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) a. **Syncope** of /i/ followed by CV
/kitib/ → ktib 'it was written'
b. **Raising** of /a/ to [i] before CV – *counterfeeds Syncope*
/katab/ → kitab 'he wrote' *ktab /samiʕt/ → simiʕt 'I heard' *smiʕt
c. **Epenthesis** of [i] between word-final CC – *counterfeeds Raising*
/gabl/ → gabil 'before' *gibil *gbil

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 $i_{[-L]}$ t $i_{[-L]}$ 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 $a_{[+L]}$ t $a_{[+L,+V]}$ b/ → kita$_{[+L,+V]}$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 $a_{[+L]}$ b l/ → gabi$_{[-V]}$l 'before' *gibi$_{[-V]}$l *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**)

(4) /k $i_{[-L]}$ t $i_{[-L]}$ b/	*$V_{[-L]}$CV	*$V_{[+low]}CV_{[+V]}$	*CC#	Dep	Max(V)	Ident(V)
kitib	*!					
☞ k∅$_{[-L]}$tib					*	
kittib				*!		
/k $a_{[+L]}$ t $a_{[+L,+V]}$ b/						
katab		*!				
☞ kitab						*
k∅$_{[+L]}$tab					*!	
/g $a_{[+L]}$ b l/						
gabl			*!			
☞ gabi$_{[-V]}$l				*		
gibi$_{[-V]}$l				*		*!
*g∅$_{[+L]}$bil				*	*!	

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 /$a_{[-L]}$/ 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 /$i_{[+L]}$/ in a final syllable is realized as [a] to minimize violations of *[-low, +L], while underlying /$i_{[+L]}$/ before underlying /CV/ is realized as [i] becase of undominated *$V_{[+low]}CV_{[+V]}$.

(5) /k $i_{[+L]}$ t $i_{[+L,+V]}$ b/	*$V_{[-L]}$CV	*$V_{[+low]}CV_{[+V]}$	*CC#	Dep	Max(V)	*[-low, +L]	Id(V)
kitib						**!	
katab		*!					**
☞ kitab						*	*
k∅$_{[+L]}$tab					*!		*

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