Voicing assimilation and the specification of [voice]

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1. Introduction

The proper characterization of voicing distinctions has long been controversial, a problem that arises in large part because of the unstable phonetic cues that are associated with laryngeal oppositions. The articulatory and acoustic cues that serve to signal voiced/voiceless opposition appear to vary from language to language. These cues include vocal fold vibration, duration, tenseness, glottal spreading or constriction and articulatory force (see Kohler 1979, 1984; Lisker 1986; Keating 1984, 1990; Doherty 1993). It is my contention that the instability of the cues does not lead to indeterminacy as to the appropriate representation of laryngeal oppositions because the true nature of the opposition is reinforced by the phonology. In Avery (1996), it is argued that what has traditionally been referred to as a voicing opposition may in fact be represented in three different ways with respect to the specification of the segments involved in the opposition. Voiced obstruents may be marked by the presence of the feature [voice], the presence of the SV node (see Rice & Avery 1989, 1990, 1993, Rice 1992, 1993) or the absence of any laryngeal specification. I refer to the first option as Laryngeal Voice (LV), the second as Sonorant Voice (SV) and the third as Contextual Voice (CV). The relevant aspects of the representations are given in (1).

(1) Representations of the voiceless-voiced opposition

<table>
<thead>
<tr>
<th>LV languages</th>
<th>SV languages</th>
<th>CV languages</th>
</tr>
</thead>
<tbody>
<tr>
<td>/p/ R Lar</td>
<td>/p/ R SV</td>
<td>/p/ R Lar</td>
</tr>
<tr>
<td>/b/ R Lar</td>
<td>/b/</td>
<td>/b/ R Lar</td>
</tr>
</tbody>
</table>

I further assume that a bare Laryngeal node may be phonetically enhanced through the addition of the feature spread glottis (SG), yielding voiceless aspirates, as is illustrated in (2). This is typically the case in languages such as English, German and Turkish which are analyzed as CV languages.

(2) Lar enhancement rule

\[
\text{Lar} \rightarrow \text{Lar} \quad \quad \quad [\text{SG}]
\]

Before examining the evidence for the three language types, I will make explicit my assumptions about final devoicing, as well as some of the advantages of the representational theory I am proposing.

2. Final Devoicing

Lombardi (1991; 1995) considers the widespread process of final devoicing to be the product of a well-formedness condition that she calls the Laryngeal Constraint, given in (3).
(3) The Laryngeal Constraint (Lombardi 1991)
Laryngeal features are only licensed in the following configuration:

\[ \sigma \]

In any configuration other than that given in (3), the Laryngeal node of a segment will be delinked, resulting in a plain voiceless consonant. I analyze final devoicing as the result of the Laryngeal Condition given in (4) (see Avery 1996 for details).

(4) Laryngeal Condition (LC)

\[
\begin{array}{c}
C^\sigma \\
| \\
Lar \\
\end{array}
\]

The Laryngeal Condition is a target representation for all syllable-final obstruents. A segment with a laryngeal dependent that occurs in syllable-final position will lose the laryngeal dependent. Thus, in LV languages, final devoicing involves delinking the feature [voice] in order to conform to the well-formedness condition, as illustrated in (5).

(5) Final Devoicing in LV languages

\[
\begin{array}{c}
C^\sigma \\
| \\
Lar \\
\end{array} \rightarrow 
\begin{array}{c}
C^\sigma \\
| \\
Lar \\
\end{array}
\]

In SV languages, the LC in (4) is not relevant for the voiced segments because of a separate constraint, the Lar-SV Constraint, a constraint disallowing the presence of both Lar and SV on the same segment. This constraint is given in (6). We, therefore, do not see any manifestation of final devoicing in these languages.

(6) Lar-SV Constraint

\[ ^aR \]

CV languages will show the effects of final devoicing, but rather than the loss of a feature, there will be the addition of a Laryngeal node, through the process that we refer to as Laryngeal Strengthening. Its effect is illustrated in (7).

(7) Laryngeal Strengthening

\[
\begin{array}{c}
C^\sigma \\
| \\
Lar \\
\end{array} \rightarrow 
\begin{array}{c}
C^\sigma \\
| \\
Lar \\
\end{array}
\]
Both Laryngeal Strengthening and Final Devoicing have the effect of bringing the respective representations into conformity with the Laryngeal Condition. It has generally been supposed that a process along the lines of Final Devoicing is enough. Indeed, that the segments I am referring to as contextually voiced surface as voiceless in syllable-final position has been taken as evidence that there is a voicing feature present on those segments that is delinked syllable finally. However, I will show that the representations that I propose are well motivated based on phonological processes. In CV languages, as the feature [voice] is inactive, there is no spreading of the feature [voice] from segments that are contextually voiced, as would be expected if the feature is not present. On the other hand, LV languages show evidence for the feature [voice], as can be seen from phonological processes which spread [voice]. SV languages are also without the feature [voice] and, as is the case with the CV languages, show no evidence for the spread of [voice].

Compare this to the theory proposed by Lombardi (1991; 1995), where all voiced segments have the feature [voice] underlingly and the spread of this feature is a parameter of UG. In her theory, the representation of voiced obstruents in what I have called CV languages is the same as the representation in what I have called LV languages. The difference in the behaviour of the voiced segments in these two language types follows not from representational considerations but rather from a parameter of the rule component, the parameter referring to the spreading of the feature [voice]. In contrast, I maintain that the rule spreading [voice] is not parameterized; rather, [voice] always spreads if it can. This is what it means for a feature to be active in the phonology. When a feature is inactive it cannot play a role in the phonology of the language because it is not present in the phonology.

It might be thought that a theory of laryngeal contrasts which permits for different representations of segments that appear on the surface to be the same may present problems of learnability. However, the theory does not raise any special learnability problems. All that is required for the child to arrive at the appropriate representation is positive evidence that the feature in question ([voice]) is active in the phonology of the language. If a feature is active in the phonology of the language, then that feature is present in the underlying representation of segments that bear that feature. This points up a major difference between a theory such as Lombardi’s and the theory being advocated here. In Lombardi’s theory, it would appear that, cross-linguistically, all voiced obstruents have the same representation. Thus, if the child hears a voiced-voiceless distinction in the input, the child will automatically posit a representation with the feature [voice] specified. The child must then determine whether the feature is active or inactive in spreading and set the voice-spreading parameter appropriately. In the theory that I am proposing the child is guided towards the appropriate representations by the universal segment structure as well as the requirement that active features be present phonologically. If a feature is not active, there is no reason for it to appear in underlying representations. In the case of [voice], merely hearing a voiced-voiceless distinction among the obstruents does not force a representation with the feature [voice], as other representations are available. The child needs evidence in the form of a spreading rule to activate the feature phonologically.

Note that the representation with the active feature [voice] is structurally more complex than a representation in which [voice] is inactive. There is a containment relation between segments unmarked for voicing in CV languages and segments marked for voicing in LV or SV languages. This perspective allows us to account for markedness reversals with respect to the voicing distinction. That is, it is possible for a ‘voiced’ obstruent to be less marked than a voiceless obstruent because a voiced obstruent in a CV language has less structure than a voiceless segment.

In this paper, I present analyses of the voicing systems of Turkish and Dutch, arguing that these are split laryngeal systems in which the stops and fricatives have different representations with respect to voicing. In this way we can account for the
asymmetrical behaviour of the stops and fricatives with respect to rules of voicing spread and final devoicing

3. Split Laryngeal Systems

3.1 Turkish

3.1.1 Final Devoicing

In this section I will argue that Turkish has a split laryngeal system. In particular, Turkish voiced fricatives have an SV node, while the voiced stops have no Laryngeal features. Evidence for this will be based on the failure of fricatives to undergo final devoicing and the failure of stops to spread [voice].

The consonant inventory of Turkish is given in (8).

(8) Turkish inventory

<table>
<thead>
<tr>
<th>Stops</th>
<th>Labial</th>
<th>Dental</th>
<th>Palatal</th>
<th>Velar</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>p, b</td>
<td>t, d</td>
<td>k, g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricatives</td>
<td>f, v</td>
<td>s, z</td>
<td>s, j</td>
<td></td>
<td>h</td>
</tr>
<tr>
<td>Affricates</td>
<td>ç, c</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasals</td>
<td>m</td>
<td>n</td>
<td>l, r</td>
<td></td>
<td>y</td>
</tr>
<tr>
<td>Liquids</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In Turkish, the voicing opposition between the stops and affricates is usually suspended in syllable-final position. In syllable-initial position the opposition is between what is generally reported as a voiced-voiceless pair, though the voiceless member of the pair is aspirated (see Underhill 1976). The fricatives, unlike the stops, have a voicing contrast in both syllable-initial and syllable-final position. The voicing alternations among the stops have generally been analysed with a rule devoicing non-continuant obstruents in syllable-final position (see for example Rice 1990). A linear version of the rule of final devoicing is given in (9). Forms illustrating the operation of this rule are given in (10) and in (11) the non-alternating fricatives are presented.

(9) 
\[-\text{son} \rightarrow [-\text{voice}]/\ldots].\]

(10) Syllable-final stops in Turkish (data from Inkelas and Orgun 1993)

a. Alternating stops

<table>
<thead>
<tr>
<th></th>
<th>‘mold’</th>
<th>‘wing’</th>
<th>‘clay pot’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. nom.</td>
<td>kalıp</td>
<td>kanat</td>
<td>güvec</td>
</tr>
<tr>
<td>b. 3 sg. poss.</td>
<td>kalıb-i</td>
<td>kanad-i</td>
<td>güveç-i</td>
</tr>
<tr>
<td>c. dat.</td>
<td>kalıb-a</td>
<td>kanad-a</td>
<td>güveç-c</td>
</tr>
<tr>
<td>d. pl.</td>
<td>kalıp-lar</td>
<td>kanat-lar</td>
<td>güveç-ler</td>
</tr>
<tr>
<td>e. abl.</td>
<td>kalıp-tan</td>
<td>kanat-tan</td>
<td>güveç-ten</td>
</tr>
</tbody>
</table>

b. Non-alternating stops

<table>
<thead>
<tr>
<th></th>
<th>‘state’</th>
<th>‘art’</th>
<th>‘monument’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. nom.</td>
<td>devlet</td>
<td>sanat</td>
<td>ant t</td>
</tr>
<tr>
<td>b. 3 sg. poss.</td>
<td>devlet-i</td>
<td>sanat-i</td>
<td>antt-i</td>
</tr>
<tr>
<td>c. dat.</td>
<td>devlet-e</td>
<td>sanat-a</td>
<td>antt-a</td>
</tr>
</tbody>
</table>

1 Turkish orthography is used throughout: ç = ğ, c = dğ, ş = š, j = ž, ı = u.
(11) Syllable-final fricatives (no voicing alternations)

<table>
<thead>
<tr>
<th>Case</th>
<th>Form</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. nom.</td>
<td>kîz</td>
<td>ev</td>
</tr>
<tr>
<td>b. 3 sg. poss.</td>
<td>kîz-i</td>
<td>ev-i</td>
</tr>
<tr>
<td>c. dat.</td>
<td>kîz-a</td>
<td>ev-e</td>
</tr>
<tr>
<td>d. pl.</td>
<td>kîz-lar</td>
<td>ev-lar</td>
</tr>
<tr>
<td>e. abl.</td>
<td>kîz-dan</td>
<td>ev-dan</td>
</tr>
</tbody>
</table>

These data appear to present a standard case of final devoicing. As the voicing specification of the intervocalic stop is unpredictable and the voicing of the syllable-final stop is predictable, the most parsimonious analysis posits underlying voiced consonants for the alternating forms and voiceless consonants for the non-alternating forms. The analogue of the rule of final devoicing given in (9) applies, yielding the appropriate surface forms. This analysis provides a descriptive account of the Turkish facts but fails to go any further. Other properties of the system remain outside the purview of the analysis. For example, the feature [voice] does not spread in clusters and this must be derived by a separate stipulation. In order to illustrate this point, consider the behaviour of the ablative marker, which has an alternating coronal stop as its initial segment, as shown in (12).

(12) Voicing alternations in the ablative morpheme

<table>
<thead>
<tr>
<th>Stem final</th>
<th>a. vowel</th>
<th>b. sonorant</th>
<th>c. vd fricative</th>
<th>d. vd. stop</th>
<th>e. vcls sound</th>
</tr>
</thead>
<tbody>
<tr>
<td>/tarla/</td>
<td>/el/</td>
<td>/kîz/</td>
<td>/kitab/</td>
<td>/sanat/</td>
<td></td>
</tr>
<tr>
<td>[tarladan]</td>
<td>[elden]</td>
<td>[kîzdan]</td>
<td>[kitaplan]</td>
<td>[sanatan]</td>
<td></td>
</tr>
<tr>
<td>‘field’</td>
<td>‘hand’</td>
<td>‘girl’</td>
<td>‘book’</td>
<td>‘art’</td>
<td></td>
</tr>
</tbody>
</table>

The normal criteria for establishing the underlying form of the ablative morpheme would lead to proposing [-dAn], with an initial voiced stop. This is because in the intervocalic environment we find the voiced segment as in (12a). Recall that this is one of the environments where voicing is not predictable in Turkish and was crucial in establishing the devoicing rule. However, the appearance of a voiceless stop in (12d, e) causes some problems for such an analysis. If the initial segment of the ablative marker is underlyingly marked for [voice]—why does it delink in /kitab+dan/ (/*[kitabdan]) or not spread in /sanat+dan/ (/*[sanaddan])? If [voice] were present, we should expect it to surface in syllable-initial position unless a specific rule deleted it. 2 I am thus led to propose that a segment unmarked for voicing is the initial segment of the ablative marker, an analysis that accords with the ‘archiphonemic’ analysis of the alternating stops given in the standard works on Turkish. The question now arises as to whether there is evidence that the neutralizing stops in words such as /kitab/’book’ and /kanad/ ‘wing’ are different from the alternating stops found in the inflectional morphology.

Among the ‘voiced’ stops found in roots there is no evidence for an active feature [voice] apart from the observation that we find a contrast between sounds that are transcribed as voiced-voiceless pairs. Indeed, as there is no voicing spread in Turkish and no parasitic licensing of voiced obstruents in syllable-final position, we are forced to conclude that [voice] is not an active feature and that the alternating stops are contextually voiced. Note that the sonorants do not license a final voiced stop as illustrated in (12). I can find no examples with fricatives but can assume that they behave in the same manner as the sonorants. If we assume that the voiced fricatives are SV obstruents and that the voiced stops are the unmarked members of a CV opposition, we can begin to understand the phonological behaviour of these segments. Clearly, the initial consonants of the

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2 Because I am assuming a privative approach to voicing, the option of a progressive [-voice] assimilation rule is not available. See Lombardi 1991 for detailed arguments concerning the privative nature of the feature [voice].
inflectional suffixes are unmarked with respect to voicing. Indeed all of the underlying 'voiced' stops are CV segments. The voiceless stops are the marked members of the voiced-voiceless pair, having a Laryngeal node present. The Laryngeal enhancement rule which inserts the feature [spread glottis] applies to these segments and they are realized as voiceless aspirated consonants.

2.1.2 Non-alternating 'voiced' stops

Inkelas and Orgun (1993) have pointed out that rather than just two types of voicing, it is necessary to recognize three types: alternating voiced segments, non-alternating voiceless segments and voiced segments that never alternate, i.e., that remain voiced in all environments. Data illustrating the necessity of the third type is given in (13).

(13) Non-alternating voiced consonants in coda position

<table>
<thead>
<tr>
<th>nominative</th>
<th>plural</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>etüd</td>
<td>etüdler</td>
<td>'étude'</td>
</tr>
<tr>
<td>jeolog</td>
<td>jeologlar</td>
<td>'geologist'</td>
</tr>
<tr>
<td>katalog</td>
<td>kataloglar</td>
<td>'catalogue'</td>
</tr>
<tr>
<td>preltüd</td>
<td>preltüdler</td>
<td>'prelude'</td>
</tr>
<tr>
<td>ad</td>
<td>adlar</td>
<td>'name'</td>
</tr>
<tr>
<td>id</td>
<td>idler</td>
<td>'id'</td>
</tr>
<tr>
<td>lig</td>
<td>ligler</td>
<td>'league'</td>
</tr>
<tr>
<td>öc³</td>
<td>öcler</td>
<td>'revenge'</td>
</tr>
</tbody>
</table>

Most of the words that fall into this category are borrowings and the complete list of monosyllables contains only seven words. Inkelas and Orgun propose three separate representations for the voicing distinction, one for alternating consonants, one for non-alternating voiced consonants and one for non-alternating voiceless consonants. The representations proposed by Inkelas and Orgun are given in (14).

(14) a. Alternating consonant

Root

b. Non-alternating voiced consonant

Root

<table>
<thead>
<tr>
<th>Lar</th>
</tr>
</thead>
<tbody>
<tr>
<td>[voice]</td>
</tr>
</tbody>
</table>

c. Non-alternating voiceless consonant

Root

<table>
<thead>
<tr>
<th>Lar</th>
</tr>
</thead>
<tbody>
<tr>
<td>[asp]</td>
</tr>
</tbody>
</table>

The theory proposed by Inkelas and Orgun is similar to the theory I am proposing in that devoicing and voicing are characterized as involving feature addition to the representation in (14a). I give their devoicing rule in (15) and their voicing rule in (16).

---

3 Recall that <c> represents a voiced alveopalatal affricate.
(15) Devoicing (after Inkelas and Orgun 1993)

\[
\begin{array}{c}
\mu_w \\
\text{Root[-son]} \\
\text{[-cont]} \\
\end{array}
\quad \rightarrow \quad
\begin{array}{c}
\mu_w \\
\text{Root[-son]} \\
\text{[-cont]} \\
\text{Lar} \\
\text{[asp]} \\
\end{array}
\]

(16) Voicing (Inkelas and Orgun 1993)

\[
\begin{array}{c}
\text{Root[-son]} \\
\text{[-cont]} \\
\end{array}
\quad \rightarrow \quad
\begin{array}{c}
\text{Root[-son]} \\
\text{[-cont]} \\
\text{Lar} \\
\text{[voice]} \\
\end{array}
\]

Rule (15) is very similar to the process of Laryngeal strengthening shown in (7). It affects coda consonants providing them with a Laryngeal node and adding the feature [asp] as a dependent of the Laryngeal node. We have no equivalent to the rule in (16), but it has the same effect as contextual voicing.

The consonants that Inkelas and Orgun refer to as alternating are equivalent to contextually voiced segments in the theory I am proposing. Where I would disagree with Inkelas and Orgun is in the proposal that the non-alternating consonants have the feature [voice] present. As I see no evidence for the active presence of this feature in Turkish, and because this feature is universally-delinked in syllable final position, I would claim that the non-alternating consonants, both the stops and the fricatives, are marked by the presence of an SV node. The representations would be as in (17).

(17) a. Alternating consonant (stops only)  b. Non-alternating voiced consonant (stops and fricatives)  c. Non-alternating voiceless consonant (stops and fricatives)

\[
\begin{array}{c}
R \\
\text{SV} \\
\end{array}
\quad \rightarrow \quad
\begin{array}{c}
R \\
\text{Lar} \\
\end{array}
\]

The alternating consonants represented as in (17a) will undergo contextual voicing when surrounded by SV segments and will be subject to Laryngeal Strengthening when in coda position. The non-alternating stops and fricatives will not be subject to Laryngeal strengthening because of the Lar-SV constraint and will surface as SV segments (voiced) in all contexts. The non-alternating voiceless consonants undergo the Laryngeal Enhancement Rule and surface as aspirated.

3.1.3 Summary

I have proposed that the Turkish voicing system involves distinct representations for voicing of stops and fricatives. In Turkish the stops are part of a CV system and the fricatives are part of an SV system. The non-alternating stops are best considered to be part of an SV system, making their voicing representation the same as that of the fricatives, which are also non-alternating. It appears that when both representations are available in the language, the language makes use of both in ways that may be considered somewhat idiosyncratic.
3.2 Dutch Clusters

3.2.1 Voicing Agreement in Dutch Clusters

In Dutch there is strong evidence that the voicing opposition among the stops is a distinction below the laryngeal node, with the voiced segments carrying a [voice] specification and the voiceless segments consisting of a bare Laryngeal node. These representations are consistent with Dutch as an LV language. The evidence comes from the spread of the feature [voice] in clusters as well as conformity to the Laryngeal Condition, which results in final devoicing. Lombardi (1991, 1995) has proposed that in Dutch a single privative voicing feature is sufficient to capture the relevant properties of the voicing alternations. In her theory, final devoicing is the result of the Laryngeal Constraint, which causes the delinking of [voice] in coda position. Voicing agreement in clusters is achieved either through the spread of the Laryngeal node in the case of uniformly voiced clusters or the delinking of [voice] from the lefthand member of the cluster in the case of uniformly voiceless clusters. The only way that an obstructive can surface as voiced outside an onset is through parasitic licensing, that is by being linked to a licensed occurrence of the feature [voice]. This situation arises when [voice] spreads from an onset obstructed to a coda obstruct. For the most part, we adopt this analysis for the stops. Consider the Dutch data in (18) (from Berendson 1983).

(18) Final Devoicing

<table>
<thead>
<tr>
<th>stem</th>
<th>phoneme</th>
<th>phoneme</th>
<th>phoneme</th>
</tr>
</thead>
<tbody>
<tr>
<td>hui[t]</td>
<td>'skin'</td>
<td>huiden</td>
<td>'skins'</td>
</tr>
<tr>
<td>kwa[p]</td>
<td>'lobe'</td>
<td>kwabben</td>
<td>'lobes'</td>
</tr>
<tr>
<td>po[t]</td>
<td>'pot'</td>
<td>potten</td>
<td>'pots'</td>
</tr>
<tr>
<td>knoo[p]</td>
<td>'button'</td>
<td>knoopen</td>
<td>'buttons'</td>
</tr>
</tbody>
</table>

The data in (18) show final devoicing in Dutch. We analyze this as the result of conformity to the Laryngeal Condition given in (4). If we merely look at the devoicing cases, we cannot tell if the devoicing is the result of delinking of the feature [voice] or of the process of Laryngeal Strengthening because both have the same result. However, an examination of heterosyllabic, stop-stop clusters reveals that the delinking analysis must be the appropriate one, as the voicing value of the cluster is always the same as the underlying voicing value of the righthand member of the cluster. If that segment is voiced, the cluster surfaces as voiced throughout. If that segment is voiceless, no mechanism will be available to license any other occurrence of the feature [voice] and the cluster surfaces as uniformly voiceless. This is shown in (19).

(19) Stop-stop clusters (data from Lombardi 1991: 50)

<table>
<thead>
<tr>
<th>type</th>
<th>stem</th>
<th>phoneme</th>
<th>phoneme</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>vcls stop-vcls stop → vcls stop-vcls stop</td>
<td>pa/kp/aard</td>
<td>[kp]</td>
</tr>
<tr>
<td>b.</td>
<td>vcls stop-vd stop → vd stop-vd stop</td>
<td>za/kd/oek</td>
<td>[gd]</td>
</tr>
<tr>
<td>c.</td>
<td>vd stop-vd stop → vd stop-vd stop</td>
<td>be/db/ank</td>
<td>[db]</td>
</tr>
<tr>
<td>d.</td>
<td>vd stop-vcls stop → vcls stop-vcls stop</td>
<td>braa/dp/an</td>
<td>[lp]</td>
</tr>
</tbody>
</table>

In our theory, these data involve the delinking of [voice] in syllable-final position for (19c, d) and the spreading of [voice] from the righthand segment in (19b, c). We make use of Lombardi’s notion of parasitic licensing to explain the presence of the feature [voice] on the coda consonant in (19b, c).

Fricative-stop clusters behave the same way as the stop-stop clusters, with the voicing of the cluster determined by the stop as illustrated in (20).
(20) Fricative -stop clusters

a. vcls fric-vd stop → vd fric-vd stop
   ka/si+b/uk [zb] ‘cashbook’

b. vd fric-vd stop → vd fric-vd stop
   ka/z+b/ot [zb] ‘cheeseboat’

c. vd fric-vcls stop → vcls fric-vcls stop
   ka/z+p/ers [sp] ‘cheese press’

d. vcls fric-vcls stop → vcls fric-vcls stop
   ka/s+i+p/ost [sp] ‘cashbook entry’

To summarize, we see that both spreading of [voice] and the Laryngeal Condition are necessary to account for voicing uniformity in two-member clusters where the righthand segment is a stop. Thus far, both the analysis proposed by Lombardi and the analysis being proposed here handle the data equally well. When we turn to the clusters that have fricatives as the righthand member, we will see that a theory allows different representations of the voiced-voiceless distinction can provide a more insightful account.

As shown in (20), fricative-stop clusters present the same array of facts as are found in stop-stop clusters. However, when a fricative is the righthand segment of a cluster, the cluster always surfaces as uniformly voiceless. As well, underlying voiced fricatives in final position are realized as voiceless, as is illustrated in (21).

(21) Stop-fricative and fricative-fricative clusters

a. ɔp+zexe → [ɔpsexe] ‘recite’ zexe ‘say’

b. ɔp+vure → [ɔpfuɾe] ‘perform’ vure ‘carry’

c. rad+zam → [ratsam] ‘advisable’ zam ‘advise’

d. az+voxel → [asfoxɛl] ‘scavenger bird’ voxel ‘bird’

e. kaz+vorm → [kasform] ‘cheese mold’ vorm ‘form’

Theories that use binary features allow for an analysis of these data involving a rule of progressive [-voice] assimilation (e.g. van der Hulst 1980 and Berendsen 1983). That is, when a fricative is the righthand member of a cluster, it assimilates in voicing to a preceding obstruent. Crucially, for this analysis to work in cases such as (21c-e), voicing assimilation must apply after final devoicing, inserting [-voice] on the lefthand obstruent. As Lombardi points out, this analysis is not available in a theory with privative features because there is no [-voice] feature to spread. She suggests that the facts can be explained with a language-specific rule of Progressive Neutralization, a rule that delinks the feature [voice] from voiced fricatives as shown in (22) (Lombardi 1995: ex. 23).

(22) Progressive Neutralization (Lombardi 1995)

\[
\begin{array}{c}
[-\text{son}] \quad [+\text{cont}] \\
\downarrow \quad \downarrow \\
\text{Lar} \quad \text{Lar} \\
\downarrow \quad \downarrow \\
[-\text{son}] \quad [+\text{cont}] \\
\end{array}
\]

While the rule of progressive neutralization accounts for the facts, it lacks explanatory power. Why should the rule of progressive neutralization apply in the fashion that it does? There is nothing in the representation of the fricatives, apart from their [+cont] specification, to indicate that this should be the case. Why should just the fricatives behave in this manner with respect to the loss of the voicing feature in a cluster? Clearly the fricatives are behaving as though they were inert with respect to voicing processes. We can propose that a representational distinction be made between the stops and the fricatives. In
the case of the stops, where we clearly find an active voicing feature, we have an LV system and the opposition between the voiced and voiceless stops is under the Laryngeal node, as in the standard analysis of Dutch. The fricatives, on the other hand, are not distinguished in the same way. Instead, they are part of a CV system, the marked member of the fricative pair being the voiceless fricative, which underlyingly has a Laryngeal node. The voiced fricative is unmarked, receiving its voicing value from the surrounding context. The representations of the fricatives are given in (23).

(23) Representation of the voicing opposition in Dutch fricatives

```
voiced fricative   voiceless fricative
    R               R
   /\                /\   \
  cont            cont  Laryngeal
```

When a fricative precedes a voiced stop, the Laryngeal features of the voiced stop can spread to the fricative, whether the fricative is voiced or voiceless as shown in (24c, d). The unmarked fricatives surface as voiced outside the coda where they are always found in a voicing context. In coda position, however, they always surface as voiceless and we can attribute this to Laryngeal Strengthening. Sample derivations for fricatives in all positions are given in (24).

(24) Derivations of clusters involving fricatives

a.  `vd fric` `vd fric`
```
    R]σ  o[R Strengthen R]σ  σ[R
      \
```

b.  `vcls fric` `vd fric`
```
    R]σ  o[R
      Laryngeal
```

c.  `vd fric` `vd stop`
```
    R]σ  o[R Strengthen R]σ  σ[R Spread R]σ  σ[R
      Laryngeal
```

[voice] [voice] [voice]
d. vcls frič vd stop

\[
\begin{array}{c}
R|_\sigma & \sigma[R \text{ Spread } R|_\sigma & \sigma[R \\
\text{Lar} & \text{Lar} & \rightarrow & \text{Lar} & \text{Lar} \\
\text{[voice]} & & & \text{[voice]}
\end{array}
\]

In the illustrations given in (24a, b), the assumption is that if the lefthand segment is marked with a Laryngeal node, then the righthand segment will be realized as voiceless as it is in a voiceless environment. In (24c), Laryngeal Strengthening applies prior to spreading as spreading requires an appropriate target.

In this analysis, the behaviour of the fricatives, and in particular their failure to pattern with the stops, follows from representational differences between the two classes of sounds. The representational difference between the stops and the fricatives should not cause any concern from a learnability perspective. It is clear that obstructive inventories are not always symmetrical with respect to stops and fricatives. A survey of a wide variety of inventories among the languages of the world (Maddieson 1984) shows that the stop and fricative inventories can differ greatly. Generally, there are more places of articulation for stops than fricatives and also more laryngeal distinctions. In the theory we are proposing, there is no reason to require that a voiced-voiceless distinction among the stops and fricatives is a result of identical representations. This is a good result as the stops and fricatives often pattern differently with respect to voicing.

In the next section, we will discuss the past tense morpheme in Dutch. I will propose that this is represented as a contextually voiced segment as are the fricatives of Dutch.

3.2.2 The Past Tense in Dutch

The availability of Contextual Voicing in the phonology of Dutch allows us to propose a new account for a major puzzle in the inflectional morphology. Consider the data in (25).

(25) Realization of the initial segment past tense morpheme in Dutch
a. Voiced after vowels and sonorants
   ski+de 'skied'
   talm+de 'hastitated'

b. Voiced after voiced stops
   krab+dø 'scratched'
   bled+dø 'bled'

c. Voiced after voiced fricatives
   schaan+dø 'planed'
   vee+ye+dø 'stroked'

d. Voiceless after voiceless stops and fricatives
   schrap+te 'scraped'
   haat+te 'hated'
   blaf+te 'barked'
   lax+te 'laughed'
The initial segment of the past tense morpheme behaves like a voiced stop in (25a-c) but like a fricative in (25d). That is, when it follows vowels, sonorants, voiced stops, and voiced fricatives it surfaces as [d]-initial. When it follows a voiceless stop or fricative, it surfaces as [t]-initial. Trommelen & Zonneveld (1982), who assume binary features, propose that the initial segment of the past tense marker is underlyingly a voiced dental fricative /ð/, a segment that does not appear in the phonetic inventory of Dutch. Being a fricative, this segment is subject to progressive [-voice] assimilation and, when preceded by a voiceless sound, it undergoes this rule. A later rule of absolute neutralization hardens a dental fricative to a stop, either [t] or [d]. In order to explain why [krabðe] does not surface as [krapte], which would be the case if final devoicing could apply to the [b], Trommelen & Zonneveld propose a verb-final theme vowel which protects the verb-final consonant from undergoing devoicing, making [krabðe] underlyingly /krabðe+ðe/. By ordering the rule of vowel deletion after final devoicing, it is possible to derive the correct surface forms with a voiced cluster. Lombardi adopts this analysis but must account for the rule of progressive voice assimilation without regard to the feature [-voice]. She accomplishes this by invoking the operation of the OCP after the deletion of the theme vowel. In this case, the deletion of the theme vowel will create an OCP violation, if both the past tense and the stem-final consonant are marked as [voice]. The process of fusion renders the Laryngeal constraint inactive. The derivation as provided by Lombardi is given in (26).

(26)

```
(σ)  (σ)
  krap/   ə  ə ə /

[voice]  [voice]
voice neutralization
DNA

(σ)
theme vowel deletion

b  ə ə

[voice]
[voice]
OCP violation is visible

(σ)
Fusion

b ə

[voice]

Progressive Neutralization
Blocked by Linking Condition

Spread
DNA

Hardening
[bdə]
```

As can be seen, Lombardi’s analysis is essentially the same as that proposed by Trommelen and Zonneveld (1982), the only difference being that she makes use of fusion to block the application of progressive neutralization. However, she still requires the theme vowel and the abstract segment.

Under the theory assumed in this paper, another representation of the past tense suffix with properties of both a stop and a fricative is available. That is, we can assume that the past tense morpheme is a CV (contextually voiced) segment, like the fricatives, but
specified as a non-continuant. All that is required is the assumption that the bound morphology constitutes a segmental class on its own (see also Dyck 1995; Steriade 1995). If there is no voicing distinction in the bound morphology, there is no reason to assume that segments are marked in the same way as full lexical entries. The segment I am proposing as the underlying representation of the past tense is representationally distinct from other non-continuant sounds in the language, however, a representation that is already required for the fricative inventory of the language is all that needs to be invoked. The fact that the past tense morpheme and the fricatives do not behave identically in surface clusters is derived from the presence of the theme vowel in the verbs. This theme vowel allows for the contextual voicing of the initial stop of the past tense marker.

The underlying representation of the past tense form of [krabde] is given in (27). The /b/ has a [voice] specification and is in the onset of a syllable, avoiding the Laryngeal Condition. The initial segment of the past tense morpheme is unmarked for laryngeal features and I assume that the theme vowel consists of just a root node.

(27)

```
           σ
         /   \
        σ
kra/ b V D ø /
   R R R R
  |   |   |   \
Lar [vce]
```

This representation constitutes a contextual voicing environment for the past tense ending represented by /D/. The theme vowel, being nothing but an empty slot, contributes nothing to the voicing environment, but neither does it take away from this environment. Its primary function is to save the /b/ of the stem from undergoing final devoicing by the Laryngeal Condition and it is not deleted until this consonant is no longer subject to this condition. This analysis holds for all of the cases where the past tense marker surfaces as voiced. When it is between sonorants as in (25a), it is contextually voiced by virtue of being between SV segments. After voiced fricatives as in (25c), it is contextually voiced as there is no Laryngeal node present in the environment that would render it voiceless.

Now we will consider the situation where the initial segment of the past tense ending surfaces as a voiceless segment. In this case, the stem-final consonant is underlyingly voiceless and thus is specified as a Laryngeal segment.

(28)

```
  schra/ p V D ø /
   R R R R
  |   |   |
Lar
```

Here, there is no voicing in the environment of the past tense ending. Indeed, the closest segment with any specification for laryngeal features is the voiceless obstruent of the stem. In this case the context is voiceless and the past tense consonant surfaces as voiceless, just as occurs with the fricative clusters.

This analysis of the Dutch past tense morpheme has several advantages over previous accounts. First, we do not need to propose an underlying fricative segment along the lines proposed in previous studies. While it is true that the stop of this morpheme is not represented in a fashion identical to the other stops of Dutch, the representation proposed for this stop has been independently motivated for the fricatives of Dutch. Given that we allow for more than one representation of the voicing distinction, our prediction is that such asymmetries should arise in languages. Secondly, because our analysis does not require a
non-occurring fricative segment, we can dispense with the rule of absolute neutralization that hardens this fricative to a stop, clearly a step in the right direction if all other aspects of the analysis are equal. Finally, it appears that this analysis reveals the true nature of the past tense morpheme. This morpheme is not a fricative, it only behaves like the fricatives of the language. I have shown that the difference between the stops and the fricatives lies in the different Laryngeal representations that these two classes of sounds have. The behaviour of the past tense morpheme has nothing to do with its specification as a fricative, only with the representation of its voicing properties. It happens that it has the same Laryngeal representation as the fricatives of the language, a fact that is independent of its specification for continuancy. In my theory, this can be captured directly through the Laryngeal representation, which appears to locate the idiosyncrasy of the past tense morpheme in precisely the right place.

4. Summary

The two languages that we have studied in this paper provide strong support for the representations we have proposed. In Turkish, we were able to provide an elegant account of the differing behaviour of stops and fricatives by exploiting the CV-SV distinction. This analysis allows us to explain the failure of voicing to spread in Turkish as well as to account for the different behaviour of the stops and fricatives with respect to the devoicing rules. We saw as well that our analysis had similarities to that proposed by Inkelas and Orgun (1993) but differed from theirs in that we propose that the feature [voice] is not an active feature in Turkish and thus is absent from representations. We also found sounds that on the surface appear to be members of one category but behave like members of the other category. In the case of Turkish, it is the non-alternating stops, i.e., those syllable-final stops that do not undergo Laryngeal Strengthening and thus surface as voiced. Our solution locates the difference between the alternating and non-alternating stops in voicing representation.

In Dutch, we are able to provide an elegant account of the differing behaviour of stops and fricatives by exploiting the LV-CV distinction. This difference carries over to the past tense marker, which behaves in many ways like a fricative but surfaces as a stop. We were able to capture its similarity to fricatives by allowing it to have the same voicing representation as the fricatives, obviating the necessity for proposing that the sound is underlyingly a fricative. Instead, we simply state that the past tense marker of Dutch is a CV segment. The advantage this analysis has over previous analyses lies in the fact that we do not need to use a feature such as [continuant] as a diacritic for the different voicing properties of the past tense marker as compared to the other stops of Dutch. Instead, we are able to locate the difference between the past tense marker and the other stops in the voicing representation, and this is where the difference really lies, not in the continuancy.

In this paper I have proposed a new approach to a variety of devoicing phenomena. Sometimes devoicing arises because the feature [voice] has been delinked, at other times it is the result of Laryngeal Strengthening. Everything depends on the representation of the voiced-voiceless distinction in the language under consideration. The existence of split laryngeal systems provides support for the analysis as it obviates the necessity for the use of features in a diacritic way. Thus, we do not need to use [continuant] as a means of blocking the application of a process that refers to voicing. Whether or not a given process applies follows directly from the representation of the voicing contrasts.
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