully matched for its general productivity also.

Derivative-formation task could have simply bolstered participants' perhaps-shaky convictions about whether they knew a particular Remote Base. While one might question how different this description of the phenomenon is from priming, if we take the theory to its logical extreme, it predicts that speakers who deny knowing Remote Bases in the pre-task vocabulary check will nevertheless form Derivatives that are similar to those formed to Local Bases with known, primed Remote Bases, since simply being exposed to the Remote Base could have given speakers enough evidence to form a lexical representation, and this representation would then be able to, through its high resting activation due to priming, influence Derivative formation in the same way as already-known primed Remote Bases.

We can test this theory by carrying out an experiment where we augment the stimulus set with a number of Local Bases that have no dictionary-listed Remote Base, but include in the vocabulary check stage entirely novel (presumably benign, in the case of English) Remote Bases. For example, the Local Base with benign Remote Base *lábor* ($\sim$ *labórious*) and the Local Base with no Remote Base *pláster* would be augmented with a class of Local Bases like *árdor* which, while having no dictionary-listed Remote Base in *ardór-*, would be accompanied by an adversarial Remote Base *ardórious* which would be asked about in the vocabulary check section of the experiment. By comparing the role of priming Remote Bases in Local Bases of the *labor* type to those of the *ardor* type, we could more stringently test whether exposure during the pre-task vocabulary check in fact lead people to *learn* the new Remote Base (and thus act as though it were already known and primed, leading to no difference in the effect of priming the Remote Base (real or fake) between these two classes), or simply increased the resting activation of an already-known Remote Base (in which case we might expect that we would find priming for Local Bases with existing and known Remote Bases like *labor*, but not for Local Bases with non-existing but primed Remote Bases like *ardor*).

6.2.1.4 The role of non-priming-related lexical factors

It may also be helpful to perform a set of experiments with stimuli specifically selected to probe for an effect of frequency of the Remote Base, as well as its semantic similarity to the Local Base, on Derivative formation. This would likely require at minimum one experiment for each lexical characteristic tested, with the Local Bases with Remote Bases selected such that the Remote Bases fell on the two extremes of the scale of interest. The experiment would then test for a main effect of binary category (high vs. low frequency, semantic similarity, etc.) of the Remote Base with known Remote Bases, as well as potentially an interaction with priming, if we expect low-frequency Remote Bases to exhibit a stronger priming effect.

In this dissertation I analyzed these data with mixed results; I found a clear effect of semantic similarity in English, except that the effect runs counter to the direction hypothesized by Steriade; I proposed a possible reason for this effect in chapter 5. The role of Remote Base frequency and its interaction with semantic similarity is less clear; the combined analysis in appendix B suggests that the varying results found across English may be artifacts of stimulus selection. Likewise in Spanish, it is difficult to interpret the finding of strong lexical effects in only Local Bases with malign Remote Bases; it is also difficult to disentangle small sample size from theoretically meaningful result, and so more work is necessary. It is unlikely, however, that at least lexical frequency of the Remote Base plays *no* role; however. Recent work on optional paradigm uniformity in Japanese voiced velar nasalization (Breiss et al., 2021b; Kawahara et al., 2021) has found that there is a robust frequency effect of the "remote" form (here the free, unaffixed form of the stem being compounded) that generalizes even to novel tokens, with increased frequency of the free stem leading to lower likelihood of undergoing nasalization when being produced as part of a compound. However, in this context, the stimuli were selected particularly to elicit the frequency effect, and also used a higher-powered design with more stimuli per person than the one here. Future experiments such as those proposed above should also use high-powered experiments that take advantage of preregistration to lock in *a priori* hypotheses and analysis methods. This approach would also allow us to put the relatively weaker priming effect seen in Spanish on firmer footing.

6.2.2 Computational and theoretical extensions

Beyond specific experiments described above that could be run to tie up the loose ends of this dissertation work, I see two general areas of inquiry where this research could be expanded on, which I briefly sketch here.

The first is implementing a computational model of the race process of speech production discussed in chapter 4. This would help in developing linking hypotheses between response time and phonological grammar. It might be accomplished by modifying the *Stan* code available from Nicenboim and Vasishth (2018) to correspond to the race between individual candidate realizations of a Derivative. This multivariate approach would allow more precise triangulation on the processing costs of grammatical and lexical factors in Derivative formation, and admit explanations both the Derivative forms, and the response time required to produce them.

A second avenue is to pursue the hypothesis suggested in chapter 4 that the voting theory of Bases may be suitable to explain both Lexical Conservatism an Paradigm Uniformity. Though not entirely clear yet, this type of work would require experimental and analytical work on documented cases of Paradigm Uniformity far beyond the scope of elaboration here, but if successful, could lead to simplification of underlying phonological theory, with fewer moving pieces required to account for more data. In combination with the computational approach described above, it could form the start of a broader theory of Base accessibility, anchored in the interaction of the phonological grammar and the lexicon as mediated by processing.

APPENDIX A

Experimentally measuring semantic similarity

A.1 Introduction

This appendix contains a description of two semantic similarity experiments, one on English and one on Spanish, that were used to create the model estimates of semantic similarity between Local-Remote Base pairs in the statistical models fit in chapters 2 and 3.

A.2 Experiment 6

To measure the semantic similarity of English Local-Remote Base pairs, I carried out a norming study where participants were asked to rate the similarity of the pairs, as well as indicate whether they knew each of a number of Local and Remote Bases.

A.2.1 Methods

63 participants were recruited through the UCLA SONA Psychology subject pool, and were compensated with course credit for their time. 15 were excluded for not having been speaking English continuously in some context since before the age of seven, or for exceeding the maximum allowed number of failures on catch items (see below for details), leaving data fro 48 participants analyzed here.

A.2.1.1 Materials

The experiment included 144 Local-Remote Base pairs, drawn from the five experiments on English reported here, as well as several other pilot studies. I also included 32 catch trials, Local-Remote Base pairs designed to make sure participants were carrying out the task as instructed. 8 catch trials had identical Local-Remote Base pairs (for example, *concept* ∼ *concept*), 8 had trials that were semantically unrelated but contained a phonological and orthographic overlap between Local and Remote Bases (such as the pair *infer* ∼ *inferno*), 8 that had semantic but not phonological overlap (such as the pair *cooperative* ∼ *helpful*), and 8 that had neither semantic nor phonological/orthographic overlap (such as the pair *surge* ∼ *novelty*). I also included 8 nonwords as catch trials in the vocabulary check portion of the experiment.

A.2.1.2 Procedure

The experiment took place over the internet, using the Labvanced platform (Finger et al., 2017). After the consent process, the experiment began with a series of training trials that taught participants how to use a 7-point Likert scale to give Local-Remote Base pairs ratings based on semantic similarity, with 1 indicating that the two words were not related at all, and 7 indicating that the two words were extremely similar. Participants were also asked to indicate whether they knew each of the Local and Remote Bases on the similarity trials.

The training trials included examples of identical words (ex., *desk* ∼ *desk*) which participants were instructed to give ratings of 7 to; examples of form overlap without meaning overlap, such as *candid* ∼ *candidacy*, that speakers were directed to give ratings of 1 or 2 to; examples without form or meaning overlap, such as *stamp* ∼ *defector*, which speakers were instructed to give low ratings such as 1 or 2 to; and examples of semantic similarity but not orthographic similarity, such as *dangerous* ∼ *risky*, which speakers were directed to give high ratings such as 6 or 7 to. Following the instructions and training trials, 8 randomly-ordered practice trials gave participants a chance to get used to the task. Included in these 8 trials were the 4 pairs from training, plus four additional pairs. Participants were excluded if they did not give the trained answers to the familiar items. After the practice trials, participants completed the semantic similarity rating task, with trials randomized on a by-participant basis.

After the semantic similarity task, participants completed a further vocabulary check. They were shown each of the Local Bases without Remote Bases in a random order and were asked to indicate whether they knew the word or not. Finally, they completed a short demographic questionnaire. The entire experiment took approximately 45 minutes on average.

A.2.2 Data screening and analysis

Participants were excluded if they made errors on more than 2 of the 8 catch trials in each of the four types across the semantic similarity task, or whether they indicated they knew more than 2 of the nonwords in the vocabulary check task. Further, I excluded from analysis any Local-Remote Base similarity rating for which a participant indicated they did not know one or both of the words. This screening process left 4,742 data points for analysis.

I fit an ordered-logit mixed effects Bayesian regression model using the *brms* to analyze the Likert data. I ran four chains for a total of 10,000 iterations each, discarding the first 1,000 samples from each chain as warm-up, with the NUTS sampler on default settings (Bürkner et al., 2017). I used a Normal(0,3) prior on intercepts.

A.2.3 Results

I used the *posterior_linpred()* function from *brms* to extract item-specific coefficients for the similarity between Local and Remote Bases. Point-estimates of the median of these distributions were used as measurements of average similarity for each Local-Remote Base pair, in arbitrary units, in the analyses of Experiments 1-3.

A.3 Experiment 7

Experiment 7 was similar in purpose to Experiment 6, and was carried out with speakers of Spanish. Because of time constraints and the availability of funding to recruit online speakers of Mexican Spanish via Prolific, as was done in Experiments 4 and 5, the format of Experiment 7 was much more informal. A short survey was circulated to speakers of Spanish in my social network, and they filled out a spreadsheet with questions identical in format to those asked in Experiment 6: a set of semantic similarity questions, and a set of vocabulary knowledge questions. Results from 5 participants were subjected to an analysis procedure identical to the one in Experiment 6.

Since the experiment was conducted in the form of a non-anonymized survey and contained responses from a mix of linguistically-trained and non-linguistically-trained participants, it is important to regard the outcome of this task as a cautious approximation of the type of data on semantic similarity that might be obtained from a more controlled experiment with a larger sample. However, having such a measure albeit flawed, I feel, is better than not having one, and so I integrate it into the analyses of Experiments 4 and 5.

APPENDIX B

Combined analysis of lexical characteristics

B.1 Goals of the analysis

This appendix contains an analysis of combined data from Experiments 1, 2, and 3. The aim of the analysis here is to aggregate evidence from across the three English experiments in an attempt to gain insight into the sometimes-contradictory and mixed effects of the lexical characteristics of semantic similarity and Remote Base log-frequency on Derivatives. The combined analysis has a larger sample size (3,929 data points), and also a wider range of semantic similarities and frequencies, pictured in figure B.1 below.

B.1.1 Analysis

I fit a mixed-effects Bayesian logistic regression model to the data from Local Bases with benign, known Remote Bases from Experiment 1, 2, and 3. Note that in Experiment 3 I included data only from the disyllables, to simplify the analysis.

The model had a dependent variable of Stress Shift (*yes* = 1, *no* = 0), and fixed effects of whether the target syllable was heavy (*yes* = 1, *no* = 0), whether the target syllable was secondarily-stressed (*yes* = 1, *no* = 0), whether the Remote Base was primed (*yes* = 1, *no* = 0), the source Experiment (a three-level unordered factor), and affix (a five-level unordered factor). The model also contained centered and scaled coefficients for semantic similarity and their interaction with centered and scaled Remote Base log-frequency.

The model's random effect structure contained a random intercept for Local Base, participant, and Derivative (Local Base + affix combination), with random slopes of all fixed effects

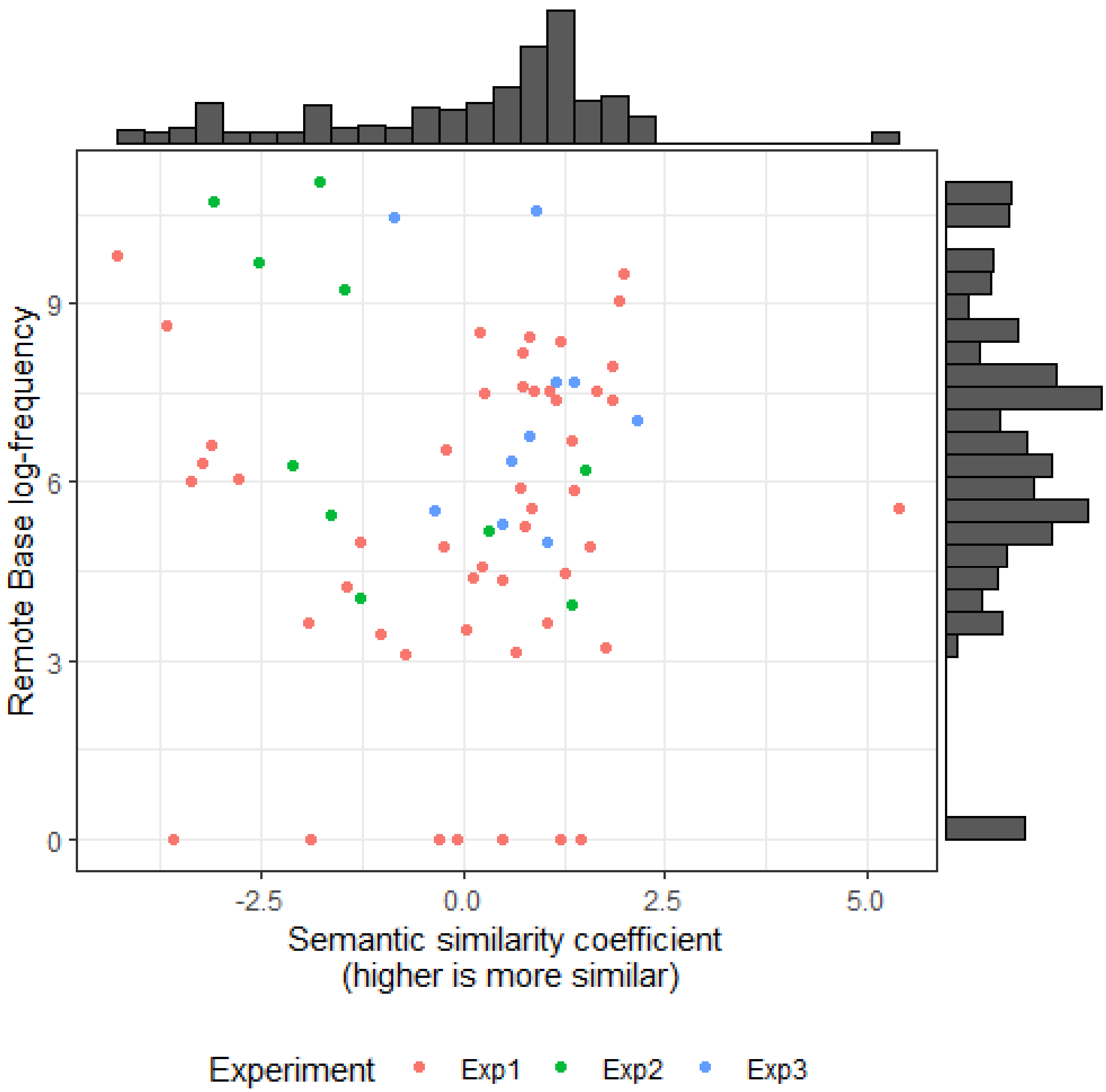

Figure B.1: Distribution of stimuli included in the combined analysis along the dimensions of semantic similarity and Remote Base log-frequency.

except Experiment by participant, random slopes of priming and Experiment by Local Base, and a random slope of Experiment by Derivative.

I used a Normal(0,3) prior on coefficients, and the default NUTS sampler settings in *brms*, and drew 10,000 samples in each of four chains from the posterior distribution over credible parameter values, discarding the first 1,000 samples from each chain as warmup.

B.2 Results

The results of the model are reported in table B.1 below.

Focusing on the lexical characteristics, we find that priming increases the odds of stress shift robustly (figure B.2, left), and that increased semantic similarity between the Local and Remote Bases yields a reliable inhibitory effect on the chance of stress shift in the Derivative, even though that stress shift would lead to the Derivative more closely resembling the Remote Base. There was no evidence suggesting any role for a main effect of Remote Base log-frequency, nor for an interaction with semantic similarity (figure B.2, right).

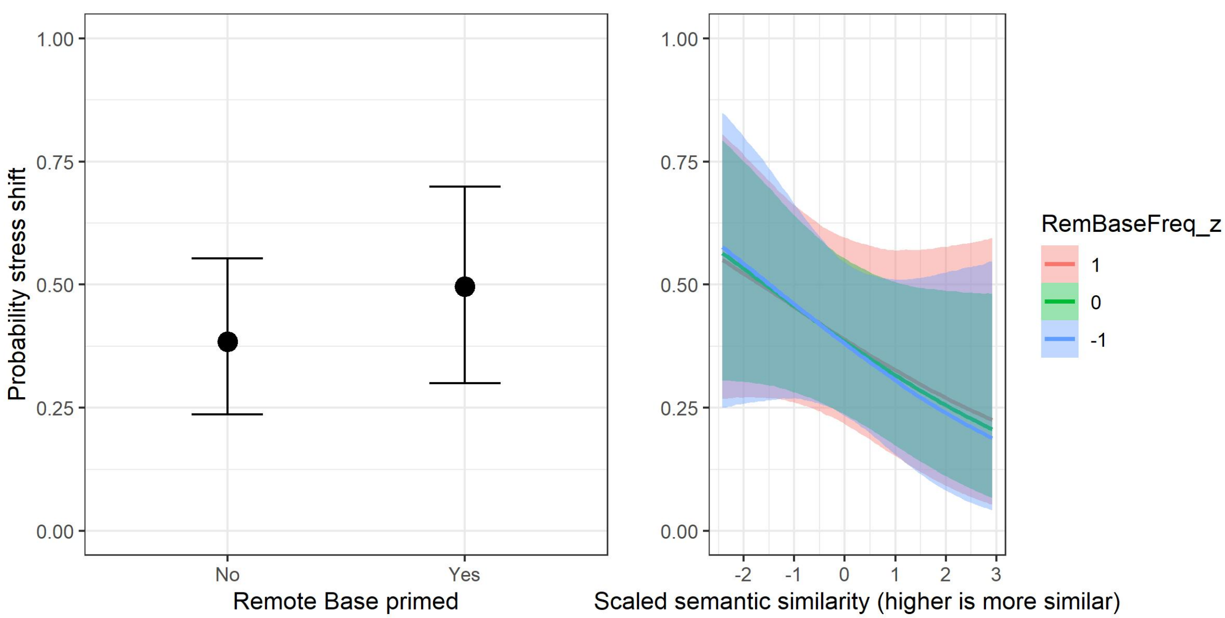

Figure B.2: Plots of the effect of priming (left) and of the interaction of scaled semantic similarity and scaled Remote Base log-frequency (right).

B.3 Discussion

The combined analysis provides confirmatory evidence that lexical characteristics — priming and semantic similarity — influence the operation of the phonological grammar in forming the Derivative. The sporadic evidence for a role for log-frequency of the Remote Base does not seem to be supported in this combined analysis. Further study with a more targeted stimulus set is needed to better understand its role in conditioning Remote Base influence on the derivative.

Parameter	*Mean*	*95% CI*	*P* $(|\hat{\beta}| > 0)$
Intercept:			
Target syllable secondary stress = *no*			
Target syllable heavy = *no*			
Affix = *-able*			
Experiment = *1*			
Remote Base = *unprimed*			
Remote Base log-freq. = *average values*			
Semantic similarity = *average values*	-0.47	[-1.17, 0.21]	
Target syllable heavy = *yes*	0.79	[0.09, 0.45]	0.99
Target syllable secondary stress = *yes*	1.05	[0.21, 1.87]	0.99
Affix = *-ic*	1.80	[1.10, 2.53]	≈ 1
Affix = *-ify*	2.07	[1.23, 2.94]	≈ 1
Affix = *-ism*	-0.57	[-1.09, -0.06]	0.99
Affix = *-ist*	-0.89	[-3.18, 1.40]	0.81
Affix = *-ity*	4.00	[3.01, 5.06]	≈ 1
Experiment = *2*	0.13	[-0.78, 1.06]	0.62
Experiment = *3*	-0.89	[-2.68, 0.85]	0.85
Remote Base = *primed*	0.42	[-0.06, 0.96]	0.97
Semantic similarity (*scaled 1-unit increase*)	-0.30	[-0.65, 0.05]	0.96
Remote Base log-freq. (*scaled 1-unit increase*)	0.02	[-0.29, 0.33]	0.55
Freq. × sim. (*scaled 1-unit increase*)	0.03	[-0.29, 0.35]	0.57

Table B.1: Model of combined data from the wug test in Experiments 1, 2, and 3. Coefficients are in log-odds, with positive signs indicating an increase in chance of stress shift, relative to the intercept.

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