A featural analysis of some onset-vowel interactions

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0. Introduction

In this paper I propose a formal analysis of some well known cases of consonant-vowel interactions that are commonly found in Asian languages. In particular, I discuss four effects of onset voicing on the vowel, namely, register genesis, vowel-height split, tonogenesis, and tone split. The theoretical framework I assume includes, first, feature geometry, which holds that distinctive features form a geometrical structure, second, the theory of 'enhancement' (Stevens et al. 1986, Stevens & Keyser 1989, cf. also the 'Grounding Condition' of Archangeli & Pulleyblank in preparation), which holds that features that phonetically enhance each other tend to cooccur, and third, the theory of underspecification, which holds that predictable features may be left unspecified in the underlying representation. I will further assume that both onset voicing and vowel register relate to the same feature [+st] ([±stiff vocal cords], following Halle & Stevens 1971, but with modifications to be explained below). Under these assumptions, register genesis is viewed as the spreading of [+st] or [-st] from the onset to the vowel. After register genesis, [+st] or [-st] on the vowel may further triggers the feature [-ATR] ([±advanced tongue root]) or [+ATR] via 'enhancement', giving vowel height split. Alternatively, [+st] and [-st] may trigger the Pitch features ([H] or [L]) via enhancement, giving tonogenesis.

This paper is organized as follows. First, I review register genesis, vowel-height split, tonogenesis, and tone split in section 1. Then I discuss relevant theoretical background in section 2. In section 3, I give the formal derivations of register genesis, vowel-height split, tonogenesis, and tone split. Finally, summary and implications are given in section 4.
1. The problems

Consonant-vowel interactions have been extensively documented in Asian languages. For example, it is generally accepted that tones in Lhasa Tibetan and Vietnamese come from the breakdown of consonants surrounding the vowel (cf. among others, Haudricourt 1954; Matisoff 1970, 1973; Diffloth 1991 for Vietnamese, and Hu 1980; Zhang 1981; Qu 1981 for Tibetan). It is also generally accepted that historically Chinese had four syllable tones, which later underwent tone split conditioned by onset voicing to give up to eight or more syllable tones in some dialects today. Moreover, there is a possibility that the four historical syllable tones in Chinese were derived from the break-down of post-verbal consonants, similar to the case in Tibetan and Vietnamese, although evidence is scarce due to the antiquity of the events.

In this paper we focus on interactions between onset consonants and the vowel. We will not discuss the effects of post-vowel consonants. Specifically, we will look at four well documented effects of onset voicing on the vowel, namely, register genesis, vowel-height split, tonogenesis, and tone split. We review these cases in turn.

1.1. Register genesis In African phonology, the term 'register' is used rather loosely. It often refers to pitch levels, along with other things. In Asian phonology, however, the term 'register' (first introduced probably by Henderson 1952) specifically refers to voice quality in the vowel that is ultimately related to onset voicing (we come to Yip's 1980 uses of 'register' directly below). In this paper I will use 'register' in the Asian tradition. The term 'register genesis' (probably first introduced by Diffloth) refers to a process in which (the loss of) onset voicing leads to changes in the voice quality of the vowel. Such cases are found in Mon-Khmer languages, and are summarized below (cf. Jenner et al 1976):

(1) a. Voiceless onsets:
   1st register (clear, head, tense, normal...)
   b. Voiced onsets:
      2nd register (deep, chest, lax, murmured...)

Typically, vowels with historically voiceless obstruent onsets have the 'first register', whose voice quality is described by such terms as 'clear', 'normal', 'tense', etc., and vowels with historically voiced obstruent onsets have the 'second register',
whose voice quality is variously described as 'deep', 'lax', 'chest', 'murmured', etc. Vowels in the first register may also have a higher pitch, and those in the second register a lower pitch, but the pitch difference does not play the major distinctive role. After register genesis, the contrast in onset voicing may be neutralized, with voiced obstruent onsets becoming devoiced. The neutralization does not go the other way, however, that is, voiceless obstruent onsets do not become voiced.

1.2. Vowel-height split Once register genesis has taken place, vowels may further undergo a split in height. In particular, vowels in the first register may become lower, and vowels in the second register may become higher. Vowel-height split is again found in Mon-Khmer (cf. Jenner et al). A typical example is seen in Rengao (Gregerson 1976)

(2) Vowel-height Split in Rengao
a. Voiceless onsets: ēi  E  a  O  əu (lower vowels)
b. Voiced onsets:  i  e  ə  o  u (higher vowels)

Gregerson suggests that vowel-height split is due to the feature [advanced tongue root] ([ATR]); vowels in the second register have [+ATR], which gives higher vowels, and vowels in the first register have [-ATR], which gives lower vowels. I think that Gregerson's insight is fundamentally correct.

1.3. Tonogenesis After register genesis, instead of vowel-height split, the first register vowels may become high-toned, and the second register vowels become low-toned. This process is called 'tonogenesis', a term introduced by Matisoff (1970). Below are two examples in Lhasa Tibetan (Hu 1980)

(3) Historical Present
a. kho --> kho  'he'  ['] = high tone
b. go --> khô  'hear'  ['] = low tone

After tonogenesis, voiced obstruent onsets often become voiceless. In addition, the register (i.e. voice quality) contrasts in the vowel may also become lost, leaving pitch the only distinctive feature.
1.4. Tone split  If vowels originally have tones, not from onset voicing, obstruent onsets may still exert their influence on the vowel and split the existing tones into two sets, a higher set after voiceless obstruents, and a lower set after voiced obstruents. These two sets are respectively called 'Yin' and 'Yang' in traditional Chinese phonology, or [+upper] and [-upper] registers in Yip (1980). Most Chinese languages have undergone tone split in some way, and a good example is seen in Songjiang (Bao 1990, in Chao 1930 letters)

<table>
<thead>
<tr>
<th></th>
<th>Ping</th>
<th>Shang</th>
<th>Qu</th>
<th>Ru</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voiceless obstruent onset: (Yin/[+upper])</td>
<td>53</td>
<td>44</td>
<td>35</td>
<td>5</td>
</tr>
<tr>
<td>Voiced obstruent onset: (Yang/[-upper])</td>
<td>31</td>
<td>22</td>
<td>13</td>
<td>3</td>
</tr>
</tbody>
</table>

Here the four historical tones, Ping, Shang, Qu, and Ru, have split to eight. It is important to note that, apart from their difference in pitch levels, [+upper] and [-upper] register vowels also differ in voice quality; [+upper] vowels are often described as 'clear', 'normal', etc., and [-upper] vowels are often described as 'muddy', 'murmured', 'breathy', etc. (cf. Sherard 1972 for Shanghai, Zheng-Zhang 1964:32 for Wenzhou). In addition, Duanmu (1990a) argues that, for register contrast, it is voice quality, not pitch, that is distinctive. We will therefore identify [+upper] and [-upper] registers in Chinese with the first and the second register in Mon-Khmer respectively. Like in the case of register genesis, after tone split, the contrast in onset voicing may remain, as in the Wu family of Chinese (e.g. Songjiang, Shanghai, and Wenzhou), or voiced obstruent onsets may become devoiced, as in other Chinese dialect families.

1.5. Summary  We have reviewed four effects of onset voicing on the vowel, register genesis, vowel-height split, tonogenesis, and tone split. It is important to note that we have been talking about voicing in obstruent onsets. Although sonorants are also voiced, their effect on the vowel is either random, or depends on the obstruent preceding the sonorant. We will return to this point when we discuss underspecification, where we will suggest that sonorants are underlyingly unspecified for voicing.