Bedouin Arabic multiple opacity with indexed constraints in Parallel OT

Opaque interactions between phonological processes (Kiparsky 1973) can be a significant challenge to OT accounts of phonology (Idsardi 2000, although see Baković 2011). Various proposals can account for opacity and related derivational phenomena, e.g., Turbidity (Goldrick 2001) and OT-CC (McCarthy 2007). However, approaches in which opacity is derived from independently motivated means are especially attractive: for instance, Stratal OT (e.g., Bermúdez-Otero 2003) derives the machinery for opacity from phonology-morphology interactions.

McCarthy (2007) presents multiple opacity in Bedouin Arabic (henceforth: BA), see (1), as a potential counterexample to the Stratal OT approach and to non-derivational approaches like Turbidity (Goldrick 2001) or Coloured Containment (van Oostendorp 2008).

1. **Syncope** of /i/ followed by CV
   
   /kitib/ → ktib ‘it was written’

2. **Raising** of /a/ to [i] before CV – counterfeeds Syncope
   
   /katab/ → kitab ‘he wrote’ *ktab /samisṭ/ → simisṭ ‘I heard’ *smisṭ

3. **Epenthesis** of [i] between word-final CC – counterfeeds Raising
   
   /gabil/ → gabil ‘before’ *gibil *gibil

I argue here that there is a solution for the BA case that is both independently motivated and non-derivational. I propose to blend two existing versions of indexed constraint theory (Pater 2000, 2010): segmentally local indexation (e.g., Temkin-Martínez 2010, Round 2017), and contrastive/binary indexation (Becker 2009), both motivated by phenomena in the realm of exceptionality. In this version, constraint indices are binary segmental features: [+i], [-k], [+x]. Crucially, indices cannot be changed by phonological GEN (an idea implicit in Pater 2000, 2010).

I hypothesize that the BA follow from two sets of indices, [±L] and [±V]. [±L] on a vowel indicates that it will behave like a low vowel (i.e., it raises before __CV), while [-L] on a vowel indicates that it will behave like a high vowel (i.e., it deletes before __CV). Finally, [+V] indicates that a segment will behave like a vowel, while all other segments are [-V]. This leads to a situation where the three processes are conditioned by distinct sets of indices, as in (2). Each segment has a value for [±L] and [±V], but only [L] and [V] values crucial to the analysis are shown.

2. a. **Syncope** of a [-L] vowel when followed by CV
   
   /k i[:1]t i[:1]b/ → k∅[±L]tib ‘it was written’

   b. **Raising** of a low vowel to a high vowel when followed by C and a [+V] segment
   
   /k a[:1] i[:1]t a[:1]i[:1]b/ → kita[i[:1]i[:1]]b ‘he wrote’ *k∅[±L]tab

   c. **Epenthesis** of [i] between word-final CC (epenthetic segment assigned [-L,-V] by default, which means that epenthetic vowels do not trigger raising)
   
   /g a[:1]i[:1]b/ → gab[i[:1]i[:1]]b ‘before’ *gibi[i[:1]i[:1]]b *g∅[±L]bil

The reformulation in (2) makes each of the three processes surface-true and surface-apparent (McCarthy 1999), which allows for a Parallel OT account. This account involves three undominated constraints, see (3), that outrank a hierarchy of faithfulness constraints, see (4), in which it is shown that, thanks to extended indexation, the opaque pattern is derived in Parallel OT.

3. a. *V[±L]CV: One * for every sequence of a [-L] vowel followed by CV (→ Syncope)

   b. *V[±low]CV[±V]: One * for every low vowel followed by C and [+V] (→ Raising)

   c. *CC#: One * for every word-final CC cluster (→ Epenthesis)
Three additional constraints ensure that both Syncope and Raising are restrictive and compatible with Richness of the Base. Two undominated constraints, *[+low, -L] and *[-syllabic, +V], ensure that [-L] is never on a low vowel and [+V] is never on a consonant or glide. Since GEN cannot change indices, these constraints will ensure that underlying /a[i,L]/ surfaces as [i] and underlying /w[+V]/ surfaces as [u]. The realization of [+L] segments as low vowels except in the raising context can be accounted for with the ranking Max(V) >> *[low, +L] >> Ident(V), as shown in (5): underlying /i[i,L]/ in a final syllable is realized as [a] to minimize violations of *[low, +L], while underlying /i[i,L]/ before underlying /CV/ is realized as [i] because of undominated *V[+low]CV[+V].

<table>
<thead>
<tr>
<th>(4)</th>
<th>/k i[i,L] t i[i,L] b/</th>
<th>*V[-L]CV</th>
<th>*V[+low]CV[+V]</th>
<th>*CC#</th>
<th>Dep</th>
<th>Max(V)</th>
<th>Ident(V)</th>
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<tbody>
<tr>
<td>kitib</td>
<td>*!</td>
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<td> kØ[i,L]tib</td>
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<td>kitib</td>
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</tbody>
</table>
| /k a[i,L] t a[i,L+V] b/ | katab | *! | | | | | *
|  kitab | | | | | | | *
| kØ[i,L]tab | | | | | | | *! |
| /g a[i,L] b l/ | gabl | *! | | | | | *
|  gabi[i,V]l | | | | | | | *
| gibi[i,V]l | | | * | | | *! |
| *gØ[i,L]bil | | | * | | | *! |