The phonology of reduplication

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Motivating a new approach to reduplication

- No previous model of reduplication has been able to account for the phonological behavior of reduplication without resorting to reduplication-specific mechanisms

- Even with Correspondence Theory (McCarthy and Prince, 1995), reduplication must be handled with process-specific mechanisms, and struggles to account for reduplication's "exceptional" behavior, such as with anomalous application of phonological processes (opacity)
    - Reduplication is so special that it requires its own sub-grammar and ranking of constraints!

Motivating a new approach to reduplication

- Raimy will argue for the explicit representation of precedence in phonological representations

- No new reduplication-specific mechanisms to generative phonology: only clarifying how precedence is represented in phonology, and how this representation changes via a linearization process
  - Phonological identity must be minimal: only self-identity, no correspondence to instantiate identity relationship between two phonologically distinct entities
  - Strong morphology-phonology relationship: phonology will receive an impoverished representation to operate on from a separate morphology component

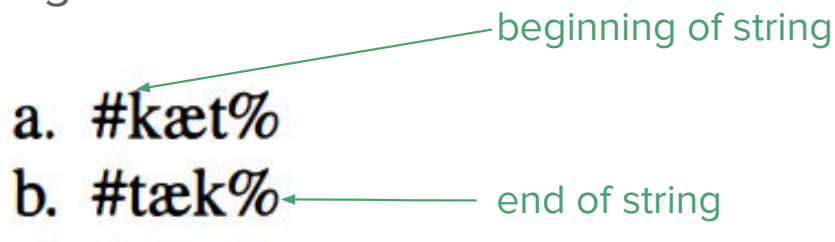
Motivating a new approach to reduplication

- All reduplication can be accounted for entirely by serial process ordering
- Instances of “anomalous application” will now be dealt with within the phonology as normal rule application or non-application
  - Overapplication and underapplication are now explainable as instances of opacity where a phonological environment has either been created or destroyed after a process has had the opportunity to apply
- Places reduplication within classical generative phonology’s explanatory capacity

Roadmap

1. Precedence-based phonology
2. Applications of precedence-based phonology
    a. Backcopying in Malay and Akan
    b. Chumash case study
3. The role of the derivation in precedence-based phonology
4. Conclusion

Precedence-based phonology

- Phonological representations can be considered as strings of segments: linear precedence is implicitly represented by left-to-right spatial orientation in visual diagrams
- 

- (a) and (b) have opposite precedence relations:
  - (a): # (nothing) precedes k, k precedes æ, æ precedes t, t precedes % (nothing)
  - (b): # precedes t, t precedes æ, æ precedes k, k precedes %
  - Difference here is based solely on segment ordering

Precedence-based phonology

- Precedence relation in such representations is **asymmetrical**, **transitive**, and **irreflexive**

a. #kæt%

- **Asymmetrical**: if “k precedes æ” in a form, then “æ precedes k” must be false if there are only unique instances of these segments
- **Transitive**: “k precedes t” is true, because “k precedes æ” and “æ precedes t” are also true
- **Irreflexive**: no way to encode that a segment precedes itself in this representation

Precedence-based phonology

- If phonological representations must be asymmetrical, transitive, and irreflexive in the phonetics component, then precedence must be explicitly represented in phonological representations
  - Otherwise wellformedness cannot be determined

- Precedence will be explicitly represented with →

  a. # → k → æ → t → %
  b. % ← t ← æ ← k ← #
  c. % ← k ← æ ← t ← #

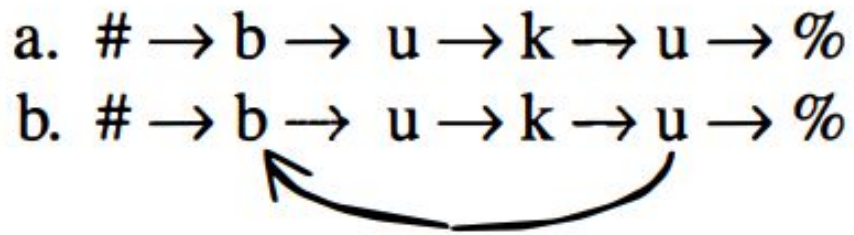
  - (a) and (b) are equivalent, with same precedence relationship
  - (c) is different from (a) and (b)

Precedence-based phonology

- What about phonological representations that have non-asymmetrical and non-irreflexive characteristics?

recall: precedence is asymmetrical, irreflexive, and transitive

- Indonesian:



[buku]

[buku-buku]

unreduplicated: asymmetrical, irreflexive, and transitive

reduplicated: non-asymmetrical, non-irreflexive, transitive

because no longer have unique instances of segments!

- Loop present in (b) causes non-asymmetry and non-irreflexivity
  - This non-asymmetry **is the cause of** the repetition of material in the phonetic form that we hear as reduplication
  - Repetition is caused by loops in phonological representations because of a **linearization process** within the phonology

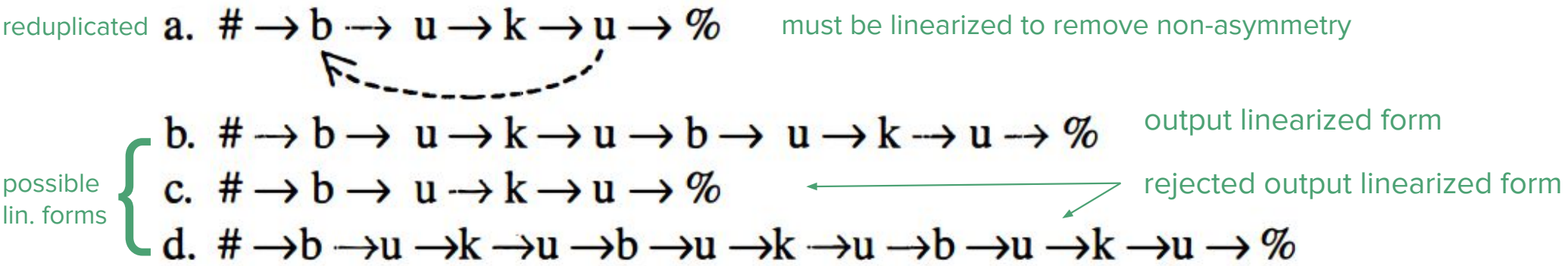
Precedence-based phonology

- Assuming phonetics imposes bare output conditions of transitivity, asymmetricality, and irreflexivity on phonology, a phonological representation must meet these requirements at the phonetics-phonology interface
  - Otherwise the phonological representation would be phonetically uninterpretable

- **Linearization** process therefore ensures output representations are **asymmetric and irreflexive**, whilst preserving precedence information
  - Precedence information in a looping structure preserved by repetition of segments in the loop

Precedence-based phonology

- Linearization is an optimization process with two inviolable characteristics:
  - Output representation must be asymmetrical
  - No new precedence relationships can be added during linearization
- Linearization repeats segments in a loop in order to make a non-asymmetrical precedence structure asymmetrical



But how can we constrain the number of times repetition occurs? Is it arbitrary?

Precedence-based phonology

- Empirical support from Moravcsik (1978) for linearization's economization aspect, where a single loop can only produce one repetition:
  - Typological survey of reduplication patterns across languages found that every pattern has a specific number of repetitions of segmental material
  - Most patterns only repeat once, but of those that repeat twice, more than one reduplicative morpheme is present

- Number of repetitions is not random or arbitrary

Precedence-based phonology

- Solutions provided to previous models of reduplication:
- Since reduplication is a loop, reduplicative morphemes are now just a phonological representation, with no copying or correspondence mechanisms
- Reduplication is merely affixation
  - Reduplicative morphemes consist of a precedence relationship that creates a loop in the temporal structure of the base
  - Only the specification of precedence relationships cause a morpheme to be reduplicative
- Provides a simpler phonological analysis of backcopying effects

Applications of precedence-based phonology

Reduplication and phonological rules

- This section
  - is about insight the precedence-based phonology provides into the interaction between reduplication and phonological rules
  - presents adequate derivational models of reduplication for various language data previously claimed to be unanalyzable for derivational models

- To discuss:
  - Backcopying in Malay and Akan
  - Chumash /l/ deletion

Malay: Backcopying of nasality

- **Backcopying**: Base "copies" reduplicant (McCarthy & Prince, 1995; Raimy, 2000)

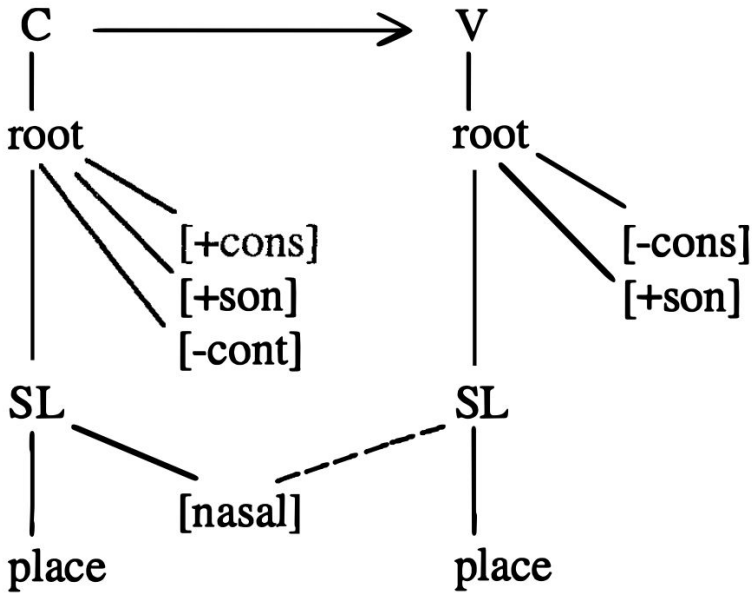
> . . . [c]orrespondence [t]heory is superior, empirically and conceptually, to serial derivational approaches [to reduplication]. All such theories are incapable of dealing with cases in which B[ase] copies (or, more neutrally, *reflects*) R[eduplicant]. (p. 366)

- **Nasality spreading in Malay**: Vowels are nasalized following nasals and non-obstruents

a.	hamə̃	'germ'	hãmə̃-hãmə̃	'germs'
b.	waɲi	'fragrant'	wãɲ̃i-wãɲ̃i	'fragrant (intens.)'
c.	aŋãn	'reverie'	ãŋãn-ãŋãn	'ambition'
d.	aŋẽn	'wind'	ãŋẽn-ãŋẽn	'unconfirmed news'

Malay: Nasality spreading rule

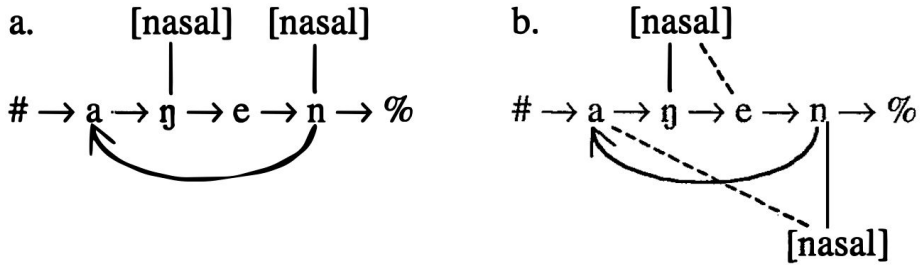
- Seong (1994)



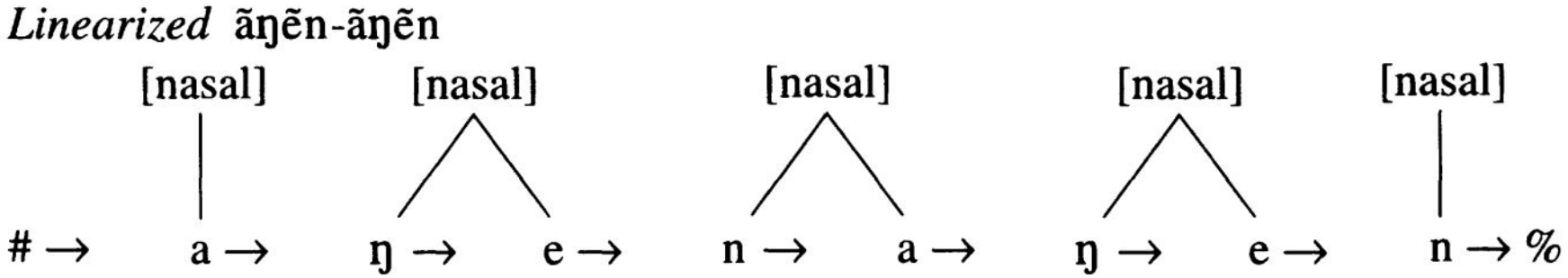
The arrow between C and V denotes precedence

Malay: precedence-based view for aŋẽn

- **Formative representation & nasality spreading**: as long as having a nasal before a vowel is sufficient to trigger nasalization

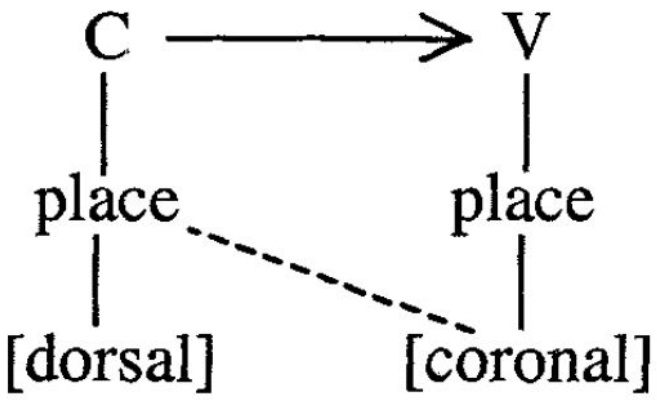


- **Linearization** (Raimy, 2000)



Akan: palatalization rule

- **Palatalization**: dorsal segments (/k, g, w, ŋ^{w}/) and /h/ change into palatodorsal segments when preceding non-low front vowels, which is a result of spreading [coronal] from the non-low front vowels onto the [dorsal] segments



ʧɛ	*kɛ	‘divide’
ʤe	*ge	‘receive’
ɥi	*wi	‘nibble’
çɪ	*hɪ	‘border’
ɲɥɪn	*ŋwɪn	‘weave’

Palatalization in Akan. Left: rule. Right: examples.

Akan: palatalization underapplies

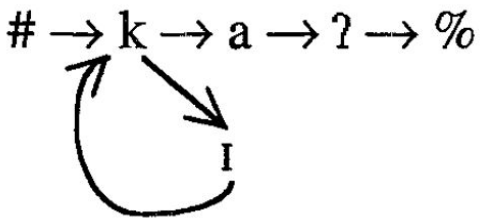
- **Problem**: In some reduplicated forms, dorsal segments and /h/ can appear before non-low front vowels

kɪ-kaʔ	*tɕɪ-kaʔ	*tɕɪ-tɕaʔ	‘bite’
hɪ-hawʔ	*çɪ-hawʔ	*çɪ-çawʔ	‘trouble’

- **Note**: This particular pattern of reduplication in Akan is CV with the V being **prespecified for the feature [high]** and it receives its value for [back] from the following vowel (backcopying the [back] feature). Here, only reduplicated forms with non-back vowels are looked at, with notated as /ɪ/ to facilitate discussion.

Akan: precedence-based view for kɪ-kaʔ

- **Formative representation**:



- **Multiple environments for /k/**: followed by both non-low front vowel /ɪ/ and low front /a/, instead of just non-low front vowels

- **Cause of underapplication**: palatalization only occurs (triggers) when dorsal segments (/k, g, w, ŋ^{w}/) and /h/ <u>precedes nothing but non-low front vowels</u>

Akan: additional evidence

- **More examples**: accidentally uniform environments

a.	dʑɪ-dʑe	*gɪ-ge	‘receive’
b.	tɕɥi-tɕɥeʔ	*kwi-kwe	‘cut’

- **Formative representations**:

a. # → g → e → %
   ↑ ↓
   ɪ

b. # → k → w → e → ʔ → %
   ↑ ↙
   i

Uniformity Parameter

- **What**: The Uniformity Parameter determines whether a rule requires all environments that a segment appears in to satisfy the structural description of the rule or if only a single environment is sufficient to trigger the rule.

- **How**: the parameter is *on* if the uniformity of environments is required for a rule to apply (conjunction); otherwise, it is said to be *off* (disjunction).
  - For the Malay case, the nasality spreading rule applies as long as a nasal precedes a vowel, so the Uniformity Parameter is off for this rule
  - For the Akan case, the palatalization only applies when dorsal segments and /h/ precedes nothing but non-low front vowels, so the Uniformity Parameter is on for this rule

Chumash /l/ deletion

- **Chumash** (Ineseño) also has a phonological process that has environment-dependent behavior (Applegate, 1976)
- /l/ deletes before dentals {t, c, s, n, l}, but underapplies in some reduplicated contexts and overapplies in others

(18)

s-talik + R	>	s-tal-talik	'his wives...'
c'aluqay + R	>	c'al-c'aluqay	'cradles'
s-pil-kowon + R	>	s-pil-pilkowon	'it is spilling'

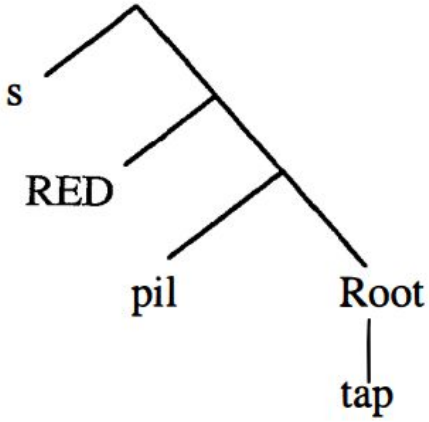
underapplication: /l/ doesn't delete when it "should"

(19) s-pil-tap > spitap +R > s-pit-pitap 'it is falling in'

overapplication: /l/ deletes, but "shouldn't"

- (19) is overapplication according to McCarthy and Prince (1995), because a potential surface form is *s-pil-pitap*, which demonstrates a normal application for the morphological structure they assume:

Chumash /l/ deletion

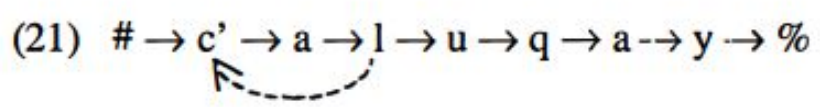


Structure for *s-pit-pitap* as per McCarthy and Prince (1995)

- Raimy's analysis claims the behavior of /l/-deletion in Chumash is dependent on the **Derived Environment Condition** (Kiparsky 1982)

does anyone know the original definition of the Derived Environment Condition?

Chumash /l/ deletion

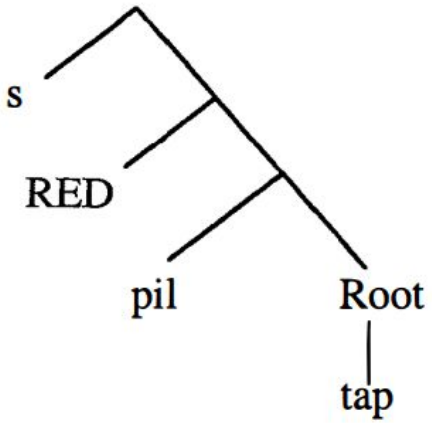
- Here, Derived Environment Condition will only consider segmental material and will ignore precedence information in determining whether a derived environment has been created
  - i.e., there must be a precedence relation between segments belonging to two distinct morphemes
  - not met when precedence relation is between two segments belonging to the same morpheme
- 

  recall: monomorphemic form where underapplication occurs
- In (21), even though the dotted link is the result of a different morpheme from the base, **DEC is not satisfied**: although dotted back link was added to the base, the precedence link connects segments from a **single morpheme**
  - not a derived environment

Chumash /l/ deletion

(19) s-pil-tap > spitap +R > s-pit-pitap 'it is falling in'

- DEC is met in (19) because the /l/ that eventually deletes is from a different morpheme than the coronal that follows it
- How is the DEC met?



(22) a. # → t → a → p → %

root before affixation

b. # → t → a → p → %

p → i → l

concat. of prefix /pil/

c. # → t → a → p → %

p → i → l

concat. of the loop, triggered by reduplicative morpheme

d. # → t → a → p → %

p → i → l

s

final affixation of prefix /s/

Chumash /l/ deletion

(22) a. # → t → a → p → %

root before affixation

b. # → t → a → p → %
p → i → l

concat. of prefix /pil/

c. # → t → a → p → %
p → i → l

concat. of the loop, triggered by reduplicative morpheme

d. # → t → a → p → %
p → i → l
s

final affixation of prefix /s/

- The graph of segmental material built by the morphology contains all of the information needed for /l/ deletion rule to apply in (21) *c'aluqay* but not in (22d)

Chumash /l/ deletion

(22) a. # → t → a → p → %

root before affixation

b. # → t → a → p → %
p → i → l

concat. of prefix /pil/

c. # → t → a → p → %
p → i → l

concat. of the loop, triggered by reduplicative morpheme

d. # → t → a → p → %
p → i → l
s

final affixation of prefix /s/

- Crucially, in (22d), /l/ deletion is not triggered by the phonological material added as the spell out of the reduplicated morpheme (dashed link from /l/ to /p/), since as in (21), this connection is within a single morpheme
  - DEC not satisfied!

Chumash /l/ deletion

(22) a. # → t → a → p → %

root before affixation

b. # → t → a → p → %
p → i → l

concat. of prefix /pil/

c. # → t → a → p → %
p → i → l

concat. of the loop, triggered by reduplicative morpheme

d. # → t → a → p → %
p → i → l
s

final affixation of prefix /s/

- DEC is instead satisfied by precedence link from /l/ to /t/, which does link material from **distinct morphemes**
- Difference in morphological composition between the forms in (21) and (22d) allows the behavior of the /l/ deletion rule to be predicted

Chumash /l/ deletion

- How do deletion processes affect a precedence structure?
- Remove the deleted segment?
  - Problem: removing a segment creates a break in the precedence structure which then has to be repaired
- Combine the “deleted” segment with another one?
  - Coalesce two segments and their precedence information into a single segment
  - Symbolized with a dashed circle around description of affected segments: (23) $\overset{\text{l} \rightarrow \text{[coronal]}}{\text{(dashed circle)}}$
  - Precedence structure that occurs between the combined segments is removed
- Result of (23) and (22d):

“/l/ followed by a coronal should be combined into a single segment”

(24) a. # → t → a → p → % ; p → i → l ; s

b. # → t → a → p → % ; p → i ; s

Linearizing (24b) produces the correct output form

Chumash /l/ deletion

- The surface appearance of over- or underapplication is opacity that results from the linearization process eliminating parts of the whole precedence graph

The role of the derivation

Typology of rule application (Wilbur 1973)

- **Overapplication**: a given rule applies in an environment where it seems it should not be applied (e.g., the Malay nasality spreading case)

- **Underapplication**: a given rule does not apply in an environment where it should be applied (e.g., the Akan palatalization case)

- **Normal application**: “a given rule only applies when the environment for the rule is surface true”, or after linearization (*from the precedence-based view*)

Normal application: Korean example (Martin, 1992)

a. moks-moks-i [moŋmokʃ'i] 'in portions, in shares'

b. # → m → o → k → s → %

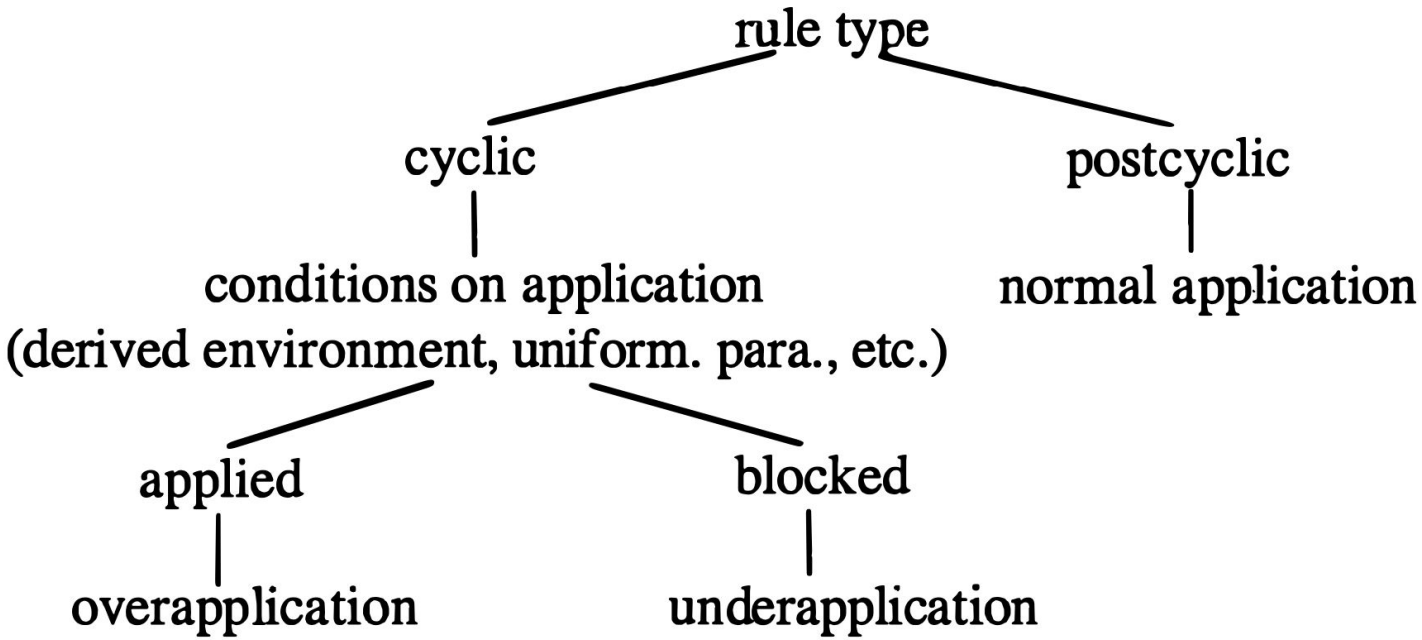
c. # → m → o → k → s → m → o → k → s → i → %

d.

	moksmoksi
syllabification	(mok)s(mok)(si)
tensification	(mok)s(mok)(s'i)
cluster simplification	(mok)(mok)(s'i)
nasal assimilation	(moŋ)(mok)(s'i)
palatalization	(moŋ)(mok)(ʃ'i)
etc.	[moŋmokʃ'i]

Typology of rule reduplication interaction (Mester 1988)

- **cyclic rules > linearization > postcyclic rules**



Precedence-based view: Wilbur's (1973) typology

- **Wilbur's (1973) typology is refuted** because the rules always apply (or fail to apply) in a normal fashion within the context of a derivation.

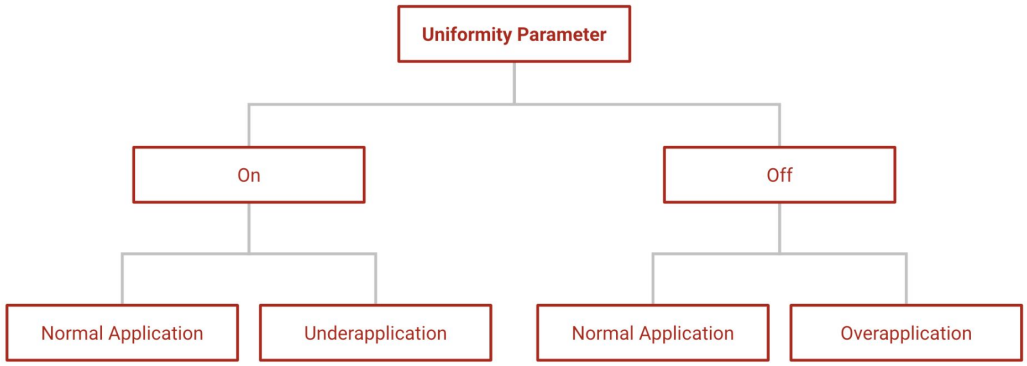
- The phenomena of overapplication and underapplication are simple opacity effects resulting from the linearization process affecting phonological repre sentations that are non-asymmetrical in nature.

- The interaction of phonological rules and reduplication is just a quirk of the complex phonological structures built by reduplicative morphology.

Precedence-based view: Mester's (1988) typology

- **Mester's (1988) typology is "simple"** for the lack of considerations of (1) Uniformity Parameter; (2) Derived Environment Condition; and (3) possibility of multiple applications of linearization (see Page 52-53, left out here).

- **(1) Uniformity Parameter**: causes the appearance of an alternation between normal application and opaque application.



- Akan (Uniformity Parameter on)
  - Normal application:
    - dʑɪ-dʑe v.s. *gɪ-ge
  - Underapplication:
    - kɪ-kaʔ v.s. *tɕɪ-ka * tɕɪ-tɕa
- Malay (Uniformity Parameter off):
  - Normal application:
    - buku ➔ buku-buku
  - Overapplication:
    - aŋẽn ➔ ãŋẽn-ãŋẽn v.s. *aŋẽn-ãŋẽn

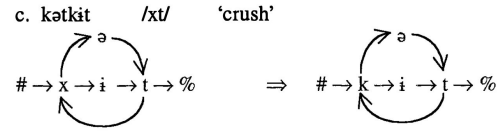
Precedence-based view: Mester's (1988) typology

- **Mester's (1988) typology is "simple"** for the lack of considerations of (1) Uniformity Parameter; (2) Derived Environment Condition; (3) possibility of multiple applications of linearization (see Page 52-53, left out here).

- **(2) Derived Environment Condition**: may require rules to apply either in derived or non-derived environments
  - Chumash /l/ deletion:
    - applies in derived environments
    - normal application in morphologically complex forms
  - Chacha /x/ dissimilation:
    - applies in non-derived environments
    - opacity in morphologically simplex forms

Rule: /x/ → [-cont] / _…[+cont, -son]

Ex:



Conclusion

Conclusion: precedence-based approach

- This presentation motivates a precedence-based approach that is capable of accounting for the phonological behavior of reduplication without resorting to reduplication-specific mechanisms. Refutes previous claim

- This approach only introduces possible a looping link into the underlying representation on the top of established principles of generative phonology

- The only novel claim that is required is the addition of a universal Uniformity Parameter on rules that indicates a rule's sensitivity to multiple environments.

Conclusion: new insights

- Reduplication is the result of a loop in a phonological representation

- Overapplication and underapplicatoin effects are reduced to instances of opacity effects

- A new and deeper understanding of rule application and interaction between phonological rules and reduplication: Uniformity Parameter & Derived Environment Condition