# Chapter 1

Introduction

One of the goals of phonological theory is to account for typology – that is, to formulate testable hypotheses about why certain sound patterns are found in natural language while others seem to be systematically unattested. In some cases, the reason a given pattern does not exist is hypothesized to be purely cognitive – for example, that no phonological feature refers to a particular class of segments. In recent decades, however, the trend has been for explanations to be grounded in 'external' phonetic facts – for example, the perceptibility of the segments involved (Ohala 1981; Steriade 2001a), how their articulation interacts with the anatomy and aerodynamics of the vocal tract (Ohala 1983; Hayes 1999), or the types of diachronic changes that can lead to the pattern (Blevins 2004). The focus of this dissertation is on the types of phonetic grounding that have been proposed for a subset of the class of phonological patterns known as 'lenition'.

Figure 1.1: Schematic illustration of sound changes commonly termed 'lenition' in Bauer (2008), in turn derived from Hock (1986). Dashed lines show 'possible but unobserved changes' Bauer (2008, 606).
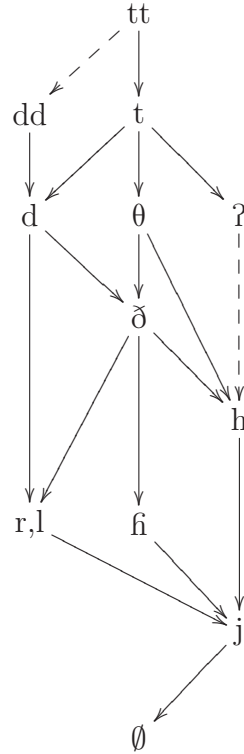
1.1   Lenition

'Lenition' refers to a loosely defined network of sound changes, especially when they occur intervocalically; figure 1.1 illustrates many of the changes to which this term is applied. Lenition is sometimes considered a distinct type of sound change, and is often presented as such in textbooks on historical linguistics (e.g., Crowley (1997, 37-41) and Campbell (2004, 44); both authors acknowledge that the term is not well defined). By extension, the term can also be applied to phonological alternations in which the surface realization of a phoneme is 'lenited'; this is the sense in which the term is used in this dissertation.

Lenition is generally understood as 'weakening' of the relevant segments; however, there is no more consensus on the meaning of the latter term than there is for the former. There have been a number of attempts in the literature to identify the defining property of lenition; Lavoie (2001, 12) classifies the various approaches into four categories:

1. "Lenition as deletion": lenition is any step along a chain of sound changes (such as those illustrated in figure 1.1) that end in [∅].

2. "Lenition as an increase in sonority": the changes that qualify as lenition involve an increase in sonority.

3. "Lenition as a decrease in effort": lenition is any sound change that involves substitution of an easy segment for a difficult one.

4. "Lenition as a decrease in duration and magnitude of gestures": lenition is any sound change that involves shorter or smaller gestures.

Note that these approaches define lenition in terms that are phonetic (gestural magnitude) or nearly so (sonority). An alternative would be to posit that the unity of lenition lies in the kind of abstract cognitive mechanisms that are the common currency of formal phonology; indeed, a classic Phonology 101 analysis of intervocalic lenition involves spreading of features such as [voice] or [continuant] from vowels to the targeted consonant.[1] However, arguments that the unity of lenition lies *solely* in the realm of formal phonology are rare (although see

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[1]An analysis along these lines could account for the specific lenition processes that are the focus of this dissertation. Since my goal is to determine the extent to which *phonetic* factors contribute to our understanding of lenition, I do not pursue such an analysis here. See also Kirchner (2001b, 12-13) for arguments that the feature-spreading approach is not the most insightful analysis of lenition.

Harris (1990)). Instead, analyses of lenition that make use of formal tools such as Optimality-Theoretic constraints typically propose that those constraints have phonetic motivations (Kirchner 2001b; Kingston 2008).

A third approach is to deny that lenition is a single, unified phenomenon and instead view it as a tightly knit network of sound patterns with overlapping causes and properties. It is this last approach that I adopt as a working assumption. If research on the phonetic and phonological characteristics of lenition has shown us anything, it is that these sound changes have many properties in common, none of which matches perfectly to the canonical set of 'leniting' alternations. Any given property that is held up as 'what lenition really is' typically excludes some alternations traditionally called lenition (e.g., deletion is not an increase in sonority) while including others (e.g., final devoicing is not typically considered leniting but has been argued to involve effort reduction – although see §3.3.3). Indeed, the reasoning behind any attempt to determine *the* defining characteristic of lenition is essentially circular: Property X is associated with many of the alternations we call lenition. But we are not certain precisely which alternations really count as lenition. Fortunately, now that we know that lenition is defined by property X, we can use X to determine which alternations are leniting and which are not.

So as we continue to investigate individual causes of lenition – a research program to which this dissertation contributes – let us acknowledge the diversity of factors that are likely responsible for the network of sound patterns sketched in figure 1.1, and continue to retain 'lenition' as convenient cover term for this set of interrelated patterns, fuzzy boundaries and all. In this spirit, I will use the term 'lenition' to refer to the four specific sound patterns under investigation here (see (1) and (2) below). Note that this approach to lenition is consonant with another

use of term: as a label for certain language-specific alternations with complex lexical and morphological conditioning. The patterns of this type for which the term is used are clearly fossilized and are no longer transparently 'lenition'-like; in addition to canonical alternations such as spirantization or gliding, they often include non-canonical alternations such as /m/ → [v] (Breton, Stump 1988, 459) or /n/ → [nj] (Nuu-chah-nulth, Kim and Pulleyblank 2009, 594).

1.2 Phonetic Bases of Lenition

This dissertation focuses on alternations that affect two features of intervocalic stops: voicing and continuancy. The four patterns that are of particular interest are schematized in (1) – (2).

(1)   a.   **Attested:** Intervocalic voiceless stops targeted for spirantization

       (e.g., Tiberian Hebrew)

       (i)   /VpV/ → [VfV]

       (ii)   /VtV/ → [VθV]

       (iii)   /VkV/ → [VxV]

   b.   **Attested:** Intervocalic voiced stops targeted for spirantization

       (e.g., Spanish)

       (i)   /VbV/ → [VβV]

       (ii)   /VdV/ → [VðV]

       (iii)   /VgV/ → [VɣV]

(2) a. **Attested:** Intervocalic voiceless stops targeted for voicing

(e.g., Warndarang)

(i)   /VpV/ → [VbV]

(ii) /VtV/ → [VdV]

(iii) /VkV/ → [VgV]

b. **Unattested:** Intervocalic voiced stops never targeted for devoicing

(i)   */VbV/ → [VpV]

(ii) */VdV/ → [VtV]

(iii) */VgV/ → [VkV]

Both voiced and voiceless stops can be targeted for spirantization intervocalically or in similar environments. In addition, voiceless stops can be targeted for voicing. Unattested, however, is another hypothetically possible change, in which intervocalica voiced stops are specifically targeted for devoicing (illustrated in (2b)). The fact that (1a), (1b), and (2a) are attested while (2b) is not is something that must be explained.

Note that it is not enough to say that the alternation of (2b) is unattested because "it wouldn't be lenition". First, this argument assumes that we know exactly what lenition is; as argued above, this is not the case. Second, unless the status of intervocalic devoicing as non-leniting is given some phonetic or other causal basis, the argument is essentially that intervocalic devoicing does not occur because it is very different from an attested process (voicing), and indeed is the reverse. There *do* exist phonological patterns that seem to be the reverse of each other (see, e.g., Crosswhite (2001) on two types of vowel reduction); thus, we are left with an argument that (2b) is unattested because it is different from patterns

that *are* attested. The explanation does not explain.

If we seek to ground our account of the contrast between (1a) – (2a) and (2b) in the particular phonetic properties of the sounds involved, there are at least two places we might look – the articulatory characteristics of the relevant sequences, or their perceptual characteristics.[2] As discussed above, one traditional understanding of lenition has in fact been that it is a type of *articulatory* effort reduction. For cases of spirantization, the intuition is that since the gesture required to produce a fricative is of smaller magnitude than the gesture required to produce a stop, the fricative is less effortful than the stop; spirantization is therefore seen as a type of articulatory 'undershoot' along the lines of Lindblom (1983). Some evidence along these lines has been adduced by the EPG experiments of Lavoie (2001) and the model of the vocal tract detailed by Kirchner (2001b). For voicing of voiceless stops, the claim is essentially that having a period of voicelessness between two (voiced) vowels requires extra effort on the part of the glottis, while simply continuing modal voicing throughout the entire sequence is less effortful; Westbury and Keating (1986) and Kingston and Diehl (1994) present evidence for this view. This account suggests one explanation for the absence of intervocalic devoicing: as the reverse of intervocalic voicing, devoicing introduces a period of voicelessness between the vowels, increasing the difficulty of the sequence.

Despite its intuitive appeal, this claim is very difficult to test directly, forcing researchers to resort to the various indirect methods described above for investigating the relative difficulty of these segments in the appropriate environments. In addition, precisely because the articulatory account seems so plausible, there

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[2]Naturally, these are not the only possibilities. Gurevich (2004) and Silverman (2006) discuss the interaction of lenition process with the pressure to avoid neutralization; see §2.3 for a discussion of these issues.

has been little investigation of other factors that might help us understand this type of lenition (although see Kingston (2008)). There may also be reasons to be a bit suspicious of the articulatory account: for example, from another perspective, we might expect fricatives to be *more* effortful than stops because they require precise placement of the active articulator (Bauer 2008, 609).[3] In addition, if lenited forms are articulatorily superior to unlenited forms, then we might expect lenition-like patterns to emerge in child language. Interestingly, though, Lleó and Rakow (2005) found in a study of Spanish-German bilingual children that instead of transferring the spirantization pattern to their German productions, children transferred *lack* of spirantization to their Spanish productions, beginning at about 2;6.[4] The evidence that lenited sounds are truly easier is far from clear.

Although discussions of phonetic grounding are dominated by articulatory considerations in the domain of lenition, there is evidence for other phonological patterns that perception – and, importantly, *mis*perception – plays an important role. For example, Ohala (1981) shows that listeners can compensate for coarticulatory effects among segments that are near each other, and proposes that overcompensation by listeners drives dissimilation-like processes. Hume (2003) argues that the likelihood of phonological metathesis is related to the ability of the listener to recover the intended order of the relevant sounds (and as related to the listener's native phonotactics). Blevins' (2004) typology of CHANGE, CHANCE, and CHOICE is intended to account for different ways in which the interaction between variable production and (mis)perception drives sound change.

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[3]On the other hand, it has been argued by Lavoie (2001), among others, that spirantization results not in fricatives but rather in approximants, for which this difficulty would not arise.

[4]As the authors acknowledge, there are a number of independent factors that might have encouraged transfer in this direction – most prominently, that the bilingual children were being raised in Germany.

In this dissertation, I present the results of a series of experiments designed to test the possible perceptual and articulatory bases of lenition. The overarching goal is to determine whether – and if so, to what extent – phonetic realities match the typology of lenition and therefore suggest explanations for the range of attested patterns.

1.3   Outline of Dissertation

In chapter 2, I survey attested lenition processes that apply to intervocalic stops in order to establish the facts that we must account for.

Chapter 3 discusses a production experiment designed to elicit more and less effortful productions and investigates whether 'lenited' productions are truly less effortful, as claimed by articulation-based accounts of lenition. The data does not support the traditional view of lenition as straightforward effort reduction, but it does suggest that considerations of effort reduction may lead speakers to avoid 'extreme' articulations, a practice that may in turn provide precursors to lenition.

Chapter 4 reports the results of three perceptual experiments designed to test whether a perceptual account of the basic typology of (1) and (2) is viable. The results of Experiments 2 and 4 suggest that a perceptual account is consistent with the broad outlines of the typology, while Experiment 3 shows that the more fine-grained differences by place of articulation revealed in chapter 2 cannot be explained in the same way.

The combined results of Experiments 1 – 4 fail to support the traditional account of lenition by which lenited productions are articulatorily easier than un-lenited ones: articulatory considerations appear to have less to say about lenition

than usually thought, and perceptual considerations have more. Chapter 5 illustrates what a phonological analysis of lenition would have to look like in order to be consistent with the results of these four experiments. Chapter 6 concludes.