A formal characterization of disjunctive application

OVERVIEW

Using the formal framework of Baković & Blumenfeld (to appear), we precisely characterize the conditions under which two rules apply DISJUNCTIVELY rather than CONJUNCTIVELY. This formal characterization clarifies four key aspects of the ELSEWHERE CONDITION (Kiparsky, 1973, 1982; Baković, 2013): CONTEXT INCLUSION, CHANGE INCOMPATIBILITY, CIRCUMSTANTIAL BLOCKING, and LOCAL BLOCKING.

BACKGROUND

In the framework of *The Sound Pattern of English* (SPE; Chomsky & Halle 1968), rules are ORDERED and apply CONJUNCTIVELY such that the input of a given rule $\mathcal{R}_i$ is the output of the preceding rule $\mathcal{R}_{i-1}$.

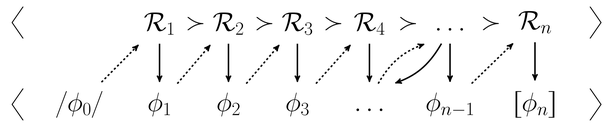

Fig. 1. Conjunctive application of rules in *SPE*. $/\phi_0/$ = UR, $[\phi_n]$ = SR, $\neg\square(\phi_i \neq \phi_{i-1})$

In certain situations, a subset $\mathbb{D}$ of rules applies DISJUNCTIVELY such that if any $\mathcal{R}_k \in \mathbb{D}$ is applicable to a representation ϕ_{k-1}, $\mathcal{R}_k$ applies and all remaining $\mathcal{R}_{k+m} \in \mathbb{D}$ are blocked from applying to $\phi_{k+(m-1)}$.

In *SPE*, disjunctive application was restricted to rules abbreviable by parentheses and other notations; e.g. the Latin stress rule in (1).

(1) $\mathrm{V} \longrightarrow \text{'}\mathrm{V} \;/\; \_\_\; \mathrm{C}_0((\check{\mathrm{V}}\mathrm{C}_0^1)\mathrm{V}\mathrm{C}_0)\#$

a. $\mathrm{V} \longrightarrow \text{'}\mathrm{V} \;/\; \_\_\; \mathrm{C}_0\check{\mathrm{V}}\mathrm{C}_0^1\mathrm{V}\mathrm{C}_0\#$ antepenult if penult is light: *'refecit, re'fugio*

b. $\mathrm{V} \longrightarrow \text{'}\mathrm{V} \;/\; \_\_\; \mathrm{C}_0\mathrm{V}\mathrm{C}_0\#$ . . . *otherwise*, penult: *re'fēcit, re'fector, 'regit*

c. $\mathrm{V} \longrightarrow \text{'}\mathrm{V} \;/\; \_\_\; \mathrm{C}_0\#$ . . . *otherwise*, ultima: *'rē, 'rem, 'rēs, 'ruct*

If a given expansion applies to a representation ϕ_k, remaining expansions are blocked from applying to ϕ_{k+m}. This mode of application is 'disjunctive' because *either* (1a), (1b), *or* (1c) applies to any form.

ELSEWHERE

The Elsewhere Condition (Kiparsky, 1973) unifies stress-rule cases with others that cannot be notationally abbreviated; Kiparsky (1982) shows that metrification obviates stress disjunctivity. Two criteria and two properties hold of the remainder (Baković, 2009, 2013).

(2) A rule $\mathcal{S}$ disjunctively blocks another rule $\mathcal{G}$ iff

- PROPER INCLUSION OF CONTEXTS
  The contexts of applicability of $\mathcal{S}$ are properly included in those of $\mathcal{G}$.
- INCOMPATIBILITY OF CHANGES
  The changes made by $\mathcal{S}$ and $\mathcal{G}$ are incompatible with one another.

(3) Phenomenological properties of disjunctive blocking

- CIRCUMSTANTIAL BLOCKING (a.o.t. 'applicational' blocking)
  $\mathcal{G}$ is blocked from applying to foci in substrings having the shape of outputs of $\mathcal{S}$, regardless of whether $\mathcal{S}$ is 'responsible' for those foci.
- LOCAL BLOCKING (a.o.t. 'global' blocking)
  $\mathcal{G}$ is only blocked from applying to the subset of potential foci of $\mathcal{S}$ in a substring, not also to other potential foci of $\mathcal{G}$ in the same form.

ENGLISH (Kenstowicz, 1994; Halle, 1995; Baković, 2013)

(4) $\mathcal{G}.\ \mathrm{V} \longrightarrow \check{\mathrm{V}} \;/\; \_\_\; \mathrm{C}_0\ \mathrm{V}$ ('σ σ) $\qquad \mathcal{S}.\ \begin{bmatrix}\mathrm{V}\\ -\text{high}\end{bmatrix} \longrightarrow \bar{\mathrm{V}} \;/\; \_\_\; \mathrm{C}\ i\ \mathrm{V}$ ('σ σ)

Shortening ($\mathcal{G}$) applies to **any vowel** in a bisyllabic foot head:

o('*păci*)⟨*ty*⟩	*di*('*vĭni*)⟨*ty*⟩	*se*('*rĕni*)⟨*ty*⟩	('*tўpi*)⟨*cal*⟩
cf. *o*('*pāque*)	*cf.* *di*('*vīne*)	*cf.* *se*('*rēne*)	*cf.* ('*tўpe*)

Lengthening ($\mathcal{S}$) applies only to (a) **a [−high] vowel** in a bisyllabic foot head, and only if the non-head vowel (b) **is *i*** and (c) **is in hiatus**:

re('*mĕdi*)⟨*al*⟩	(a)	('*jōvi*)⟨*al*⟩	(b) ('*grādi*)⟨*ent*⟩	(c)	('*rādi*)⟨*al*⟩
cf. ('*rĕmĕ*)⟨*dy*⟩		*vs.* ('*trĭvi*)⟨*al*⟩	*vs.* ('*grădu*)⟨*al*⟩		*vs.* ('*rădi*)⟨*cal*⟩

Shortening is CIRCUMSTANTIALLY BLOCKED by Lengthening in ('*grādi*)⟨*ent*⟩, *cf.* ('*grāde*); (ˌ*Shake*)('*speāri*)⟨*an*⟩, *cf.* ('*Shake*)(ˌ*speāre*), even though Lengthening is not 'responsible' for these long vowels.

DIOLA FOGNY (Sapir, 1965; Kiparsky, 1973; Ito, 1988)

(5) $\mathcal{G}.\ \mathrm{C} \longrightarrow \boxtimes \;/\; \_\_\; \mathrm{C}$ $\qquad \mathcal{S}.\ \begin{bmatrix}\mathrm{C}\\ +\text{nasal}\end{bmatrix} \longrightarrow [\alpha\text{place}] \;/\; \_\_\; \begin{bmatrix}-\text{cont}\\ \alpha\text{place}\end{bmatrix}$

Deletion ($\mathcal{G}$) applies to **any consonant** before another consonant:

le~~*k*~~*kuɡaw*	*ko*~~*b*~~*koben*	*uju*~~*d*~~*ja*
'they won't go'	'yearn, long for'	'if you see'

Assimilation ($\mathcal{S}$) applies only to (a) **a [+nasal] consonant**, and only when it stands before (b) **a [−cont] consonant**:

(a)	*niɡaŋɡam*	'I judge'	(b)	*nimammaŋ*	'I want'
vs.	*le*~~*k*~~*kuɡaw*	'they won't go'	*vs.*	*nala*~~*ŋ*~~*laŋ*	'he returned'

Assimilation is LOCALLY BLOCKED by Deletion in *numaŋɡi*~~*ŋ*~~*maŋɡ* 'you know them', applying to ~~*ŋ*~~*m* and blocked only in the *ŋɡ* substrings.

FORMALISM

Baković & Blumenfeld (to appear) propose a formal framework for understanding interactions among conjunctively ordered rules.

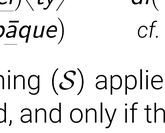

Fig. 2. $\mathcal{R}$aising FEEDS $\mathcal{P}$alatalization
$\mathcal{R}$ = *e* → *i* / __ #; $\mathcal{P}$ = *s* → ʃ / __ *i*

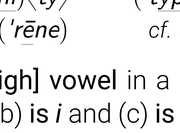

Fig. 3. $\mathcal{L}$owering BLEEDS $\mathcal{P}$alatalization
$\mathcal{L}$ = *i* → *e* / __ #; $\mathcal{P}$ = *s* → ʃ / __ *i*

For two rules to interact, one rule must *provide inputs and/or outputs to* the other or *remove inputs and/or outputs from* the other. Input/output-provision/removal are *atoms of molecular interactions*.

	provision	*removal*
input	$\mathcal{A}$+i$\mathcal{B}$	$\mathcal{A}$−i$\mathcal{B}$
output	$\mathcal{A}$+o$\mathcal{B}$	$\mathcal{A}$−o$\mathcal{B}$

Fig. 4. Atoms of molecular interactions

- UNDERAPPLICATION
  When $\langle \mathcal{B} \succ \mathcal{A} \rangle$, $\mathcal{B}$ *underapplies* if $\mathcal{A}$+i$\mathcal{B}$.
- MISAPPLICATION
  When $\langle \mathcal{B} \succ \mathcal{A} \rangle$, $\mathcal{B}$ *misapplies* if $\mathcal{A}$−o$\mathcal{B}$.

Fig. 5. Opaque interaction atoms

CHARACTERIZATION

The two criteria and two phenomenological properties of rules that apply disjunctively appear to be facets of a single atom: $\mathcal{G}$−o$\mathcal{S}$.

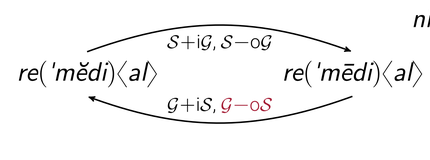

Fig. 6. Lengthening (4$\mathcal{S}$) and Shortening (4$\mathcal{G}$)

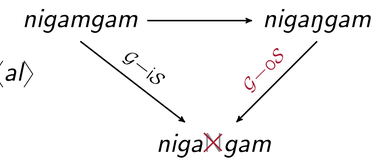

Fig. 7. Assimilation (5$\mathcal{S}$) and Deletion (5$\mathcal{G}$)

These two types of cases satisfy the two key criteria in (3) as follows.

- PROPER INCLUSION: $[\mathcal{S}(x) \neq x] \Longrightarrow [\mathcal{G}(\mathcal{S}(x)) \neq \mathcal{S}(x)]$
  If $\mathcal{S}$ applies to a representation x nonvacuously, then the result of applying $\mathcal{G}$ to $\mathcal{S}(x)$ is also nonvacuous — in other words, $\mathcal{G}$−o$\mathcal{S}$ is TOTAL on all strings Σ^*.
  - English: $[\mathcal{S}(re('mĕdi)\langle al\rangle) = re('mēdi)\langle al\rangle] \Longrightarrow [\mathcal{G}(re('mĕdi)\langle al\rangle) = \mathcal{G}(re('mēdi)\langle al\rangle) = re('mēdi)\langle al\rangle]$
  - Diola Fogny: $[\mathcal{S}(nigamgam) = niganɡam] \Longrightarrow [\mathcal{G}(nigamgam) = \mathcal{G}(niganɡam) = nigaⱾgam]$

  (Total output-removal is reminiscent of Anderson's (1974, 207) interesting concept of a *hemorrhaging* interaction.)
- INCOMPATIBILITY: $\forall x, \mathcal{S}|\mathcal{G}(x) = \textit{undefined}$ ('$\mathcal{A}|\mathcal{B}(x)$' is simultaneous application of $\mathcal{A}$ and $\mathcal{B}$ to x)
  Incompatible changes are those that cannot apply simultaneously.
  The changes must apply to the same segment and be contradictory, which implies that at least one rule must output-remove the other: $\mathcal{G}$−o$\mathcal{S}$.
  - English: The result of simultaneously lengthening and shortening a vowel is undefined.
  - Diola Fogny: The result of simultaneously assimilating and deleting a nasal is undefined.

BLOCKING DEFINED: Suppose rules $\mathcal{S}, \mathcal{G}$ meet the criteria above. For every nonvacuous mapping $\mathcal{S}(x) = y$, the otherwise expected mapping $\mathcal{G}(y) = z$ is BLOCKED. Rule $\mathcal{G}'$ is obtained by removing all such blocked mappings from $\mathcal{G}$, and $\mathcal{G}$ is replaced by $\mathcal{G}'$ in the grammar.

(Situations with more than one locus of application per string present additional complexities; see below.)

Blocking of $\mathcal{G}$ has the right phenomenological properties:

- CIRCUMSTANTIAL BLOCKING: $\mathcal{G}$ is blocked whenever $\mathcal{G}$−o$\mathcal{S}$.
  Regardless of whether $\mathcal{S}$ applies vacuously ($\mathcal{S}(x) = x$) or nonvacuously ($\mathcal{S}(x) \neq x$), $\mathcal{G}$−o$\mathcal{S}$ holds of any map $\mathcal{G}(\mathcal{S}(x)) \neq \mathcal{S}(x)$.
  - English: $(\text{ˌ}Shake)(\text{'}speāri)\langle an\rangle \in Out(\mathcal{S})$, regardless of whether $\mathcal{S}$ is 'responsible' for the long vowel.
- LOCAL BLOCKING: $\mathcal{G}$ is *only* blocked whenever $\mathcal{G}$−o$\mathcal{S}$.
  Cases with multiple loci require more complex machinery.* Briefly, any string can be broken up into substrings each with one locus of application, and the formal properties can be evaluated separately for each substring.
  - Diola Fogny: $numaŋɡi\overset{1}{Ȿŋmaŋɡ} = numaŋɡ\overset{1}{\frown}i\overset{2}{Ȿŋmaŋɡ}\overset{3}{\frown}aŋɡ$; $\mathcal{G}$−o$\mathcal{S}$ only holds of the first and third concatenees.

*See Baković & Blumenfeld (to appear, §3.3) for details on what are there called 'nonvacuous breaks' (NVBs).

CONCLUSION

Viewed from our formal perspective, disjunctive blocking is one way to avoid specific instances of what would otherwise be opaque misapplications of $\mathcal{S}$ if $\langle \mathcal{S} \succ \mathcal{G} \rangle$ and $\mathcal{G}$−o$\mathcal{S}$. $\langle \mathcal{G} \succ \mathcal{S} \rangle$ is an alternative for English (albeit resulting in Duke of York derivations), but not for Diola Fogny; this case requires otherwise restricting $\mathcal{G}$ to the complement of $\mathcal{S}$, for example Ito's (1988) prosodic licensing alternative.

REFERENCES

Anderson, S. R. 1974. *The Organization of Phonology*. Academic Press. • Baković, E. 2009. Local blocking and minimal violation. *CLS* 45. • Baković, E. 2013. *Blocking and Complementarity in Phonological Theory*. Equinox. • Baković, E. & L. Blumenfeld. to appear. A formal typology of process interactions. *Phonological Data & Analysis*. • Chomsky, N. & M. Halle. 1968. *The Sound Pattern of English*. Harper & Row. • Halle, M. 1995. Comments on Burzio (1995). *GLOT International* 1. • Ito, J. 1988. *Syllable Theory in Prosodic Phonology*. Garland. • Kenstowicz, M. 1994. *Phonology in Generative Grammar*. Blackwell. • Kiparsky, P. 1973. "Elsewhere" in phonology. In S. R. Anderson & P. Kiparsky (eds.), *A Festschrift for Morris Halle*, Holt, Reinhart, and Winston. • Kiparsky, P. 1982. From cyclic phonology to lexical phonology. In H. van der Hulst & N. Smith (eds.), *The Structure of Phonological Representations*, Foris. • Sapir, D. 1965. *A Grammar of Diola-Fogny*. Cambridge.

Eric Baković, UC San Diego | ebakovic@ucsd.edu • Lev Blumenfeld, Carleton University | lev.blumenfeld@carleton.ca • MorrisHalle@100, MIT | September 9, 2023