Opaque interactions with rules and constraints[1]

1. **Linear Rule Systems**

a. Underlying representations (URs) are mapped to surface representations (SRs) by sequential application of phonological rules.
b. Rules have an ordering that is determined by the language (not by the UR, UG, etc.)
c. Each rule applies at exactly one point in a given derivation.

2. Major research questions

d. What types of phonological patterns can be described with linear rule systems?
e. Are there gaps relative to these predictions?

3. **Non-interaction**

No ordering relation can be established between two rules.

Ex. Zoque nasal place assimilation and post-nasal voicing. Proof by enumeration of possibilities:

UR	/N+pama/		NPA.[+cons,+nasal]→[αpla] /__+[+cons,–cont, αpla]
NPA	mpama	PNV Nbama	PNV. [+cons] → [+voice] / [+cons,+nasal] __
PNV	mbama	NPA mbama	

4. Ordering by transitivity

If A precedes B and B precedes C, then A precedes C.
In other words, linear orders are transitive (A>B & B>C ⇒ A>C). This can lead to non-obvious predictions: if given A>B and B>C, then A and C *must* interact as A>C (if at all).

Analogous predictions in Optimality Theory.

5. Non-interaction

f. Only forms that could potentially undergo both rule A and rule B at some point in their derivation are relevant for determining how A and B interact.
g. If neither the focus nor the change of rule A is contained in the context of rule B, and vice versa, then A and B do not interact. (Ex. [+cons]→[–voice]/__# and [–cons]→∅/__ [–cons])

6. **Feeding interaction**

• R1 feeds R2 if the R1's output contains more input strings to R2 than R1's input.
• R1 bleeds R2 if the R1's output contains fewer input strings to R2 than R1's input.

7. Alternations in Karok

Imperative	1 sg.	3sg.	gloss
pasip	nipasip	ʔupasip	'shoot'
ʔiʃriv	niʃriv	ʔusriv	'shoot at target'
suprih	niʃuprih	ʔusuprih	'measure'
ʔiʃkak	niʃkak	ʔuskak	'jump'
ʔifik	niʔifik	ʔuʔifik	'pick up'
ʔaktuv	niʔaktuv	ʔuʔaktuv	'pluck at'
ʔaxyar	nixyar	ʔuxyar	'fill'
ʔikʃah	nikʃah	ʔuksah	'laugh'
si:tva	niʃi:tva	ʔusi:tva	'steal'
ʔuksup	nikʃup	ʔuksup	'point'

Source: Kenstowicz & Kisseberth 1979:73 (based on Bright 1957).

[1] Acknowledgment: 1st part of this comes from a handout by Colin Wilson (UCLA Ling 200, 2001)

8. Rules for Karok with example derivations

UR	/ni+uksup/			/u+iksah/		
Vowel Deletion.	V→∅ / V__	niksup	*feeding*	uksah	*bleeding*	
Palatalization.	s→ʃ / i(C)__	nikʃup		n/a		
Onset epenthesis.	∅→ʔ / #__V			ʔuksah		

• This example shows that a rule feeds or bleeds another rule *only with respect to a particular form* . The same is true of other types of interactions discussed below.

9. Counterfeeding and counterbleeding

R1 counterfeeds R2 if (a) the output of R1 has more potential inputs to R2 than its input
And (b) R2 does not apply to the inputs created by R1

R1 counterbleeds R2 if (a) R1 has the potential to make strings ineligible for R2 application
And (b) R2 applies anyway to those strings.

10. Alternations in Yawelmani (Yowlumne) Yokuts

nonfuture	perfective	future passive	gloss
xathin 'ate/eats'	xatmi 'having eaten'	xatnit 'will be eaten'	'eat'
bok'hin	bok'mi	bok'nit	'find'
xilhin	xilmi	xilnit	'tangle'
dubhun	dubmu	dubnut	'lead by the hand'

•Other nonfutures: maxhin 'procures', k'oʔhin 'throws', giy'hin 'touches', hudhun 'recognizes'

dubitative	participative	gerundive	gloss
xatal 'might eat'	xatxa 'let us eat'	xattaw 'eating'	'eat'
bok'ol	bok'xo	bok'tow	'find'
xilal	xilxa	xiltaw	
dubal	dubxa	dubtaw	'lead by the hand'

•Other dubitatives: maxal 'procure', k'oʔol'throw', giy'al 'touch', hudal 'recognize'

Vowel harmony. A vowel is pronounced round (and back) if the immediately preceding vowel is a round vowel that has the same height specification.

V [αhigh] → [+round] /	V C_0 __ [αhigh] [+round]	Alternative environment: 'an [αhigh, +round] vowel in preceding syllable'.

nonfuture	future	imperative	dubitative	gloss
saphin	saːpen	sapk'a	saːpal	'eat'
doshin	doːsen	dosk'o	doːsol	'report'
lanhin	laːnen	lank'a	laːnal	'hear'
mek'hin	meːk'en	mek'k'a	meːk'al	'swallow'
wonhin	woːnen	wonk'o	woːnol	'hide (trans.)'

Shortening.	A vowel is shortened before a sequence of two or more consonants.
Vː → V / __CC	Alternative environment: 'in a closed syllable'.

nonfuture	dubitative	gloss	nonfuture	dubitative	gloss
c'omhun	c'oːmal	'destroy'	doːshin	doːsol	'reports'

so:ghun	so:gal	'pull out a cork'	wo:nhin	wo:nol	'hide'
wo:ʔyuhun	woʔyal	'falls asleep'	so:nihin	sonlol	'pack on the back'
do:lulhun	dollal	'might climb'	ho:tinhin	hotnol	'takes the scent'

Lowering. A long vowel becomes [–high].
V: → [–high]

Epenthesis. [i] is inserted between the first two members of a triconsonantal cluster.
∅ → i / C __ CC

Source: Kenstowicz & Kisseberth 1979:77-99, which is based on Newman (1944).

11. Example derivations for Yawelmani: non-opacity-inducing interactions

UR	/dub+hin/	/bok'+al/	/do:s+k'a/
Vowel Harmony	dubhun	bok'ol	do:s+k'o
Lowering	— —	— —	— —
Shortening	— —	— —	dosk'o

12. Example derivations for Yawelmani: opacity-inducing interactions

UR	/c'u:m+hin/		/su:g+al/	
Vowel Harmony	c'u:mhun	*two examples of counterbleeding*	— —	*counterfeeding*
Lowering	c'o:mhun		so:g+al	
Shortening	c'omhun		— —	

13. Additional Yawelmani data: deverbal nouns

noun form	gloss	UR	noun form	gloss	UR
bok'	'finding'	/bok'/	moyin	'getting tired'	/mo:yn/
ʔut'	'stealing'	/ʔu:t'/	ʔutuy	'falling'	/ʔuty/
ʔidil	'getting hungry'	/ʔi:dl/	wuʔuy	'falling asleep'	/wu:ʔy/
logiw	'pulverizing'	/logw/			

The first vowel of this type of deverbal noun is required to be short — a type of *prosodic template* — and this requirement allows proposed underlying [high] values to surface (because Lowering can't apply).

14. Opacity: Kiparsky (1971, 1973: in Kiparsky *Explanation in Phonology*, Foris 1982)
A phonological rule P of the form A→B/C__D is opaque if there are surface structures with any of the following characteristics:

a. instances of A in the environment C__D. (counterfeeding interactions yield this)
b. instances of B derived by P that occur in environments other than C__D (counterbleeding yield sthis)
c. instances of B not derived by P that occur in the environment C__D.

15. Two preliminary classifications of opaque interactions

a. **motivated by anti-merger considerations**: opaque interactions preserve an underlying contrast, whereas corresponding transparent ones do not.

E.g. As a result of the opaque interaction between RH and Lowering, Yokuts c'omhun is uniquely recoverable as /c'u:mhun/. A transparent interaction of RH and Lowering would have yielded [c'omhin], indistinguishable from UR /c'omhin/ or /c'o:mhin/.

b. **motivated by distantial faithfulness**: one class of counterfeeding scenarios preserve a smaller distance between Input and Output than corresponding feeding scenarios.

E.g. a→ e, e→ i, i→j/_V, all 3 applying in counterfeeding order, in Basque (Kenstowicz and Kisseberth1978). Measured in F1 distance, the actual UR-SR mappings compare as follows with the UR-SR mappings of the transparent interaction:

Transparent			Opaque		
/a/	→	[j]	/a/	→	[e]
/e/	→	[j]	/e/	→	[i]
/i/	→	[j]	/i/	→	[j]

a. opaque interactions that do allow recovery of the interacting constraints/rules
b. …. that don't.

16. No recovery: Polish (Sanders UCSC diss 2002)
Final devoicing counterbleedsV-Raising; V-Raising not learned.

(a) Final Devoicing

klub-ɪ	klup	'club (PL/SG)'
tɕɛkav-ɪ	tɕɛkaf	'ready (regular/short form)'
kɔlɛ̃nd-a	kɔlɛ̃nt	'Christmas carol (NOM SG/GEN PL)'
dva raz-ɪ	ras	'twice/once'
talɛʐ̩-ɛ	talɛʂ	'plate (PL/SG)'
grɪʑ̩-ɛʂ	grɪɕ	'bite (2SG/IMP)'
bzʐ̩g-u	bzʐ̩k	'edge (GEN/ACC)'

(b) Raising

stemUR	*NOM SG*	*NOM PL*	*gloss*
/dvɔr/	dvur	dvɔrɪ	'mansion'
/bɔl/	bul	bɔlɛ	'ache'
/pɔkɔj/	pɔkuj	pɔkɔjɛ	'room'
/stɔw/	stuw	stɔwɪ	'table'
/ʐ̩ur/	ʐ̩ur	ʐ̩urɪ	'a kind of sour soup'
/ul/	ul	ulɛ	'beehive'
/vuj/	vuj	vujɛ	'uncle'
/muw/	muw	muwɪ	'mule'
/tʂ̩ɔp/	tʂ̩ɔp	tʂ̩ɔpɪ	'peg'
/kɔt/	kɔt	kɔtɪ	'cat'
/vwɔs/	vwɔs	vwɔsɪ	'hair'
/wɔɕ/	wɔɕ	wɔɕɛ	'elk'
/sɔk/	sɔk	sɔk̟i	'juice'
/grɔx/	grɔx	grɔxɪ	'pea'
/dɔm/	dɔm	dɔmɪ	'house'
/tʂ̩ɔn/	tʂ̩ɔn	tʂ̩ɔnɪ	'trunk'
/kɔɲ/	kɔɲ	kɔɲɛ	'horse'

(c) Opaque interaction of Raising and Devoicing

/bɔb/	bup	bɔbɪ	‘bean’
/rɔv/	ruf	rɔvɪ	‘ditch’
/lɔd/	lut	lɔdɪ	‘ice’
/dɔvɔz/	dɔvus	dɔvɔzɪ	‘supply’
/nɔz̨/	nuṣ	nɔz̨ɛ	‘knife’
/rɔg/	ruk	rɔgi	‘horn’

17. Rules

- ɔ-Raising: ɔ -> u / ___ [C,–nasal,+voice] #
- Devoicing: [–sonorant] -> [–voice] / ___ # counterbleeds Raising

18. Exceptions, loans

stem UR	*NOM SG*	**NOM SG*	*NOM PL*	*gloss*
/kɔlɔr/	kɔlɔr	*kɔl**u**r	kɔlɔrɪ	‘card suit’
/xɔl/	xɔl	*x**u**l	xɔlɛ	‘lobby’
/parasɔl/	parasɔl	*paras**u**l	parasɔlɛ	‘umbrella’
/kɔvbɔj/	kɔvbɔj	*kɔvb**u**j	kɔvbɔjɛ	‘cowboy’
/grutṣɔw/	grutṣɔw	*grutṣ**u**w	grutṣɔwɪ	‘gland’
/glɔb/	glɔp	*gl**u**p	glɔbɪ	‘globe’
/snɔb/	snɔp	*sn**u**p	snɔbɪ	‘snob’
/ɛpʲizɔd/	ɛpʲizɔt	*ɛpʲiz**u**t	ɛpʲizɔdɪ	‘episode’
/kɔd/	kɔt	*k**u**t	kɔdɪ	‘code’
/nɛkrɔlɔg/	nɛkrɔlɔk	*nɛkrɔl**u**k	nɛkrɔlɔgi	‘obituary’
/prɔlɔg/	prɔlɔk	*prɔl**u**k	prɔlɔgi	‘prologue’
/rɛkɔrd/	rɛkɔrt	*rɛk**u**rt	rɛkɔrdɪ	‘record’
/fʲɔrd/	fʲɔrt	*fʲ**u**rt	fʲɔrdɪ	‘fjord’

19. An experiment with forest creatures

• 2 subjects.
• Stimuli: plurals of Polish sounding non-words like szlapogy (‘szlapogs’) embedded in sentences
• Task: form the singular, where the voiced C is in final position.

• Example stimuli bardzo ładne źnabody dały Jankowi kawę, nie herbatę
bardzo ładne szlapogy dały Jankowi kawę, nie herbatę
‘The very pretty źnabods (szlapogs, ...) gave John coffee, not tea.’

• Example target sentences : Jeden bardzo ładny _____ pozyczył Jankowi i pieniądze, i koszulę ‘One very pretty _____ lent John both money and a shirt.’

• Results: the V-height in the źnabod, szlapog forms is in the same category as the V-height of the plurals. Raising does not apply to nonce forms.

• Sanders’ Moral: Raising is not part of the grammar.