Biaspectual phonology and phonological opacity

One recent trend within OT is the denial that genuinely phonological instances of opacity exist. Researchers such as Sanders (2003) claim that opacity represents nothing more than the residue of diachronic processes and is best relegated to the lexicon or to the morphology. Some case of opacity are doubtless of this kind. Nevertheless, research continues to bring to light new cases of fully productive, yet opaque, phonological generalizations, underscoring the continuing need for OT to address opacity as a synchronic phonological phenomenon. To date, though, parallel OT has failed to grapple satisfactorily with opacity. This lack of descriptive success has lead to a florescence in serialist approaches, both rule-based (Idsardi 1997, 1998) and constraint-based (Stratal OT; Kiparsky 1998), which luxuriate in intermediate levels. While descriptively more satisfying in the short term, any concession to serialism ultimately undermines the fulfilment of OT's longer term explanatory goals (Halle and Idsardi 1997). In this paper I will describe a fully parallel approach to phonological opacity. In diagnosing the problem, I will argue that parallel OT's lack of success stems from the failure to recognize that the phonological grammar serves as the interface between *two* extragrammatical interpretative systems, PHONETIC INTERPRETATION (Φ) and LEXICAL RECOGNITION (Λ). Once we construe phonology in this way, phonological opacity is no longer an anomaly and becomes instead more or less inevitable. It might be added that, measured against the last fifty years of research in generative phonology, there is nothing radical about this move: rather, it reintegrates the insight that the phonological grammar mediates between memory and realization (see Halle 2002), although in a way which is fully cognisant of the *richness of the base*.[1] In parallel terms, phonological opacity arises because the phonetic interpretation and lexical recognition systems may in principle 'see' different aspects of the phonological representation. The candidate output is BIASPECTUAL, which is to say that each node, feature and association line in the phonological representation is explicitly flagged for visibility to the phonetic interpretation (flag: ϕ) and lexical recognition (flag: λ) system. A phonetically inaudible trigger or blocker is not literally deleted in the surface representation — it is simply not flagged as visible to Φ. By way of illustration we can take the counterbleeding of Glottal Deletion by Epenthesis in Tiberian Hebrew (McCarthy 1999). The form [deše], 'tender grass' (< input /dašʔ̱-/), is phonologically d$^{\lambda}_{\phi}$e$^{\lambda}_{\phi}$š$^{\lambda}_{\phi}$e$_{\phi}$ʔ$^{\lambda}$. The final glottal stop is flagged as visible to Λ (making it available for purposes of computation) but not to Φ (making it unavailable for purposes of realization). Seeing phonological representations in this way requires that we reconstrue markedness and faithfulness constraints. Markedness constraints may be interpreted as requiring *invisibility* to a given system, while faithfulness constraints require *visibility* of input material to a given system. Each markedness and faithfulness constraint comes in two flavours, RECESSIVE or AGGRESSIVE, as shown in (1) and (2). A recessive constraint requires visibility/invisibility to *one* of the interpretative systems while an aggressive constraint requires visibility/invisibility to *both* systems. /X/ in the input may be mapped onto one of four distinct representational 'states', whose patterns of violation are shown in (3). ('Defective' elements which are only visible to *one* of the systems are shown in outline.) Permuting the four constraints in (1) and (2) generates 24 (= 4!) total rankings, 9 of which optimize the mapping $/\mathrm{X}/\rightarrow \mathrm{X}^{\lambda}_{\phi}$, 9 the mapping $/\mathrm{X}/\rightarrow \emptyset$, 6 the mapping $/\mathrm{X}/\rightarrow \mathbb{X}^{\lambda}$ (covert X), and 0 the mapping $/\mathrm{X}/\rightarrow \mathbb{X}_{\phi}$ (which is harmonically bounded by the other candidates). The hallmark of opacity is that recessive dominates aggressive, i.e. (i) $^*\mathrm{X}_{\phi} \gg$ Faith-$\mathrm{X}^{\lambda}_{\phi}$, and (ii) Faith-$\mathrm{X}^{\lambda} \gg {}^*\mathrm{X}^{\lambda}_{\phi}$. The possibilities for Dep and Ident exactly mirror the possibilities for Max. When X is covert (X^{λ}), the only way it is recoverable is if some other sufficiently highly-ranked markedness constraint which makes reference to it. To this end, we recognize that contextual markedness constraints come in two versions, $^*\mathrm{Y}/\mathrm{X}_{\phi}$, which penalizes Y in transparent contexts only, and $^*\mathrm{Y}/\mathrm{X}^{\lambda}$. The latter will penalize Y in the context of any X which is visible to Λ, whether also visible to Φ or not. When X is not visible to Φ, but conditions changes in target Y nonetheless, we are of course dealing with

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[1] In process morphophonemics, this insight was formalized by countenancing two privileged levels, the systematic phonemic (underlying) and the discrete phonetic (Postal 1968; Kiparsky 1973).

phonological opacity.

The theory will be illustrated in a novel analysis of the well-known data from Yawelmani Yokuts which also figures prominently in McCarthy's Sympathy paper. In this language, there is a vowel harmony process which spreads colour from a root vowel to a suffix vowel of the same phonological height (/hud+hin/→*hudhun* 'recognize(d)'; /bok'+al/→*bok'ol* 'may find'; *but* /bok'+hin/→*bok'hin* 'find, found'; /hud+al/→*hudal* 'may recognize') and a context-free process lowering long high vowels. These two processes interact opaquely giving rise to instances where harmony either overapplies (/c'uːm+it/→*c'oːmut* 'destroy'), or underapplies (/c'uːm+al/→*c'oːmol* 'may destroy'). A fragment of the analysis is given in (4). (Here, $*[+\mathrm{hi}]/\mu_w$ assesses a mark against a long high vowel.) In biaspectual terms, the grammar makes an input /uː/ visible to Λ as a high vowel, but to Φ as a non-high vowel *oː*. This is shown by o$_{[\![+\mathrm{hi}]\!]}$ in the tableau. The opacity is derived by assuming that the constraint responsible for vowel harmony, Harmony$^{\lambda}$, is only sensitive to root vowel contexts which are visible to Λ as [+high]. The sister constraint, Harmony$_{\phi}$, which is only sensitive to root vowel contexts which are visible to Φ as [+high], is too low ranked for the 'transparent' candidates (b,f) to win.

A central part of the talk will address the different empirical predictions made by Sympathy Theory and biaspectual phonology with respect to a particular kind of three-rule interaction, $\mathcal{P} > \mathcal{Q} > \mathcal{R}$, known as rule sandwiching. Cases of rule sandwiching have the following properties: (i) $\mathcal{P}$ feeds/bleeds $\mathcal{Q}$, (ii) $\mathcal{R}$ counterfeeds/counterbleeds $\mathcal{Q}$, and (iii) $\mathcal{P}$ and $\mathcal{R}$ introduce identical faithfulness violations. In Yawelmani, which furnishes an example of precisely such a case, there are two vowel shortening processes, one of which applies before a word-final coda glottal stop, and a second which applies in closed syllables generally. However, Word-final Preglottal Shortening is crucially ordered *before* Lowering, and Closed Syllable Shortening *after* Lowering, hence /c'uːm+hin/(→c'uːmhun→c'$\underline{\mathrm{o}}$ːmhun)→*c'omhun*, 'destroyed', but /c'uyuː+ʔ/→*c'uyuʔ*, 'will urinate'; *not* **c'uyoʔ*. Sympathy Theory predicts that such cases should not exist. However, as I will show, not only are there several robust and productive cases of phonological rule sandwiching (e.g. in Yawelmani, Mohawk, Ivrit, Saami, …), but that biaspectual phonology deals with them elegantly and in a fully parallel fashion. As we have observed, in cases of plain opacity, it must be the case that (i) $*\mathrm{X}_{\phi} \gg$ Faith-$\mathrm{X}^{\lambda}_{\phi}$ and (ii) Faith-$\mathrm{X}^{\lambda} \gg *\mathrm{X}^{\lambda}_{\phi}$. Here, *recessive* $*\mathrm{X}_{\phi}$ drives the process closest to the surface, $\mathcal{R}$ in our schema. In cases of rule sandwiching, however, it must also be the case that Faith-X^{λ} is dominated by a more highly ranked *aggressive* markedness constraint, $*\mathrm{X}'^{\lambda}_{\phi}$, specifically the one driving the most deeply embedded process $\mathcal{P}$. Grounded as it is in the conception of phonology as mediating between lexical recognition and phonetic interpretation, biaspectual architecture entails, moreover, a *principled* limit on the depth of opaque interactions: rule sandwiching is as opaque as it can possibly get. This is a prediction which seems so far to be borne out by the available evidence, yet it is something that serial models can only stipulate.

(1) a. $*\mathrm{X}_{\phi}$ (recessive)
X must be invisible to Φ.
b. $*\mathrm{X}^{\lambda}_{\phi}$ (aggressive)
X must be invisible to *both* Φ *and* Λ.

(2) a. Max-X^{λ} (recessive)
If X is present in the input, then
X must be visible to Λ.
b. Max-$\mathrm{X}^{\lambda}_{\phi}$ (aggressive)
If X is present in the input, then
X must be visible to *both* Φ *and* Λ.

(3)

	/X/	$*\mathrm{X}^{\lambda}_{\phi}$	$*\mathrm{X}_{\phi}$	Max-$\mathrm{X}^{\lambda}_{\phi}$	Max-X^{λ}
a.	$\mathrm{X}^{\lambda}_{\phi}$	*	*		
b.	$\mathbb{X}^{\lambda}$	*		*	
c.	$\emptyset$			*	*
d.	$\mathbb{X}_{\phi}$	*	*	*	*

(4)

		/c'uːm+al/	Har$^{\lambda}$	Id[hi]$^{\lambda}$	$*[+\mathrm{hi}]_{\phi}/\mu_w$	Id[Color]	Har$_{\phi}$	Id[hi]$^{\lambda}_{\phi}$	$*[+\mathrm{hi}]^{\lambda}_{\phi}/\mu_w$
a.	☞	c'o$_{[\![+\mathrm{hi}]\!]}$ːmal					*	*	*
b.		c'o$_{[\![+\mathrm{hi}]\!]}$ːmol				*!		*	*
c.		c'uːmal			*!				
d.		c'uːmol			*!	*			
e.		c'oːmal		*!			*	*	
f.		c'oːmol		*!		*		*	

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