Harmonic Phonology

Levels and Harmonic Phonology

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To recapitulate¹:

A highly stratified², autosegmentalized model with two types of rules:
Inter-level rules (M,W), (W,P)
Intra-level rules (M,M), (W,W), (P,P)

Rules which apply if and only if their output satisfies the tactics of
the level better than their input. (Otherwise, no intermediate
stages.) We call such a mode of application "harmonic application".

Harmonic application: within a level (W-level, here). Rules
apply if and only if they increase the fit between the
representation and the tactics of the level.

Inter-level rules may or may not be limited to harmonic
application; intralevel rules are limited to harmonic
application.

Historical Overview of the problem

(1) Classical SPE view of rule application, with extrinsic ordering; rules triggered by
structural description being met. Two sources of the metaphor: Post production
systems, and regular historical sound change.

(2) Long-time recognition of difference between types of ordering
(Chafe³) -- bleeding relations of priority different from feeding orders, e.g.; each in
turn different from priorities which are neither feeding nor bleeding, i.e., relation of
stress and epenthesis in many languages.
(3) Arguments requiring simultaneous application of two rules, \( R_1 \) and \( R_2 \): Haya stem softening.

In essence: coronal continuants + y are "soft" Cs.
Past tense suffix is -ile

\[
\begin{align*}
\text{soft} & \quad \text{C - i l e} \\
\downarrow & \quad \downarrow \\
\text{hard} & \quad \text{z} \\
\text{baz - ile} & \Rightarrow \text{bal - ize}
\end{align*}
\]

\[
\begin{align*}
\text{hard} & \quad \text{C - i l e} \\
\downarrow & \quad \downarrow \\
\text{soft} & \quad \text{bal - ile} \Rightarrow \text{baz - ile}
\end{align*}
\]

(4) Early work pointing out problems of this notion: "conspiracies" (Kisseberth (1970)\textsuperscript{4}, and many papers since, through to Ito 1989).

Two examples:
A) epenthesis, in order to achieve proper syllabification.

Yokuts: CVX syllables

<table>
<thead>
<tr>
<th>Nonfuture</th>
<th>Dubitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. xat-hin</td>
<td>/xat-hin/</td>
</tr>
<tr>
<td>b. bok'-hin</td>
<td>/bok'-hin/</td>
</tr>
<tr>
<td>c. dos-hin</td>
<td>/do:s-hin/</td>
</tr>
<tr>
<td>d. logw-hin</td>
<td>/logw-hin/</td>
</tr>
</tbody>
</table>

B) Vowel deletion, in order to achieve heavy syllables (in some cases, to match syllable weight with rhythmic prosody) (Tonkawa)

"he Xx it" progressive "he Xs them" progressive
cut picno? picnano? wepceno? wepcenano?

\[
\begin{array}{c}
\text{picena} \\
\hline
\text{hoe}
\end{array}
\]

notxo? notxono? wentoxo? wentoxono?
kentxo? kentxono?

\[
\begin{array}{c}
\text{lick}
\end{array}
\]

netlo? netleno? wentalo? wentaleno?
kentalo? kentaleno?

\[
\begin{array}{c}
\text{make it a fire}
\end{array}
\]

naxco? naxceno? wenxaco? wenxaceno?
kexaco? kexaceno?
In short:
  o delete the second vowel of the word;

in addition:
  o The rule 'delete the second vowel' will not apply if that would
create an illegal syllable:

pull sinew from meat /salke/
salko? salkeno? wesalko?

smoke (tr) /nepaxke/
nepaxko? nepaxkeno? wenpaxko?

rub /xeyce/
xeco? weiceno? kexeico?

C Consonant deletion in Lardil: to achieve well-formed word-final
syllables (looking ahead, licensing units):

Consonants

<table>
<thead>
<tr>
<th>Labial</th>
<th>Dental</th>
<th>Apico-alveolar</th>
<th>Lamino-alveolar</th>
<th>Domal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t*</td>
<td>t</td>
<td>t'</td>
<td>t.</td>
<td>k</td>
</tr>
<tr>
<td>m</td>
<td>n*</td>
<td>n</td>
<td>n'</td>
<td>n.</td>
<td>N</td>
</tr>
<tr>
<td>l</td>
<td>l'</td>
<td>l</td>
<td></td>
<td></td>
<td>r</td>
</tr>
<tr>
<td>r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>r</td>
</tr>
<tr>
<td>w</td>
<td></td>
<td></td>
<td>y</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Uninflected | Nonfuture | Future | Gloss
---|------------|-------|---
*a* | 
ketapal | ketapal-in | ketapal-ur. | dugong |
k*ar | k*ar-in | k*ar-ur. | river |
miyar. | miyar.-in | miyar.-ur. | spear |
yar.put | yar.put'-in | yar.put*-ur. | snake,bird |
yaraman | yaraman-in | yaraman-kur. | horse |
pirNen | pirNen-in | pirNen-kur. | woman |
*b* | 
yalul | yalulu-n | yalulu-r. | flame |
mayar | mayara-n | mayara-r. | rainbow |
wiwala-n | wiwala-r. | bush mango |
karikari-n | karikari-wur. | butter-fish |
yiliyili-n | yiliyili-wur. | oyster (sp.) |
yukarpa-n | yukarpa-r. | husband |
wulunka-n | wulunka-r. | fruit (sp.) |
wut.al | wut.alt'i-n | wult.alt'i-wur. | meat |
kantukan | kantukantu-n | kantukantu-r. | red |
karwakarwa-n | karwakarwa-r. | wattle (sp.) |
t*urara | t*uraraN-in | t*urarN-kur. | shark |
Nalu | Naluk-in | Naluk-ur. | story |
putu | putuka-n | putuka-r. | short |
murkuni | murkunima-n | murkunima-r. | nullah |
NawuNa  NawuNawu-n  NawuNawu-r.  termite
tipiti  tipitipi-n  tipitipi-wur.  rock-cod (sp.)
t*apu  t*aput'i-n  t*aput'i-wur.  older brother
muNkumu  muNkumuNku-n  muNkumuNku-r.  wooden axe
t'umput'u  t'umput'umpu-n  t'umput'umpu-r.  dragon fly

Derivalional approach:
Bleeding/C-Bleeding
('elsewhere'/competitive
strategy relation)

Feeding/C-feeding:
distinct levels
relation

Or: for rules C, D, E:

\[
\begin{align*}
(A) \ & \emptyset \rightarrow W / \ i- \ u \\
(B) \ & V \rightarrow \emptyset / \ i- V \\
(C) \ & V \rightarrow \emptyset / \ i- V \\
(D) \ & C \rightarrow \emptyset / \ i- V \\
(E) \ & [C \ \text{-apical}] \rightarrow \emptyset / \ i- V \\
\end{align*}
\]
along with licensing
condition:
word-final coda \( \emptyset \) licenses only
apical point of articulation.

Similarly, rules A, B above are both
\((M,W)\) rules.

(5) Continuing modifications of "structural description" paradigm:
- Well-formedness Condition in early autosegmental phonology
- Somerstein (1975)' on phonotactically motivated rules — development of Lamb
(1966, etc.) [fn 2]. Recent followup by R. Singh, and to his work by C. Paradis.
Also recent work by K.P. Mohanan*.

Lexical Phonology (Kiparsky 1982') adopts two stratificational perspectives:
(i) 'structure preservation' within a level, linking inventories of segments and
structures to rule application (though the interpretation remains to be worked
out; cf. controversy on application-blockage interpretation of Kiparsky (1985))
(ii) principle that lexical rules and redundancy rules are the same thing: a
principle not always honored, but which suggests that output of each stratum
has a set of tactics, and lexical rules of that stratum all push in precisely that
direction.

- Syllabification (noted above in Yokuts examples; and cf. Ito 1989) work on
syllabification consistently requires application "when necessary"; e.g., Lapointe and
Feinstein. Same point often made in work on metrical grid ('move x, motivated by stress clash')

More recently: OCP effects (McCarthy, Yip)

Inalterability and integrity effects (Schein, Steriade, Hayes)

(6) Work on predicting rule ordering (Koutoudas et al., etc.)

Proposal
1) Cross-level rules (interface rules): (M, W) rules, (W, P) rules
2) Interlevel rules: (W, W), (M, M), (P, P) rules, with free reapplication.
   All ordering within levels predictable,
   by principles, such as "elsewhere" condition.
3) Divide modifications into well-formedness conditions on levels, plus rules which apply
   minimally to maximize well-formedness.

Type of Arguments

(1) Allows for simpler formulation of individual rules: cases where the statement of an
   environment where a change should occur is harder to specify than what should be
   allowed. (Allied learning problem: the difficulty of establishing (especially in counter-
   feeding situations) how the learner determines what the structural description for a
   rule should be.) In some cases, predicts non-canonical (e.g., counterfeeding)
   orders. Cf. Lardil discussion above.

(2) Allows for capturing generalization across several environments in which the same change
   occurs. >Sommerstein’s argument for Latin.

(3) Allows for generalization across several different rule-changes: the 'conspiracy' case,
   where several 'repair strategies' all aim at a single target structure or template.

(4) Missing generalizations across languages, where 'soft constraints' kick in where they
   can, i.e., where the language provides opportunities to meet them.

Accent-Weight Harmony Principle (universal)
In prose:
a. a stressed heavy syllable is better than an unstressed heavy syllable.
b. a stressed heavy syllable is better than a stressed light syllable.
c. an unstressed light syllable is better than a stressed light syllable.
d. an unstressed light syllable is better than an unstressed heavy syllable.

More formally, on a metrical grid:
wellformed: x  o   foot
         xx  x   mora

illformed: x  o   foot
         x   xx  mora
This accounts for why stressed closed syllables don't have their vowel lengthened (Zoque, Selayarese, Scandinavian, etc.). There's nothing about the input that makes stressed closed syllables unfit for lengthening; it's rather that there is no need to lengthen such syllables.

The Accent-Weight Harmony Principle, predicts that there are four kinds of accent/weight rule interactions, as countenanced by harmony theory:

i. by a: stress a heavy syllable.
ii. by b: make heavy a stressed syllable.
iii. by c: unstress a light syllable.
iv. by d: make light an unstressed syllable.

(i) is our familiar rule of "Quantity-Sensitivity".
(ii) is widespread, and is our rule here in Selayarese; see also Scandinavian.
(iii) is formalized in systems variously as Obligatory Branching and as certain stress shift rules.
(iv) is also fairly widespread, and found in languages such as Chimwiini (see Goodman 1969), Kisséberth and Abasheikh (1974), Goldsmith (1988) and KiHunde (Goldsmith 1986), in which only syllables in prosodically prominent positions can be long.¹⁶

o Second examples: Tone-Accent Association Condition¹⁷

(5) Inalterability effects (linking harmonic application with licensing)¹⁶

Hausa (Afroasian; Nigeria, Niger)
(capital letter marks ingressive)

continuant sonorant
[kont] kaskoo 'bowl' kasàakee 'bowls'
[rhotic] turmii 'mortar' turàamee 'pl.'
[lateral] gulfii 'stream' gulàabe 'pl.'
[trill] kuRfoo 'whip' kuRàafee 'pl.'

glides
Kaimii 'spur' Kayàamee 'pl.'
Kyauree 'door' Kyawàaree 'pl.'

nasal
[homorganic]
dumBuu 'whip' dumBàaye 'pl.'
kundii 'wad of paper' kundàaye
zankoo 'crest' zankàaye

(in generalizations concerning plural formation class, codas with s,l,r,R act differently from all others)

Klingenheben's Law effects¹⁹: *Κ,*P > w/ -- $
Inalterability effects (reprise from "Licensing" talk):
Geminates give rise to labials and velars in codas:
garukkāa 'pens'  kakkaraṉṭa 'reread'
babhobbaku 'be well roasted' etc.

References


(2) In the sense of stratificational phonology ("Linguistic Elements and Their Relations", Charles Hockett, Language 37:29-53 (1961); "Prolegomena to a Theory of Phonology" Sydney M. Lamb. Language 42:536-73 (1966)) and elsewhere; we return to the relation of lexical phonology to stratificational views below. Cf. also recent autolexical work of Jerrold Sadock (e.g., in NLLT 1985, and in Autolexical Syntax, University of Chicago Press, 1990), and the development of stratificational models from a connectionist perspective (e.g., Lakoff 1988 LSA paper, and Goldsmith 1990 LSA paper, as well as work in progress by Gary Larson, University of Chicago). The emphasis on interlevel rules is classical stratificationalism; intralevel rules are not.

(3) E.g., The ordering of phonological rules, by Wallace Chafe, IJAL 34:115-36.


Lapointe, Steven G. and Mark H. Feinstein. The Role of Vowel Deletion and Epenthesis in the Assignment of Syllable Structure. 1982. In van der Hulst and Smith, Part II.

See Liberman and Prince 1977, and much work since. McCarthy's lectures at the 1987 LSA Institute at Stanford also developed this point.


See also Sampson, G. 1970. "On the Need for a Phonological Base". Language 46.

See also Abu-Salim on Palestinian Arabic, where unstressed long vowels shorten; discussed in "Vowel Harmony in Palestinian Arabic", J of L 23/1 1987, 1-24; See Abu-Salim (1986) Vowel shorteningin Palestinian Arabic: a metrical perspective Lingua 68:339-56.


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To recapitulate:
A highly stratified, autosegmentalized model with two types of rules:
Inter-level rules (M,W), (W,P)
Intra-level rules (W,W), (P,P)
Rules which apply if and only if their output satisfies the tactics of the level better than their input. (Otherwise, no intermediate stages.) We call such a mode of application "harmonic application".

M-level
|--- (M,W) rules (apply simultaneously, with no intermediate representations)
W-level
|------------------- (W,W) rules (free reapplication, with harmonic function)
P-level
|<-- (W,P) rules (apply simultaneously, with no intermediate representations)

Harmonic application: within a level (W-level, here). Rules apply if and only if they increase the fit between the representation and the tactics of the level. Inter-level rules may or may not be limited to harmonic application; intralevel rules are limited to harmonic application.

Historical Overview of the problem
(1) Classical SPE view of rule application, with extrinsic ordering; rules triggered by structural description being met, i.e., a Post production system.
(2) Long-time recognition of difference between types of ordering (Chafe'-) -- bleeding relations of priority different from feeding orders, e.g.; each in turn different from priorities which are neither feeding nor bleeding, i.e., relation of stress and epenthesis in many languages.
(3) Arguments requiring simultaneous application of two rules, \( R_1 \) and \( R_2 \): Haya stem softening.

In essence: coronal continuants + y are "soft" Cs.
Past tense suffix is -ile

\[
\begin{align*}
C  & \quad - \quad i \quad l \quad e \\
\downarrow \quad \downarrow \\
\text{hard} \quad z \\
\text{soft} \quad \text{bal} - \text{ile} \Rightarrow \text{bazi} - \text{ile}
\end{align*}
\]

(4) Early and more recent modifications of "structural description" paradigm:
- Well-formedness Condition in early autosegmental phonology
- Sommerstein (1975)\(^1\) on phonotactically motivated rules (also, perhaps, Kisseberth 1970\(^1\)) -- development of Lamb (1966, etc.) [fn 2]. Recent followup by R. Singh, and to his work by C. Paradis.

Lexical Phonology (Kiparsky 1982\(^2\)) adopts two stratificational perspectives:

(i) 'structure preservation' within a level, linking inventories of segments and structures to rule application (though the interpretation remains to be worked out; cf. controversy on application-blockage interpretation of Kiparsky (1985))

(ii) principle that lexical rules and redundancy rules are the same thing: a principle not always honored, but which suggests that output of each stratum has a set of tactics, and lexical rules of that stratum all push in precisely that direction.

- other scattered examples: e.g., work on syllabification often seemed to require application "when necessary"; e.g., Lapointe and Feinstein\(^7\). Same point often made in work on metrical grid ('move x, motivated by stress clash')
- More recently: OCP effects (McCarthy, Yip\(^3\))
- Inalterability and integrity effects (Schein, Steriade, Hayes\(^10\))

(5) Work on predicting rule ordering (Koutoudas et al.\(^11\), etc.)

Proposal
1) \((M,W)\) rules\(^12\)
2) \((W,W)\) rules, with free reapplication.
   All ordering within \((W,W)\) predictable,
   by principles:
   - "elsewhere" condition
   - structure-building before structure-changing (i.e., non-destructive before destructive): predicts no stressing of epenthetic vowels, if both in \((W,W)\) component

3) Divide modifications into well-formedness conditions on levels, plus rules which apply minimally to maximize well-formedness.
Type of Arguments

(1) Allows for simpler formulation of individual rules: cases where the statement of an environment where a change should occur is harder to specify than what should be allowed. (Allied learning problem: the difficulty of establishing (especially in counterfeeding situations) how the learner determines what the structural description for a rule should be.)

Cf. Lardil:

Consonants

<table>
<thead>
<tr>
<th>Labial</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Apico-</th>
<th>Lamino-</th>
<th>Domal</th>
<th>Velar</th>
</tr>
</thead>
<tbody>
<tr>
<td>p</td>
<td>t*</td>
<td>t</td>
<td>t'</td>
<td>t</td>
<td>k</td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>n*</td>
<td>n</td>
<td>n'</td>
<td>n</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>l</td>
<td>l'</td>
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<td>y</td>
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</table>

Uninflected

<table>
<thead>
<tr>
<th>Nonfuture</th>
<th>Future</th>
<th>Gloss</th>
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</thead>
<tbody>
<tr>
<td>kentapal</td>
<td>ketapal-in</td>
<td>dugong</td>
</tr>
<tr>
<td>ket*ar</td>
<td>ket*ar-in</td>
<td>river</td>
</tr>
<tr>
<td>miyar.</td>
<td>miyar.-in</td>
<td>spear</td>
</tr>
<tr>
<td>yar.put</td>
<td>yar.put*-in</td>
<td>snake, bird</td>
</tr>
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<td>yaraman</td>
<td>yaraman-in</td>
<td>horse</td>
</tr>
<tr>
<td>pirNen</td>
<td>pirNen-in</td>
<td>woman</td>
</tr>
<tr>
<td>yalul</td>
<td>yalulu-n</td>
<td>flame</td>
</tr>
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<td>mayar</td>
<td>mayara-n</td>
<td>rainbow</td>
</tr>
<tr>
<td>wiwala</td>
<td>wiwala-n</td>
<td>bush mango</td>
</tr>
<tr>
<td>karikar</td>
<td>karikari-n</td>
<td>butter-fish</td>
</tr>
<tr>
<td>yiliyil</td>
<td>yiliyili-n</td>
<td>oyster (sp.)</td>
</tr>
<tr>
<td>yukar</td>
<td>yukarpa-n</td>
<td>husband</td>
</tr>
<tr>
<td>wulun</td>
<td>wulunka-n</td>
<td>fruit (sp.)</td>
</tr>
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<td>wut.al</td>
<td>wut.alt*-in</td>
<td>meat</td>
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<td>kantukantu-n</td>
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<td>karwakar</td>
<td>karwakarwa-n</td>
<td>wattle (sp.)</td>
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<td>t*urarA-n-in</td>
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<td>Naluk-in</td>
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<td>putuka-n</td>
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<td>murkunima-n</td>
<td>nullah</td>
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<tr>
<td>NawuNa</td>
<td>NawuNawu-n</td>
<td>termite</td>
</tr>
<tr>
<td>tipiti</td>
<td>tipiti-p-n</td>
<td>rock-cod (sp.)</td>
</tr>
<tr>
<td>t*apu</td>
<td>t*aputi'-n</td>
<td>older brother</td>
</tr>
<tr>
<td>muNkumu</td>
<td>muNkumuNku-n</td>
<td>wooden axe</td>
</tr>
<tr>
<td>t'umput'u</td>
<td>t'umput'umpu-n</td>
<td>dragon fly</td>
</tr>
</tbody>
</table>
Derivational approach:
Bleeding/C-Bleeding
('elsewhere'/competitive strategy relation)

Feeding/C-feeding:
distinct levels
relation

\[
\begin{align*}
(A) &: \emptyset \rightarrow W / i \rightarrow W \\
(B) &: V \rightarrow \emptyset / - V \\
(C) &: V \rightarrow \emptyset / - # \\
(D) &: C \rightarrow \emptyset / - # \\
(E) &: \left[ C \quad \text{-apical} \right] \rightarrow \emptyset / - #
\end{align*}
\]

Or: for rules C, D, B:

Nonharmonic (M,W) rule
M: \( V \) \\
\( \emptyset \) \\
W: \( \emptyset \)

Harmonic (W,W) rule
C \rightarrow \emptyset / - #

along with licensing condition:

word-final coda \( \Omega \) licenses only apical point of articulation.

Similarly, rules A, B above are both (M,W) rules.

(2) Allows for capturing generalization across several environments in which the same change occurs. >Sommerstein's argument for Latin.

(3) Allows for generalization across several different rule-changes: the 'conspiracy' case, where several 'repair strategies' all aim at a single target structure or template.

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**Accent-Weight Harmony Principle** (universal)

In prose:

a. a stressed heavy syllable is better than an unstressed heavy syllable.

b. a stressed heavy syllable is better than a stressed light syllable.

c. an unstressed light syllable is better than a stressed light syllable.

d. an unstressed light syllable is better than an unstressed heavy syllable.
More formally, on a metrical grid:

| wellformed: | x | o foot |
|            | xx | x mora |
| illformed:  | x | o foot |
|            | x  | xx mora |

This accounts for why stressed closed syllables don't have their vowel lengthened (Zoque, Selayarese, Scandanavian, etc.). There's nothing about the input that makes stressed closed syllables unfit for lengthening; it's rather that there is no need to lengthen such syllables.

The Accent-Weight Harmony Principle, predicts that there are four kinds of accent/weight rule interactions, as countenanced by harmony theory:

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(i) is our familiar rule of "Quantity-Sensitivity".
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(iv) is also fairly widespread, and found in languages such as Chimwiini (see Goodman (1969), Kisseberth and Abasheikh (1974), Goldsmith (1988)) and KiHunde (Goldsmith 1986), in which only syllables in prosodically prominent positions can be long.13

Second examples: Tone-Accent Association Condition16

(5) Inalterability effects (linking harmonic application with licensing)17

Hausa (Afroasiatic; Nigeria, Niger)
(capital letter marks ingessives)

| continuant | sonorant | kaskoo 'bowl' | kasàakee 'bowls' |
|           | [cont]   | turmii 'mortar' | turàamee 'pl.' |
|           | [rhotic] | gulbii 'stream' | gulâabee 'pl.' |
|           | [lateral] | kuRfoo 'whip' | kuRàafee 'pl.' |
|           | [trill]   | Kaimii 'spur' | Kayàamee 'pl.' |
|           | glides     | Kyauree 'door' | Kyawàaree 'pl.' |
| nasal      | homorganic | dumBuu 'whip' | dumBàayee 'pl.' |
| nasal      | [nasal]   | kundii 'wad of paper' | kundàayee |
|           |           | zankoo 'crest' | zankàayee |

(in generalizations concerning plural formation class, codas with s,l,r,R act differently from all others)
Klingenheben's Law effects : $K,*P > w/ ---$

talawcii 'poverty' cf. talaka 'poor person'

zuwciiya 'heart' zukaataa 'hearts'
juwjili 'rubbish heap' jibaajee 'pl.'
zuwciiya 'heart' zukaataa 'hearts'
Baunaa 'buffalo' Bakaanee 'pl.'
gwauroo 'bachelor' gwagwaaree 'pl.'
taushii 'drum' tafaashee 'pl.'
kyauuroo 'arrow-shaft' kyamaaree 'pl.'

Inalterability effects:
  Geminates give rise to labials and velars in codas:
garukkaa 'pens' kakkaRanta 'reread'
babbbaku 'be well roasted' etc.

(6) Connection between syllable structure of words, whether monomorphemic or not, and the targets of phonological rules (the 'duplication problem')
References


(2) In the sense of stratificational phonology ("Linguistic Elements and Their Relations", Charles Hockett, Language 37:29-53 (1961); "Prolegomena to a Theory of Phonology" Sydney M. Lamb. Language 42:536-73 (1966)) and elsewhere; we return to the relation of lexical phonology to stratificational views below. Cf. also recent autolexical work of Jerrold Sadock (e.g., in NLLT 1985), and the development of stratificational models from a connectionist perspective (e.g., Lakoff 1988 LSA paper). The emphasis on interlevel rules is classical stratificationalism; intralevel rules are not.

(3) E.g., The ordering of phonological rules, by Wallace Chafe, IJAL 34:115-36.


(8) See Liberman and Prince 1977, and much work since. McCarthy's lectures at the 1987 LSA Institute at Stanford also developed this point.


(12) On simultaneous application (non-feeding order), cf. especially Goldsmith (1988a) on Haya past tense stem formation, mentioned above also.

(13) See also Sampson, G. 1970. "On the Need for a Phonological Base". Language 46.


(15) See also Abu-Salim on Palestinian Arabic, where unstressed long vowels shorten; discussed in "Vowel Harmony in Palestinian Arabic", J of L 23/1 1987, 1-24; See Abu-Salim (1986) Vowel shortening in Palestinian Arabic: a metrical perspective Lingua 68:339-56.


The Syllable and Autosegmental Licensing
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A phonological theory is composed of statements about three things:
A. Representations
B. Levels
C. Rules

A. Representations
- tiered autosegmental structure
- metrical grid
- syllable structure

B. Levels
- Morphological M-level
- Word level W-level
  well-formedness conditions (tactics) such as syllabification
- Phonetic level P-level
  (secondary syllabification tactics)

C. Rules
Two types of rules:
- Inter-level rules (M,W), (W,P)
- Intra-level rules (M,M), (W,W), (P,P)
  Rules which apply harmonically: if and only if their output satisfies the tactics of the level better than their input. (Otherwise, no intermediate stages.)

Harmonic application: within a level (W-level, here). Rules apply if and only if they increase the fit between the representation and the tactics of the level.
O Syllable structure: a wellformedness condition on W-level.4

Coda ‘weakening’

1. Static sense: the ‘system’ in the coda is degenerate:
   The set of contrasts that can appear in coda position is smaller than
   the set of contrasts that can appear in onset position.

2. Dynamic sense: morphologically related forms can give rise to weakenings
   of segments in coda position (e.g., Klingenstein’s Law in Hausa:
   obstruents become closest sonorant (w, r); Korean: laryngeal features
   neutralized in coda position)

A means for stating formally what the ‘system’ is of a syllable position (here,
   coda):

1. There are licensors:
   primary licensor is the syllable (r), which licenses all the contrastive
   features of the language.
   secondary licensors, which license a subset of the contrastive
   features of the language.
   o Coda (C)
   o Appendixa (word-initial, word-final) Ω
   o Morphological M (cases: English -th, French latent consonants,
     ASL cases6)

2. Licensing Criterion:
   a. Each licensor can license no more than one occurrence of a feature
      that it licenses.
   b. In a well-formed structure [at W-level], all autosegments are
      licensed by their nearest licensor).

Geminate/nasal-cluster languages7
   Permit only single consonants (apa),
   geminates (appu), or homorganic nasal
   clusters (ampa) intervocically.

Note: A node may associate where it does not
   license.

Selavarese® (Indonesia; Austronesian)
   Word-medially, permits intervocically only
   single consonant [sæpol] ‘house’
   geminates [s.APPo] ‘missing front teeth’
   nasal clusters [s.AMPo] ‘carry over shoulder’
   ? + voiced C [tA.gARaN] ‘get stained’

Word-initially, no clusters
Word-finally, only
   light open syllable [sASsA] ‘wash’
   velar nasal [pASoN] ‘tree’
   glottal stop [sASsA?] ‘lizard’
W-level: Coda licenses (nasal);

Ω Appendix licenses (continuant, liquid, lateral, consonantal)
  i.e., s, r, l.

P-level: coda licenses (nasal, consonantal)

(W,P) rule: Ω—conversion: Ω —> σ

Evidence for appendix at W-level:
Contrast between 'epenthetic' (i.e., consonant-final) words like
  kátala 'itch'
  bólolo 'bottle'
  pótololo 'pencil'
  sússulu 'burn'
  kikiri 'metal file'
  lámberé 'long'
  bérasa 'rice'
  párisi 'painful'
and the regular forms like
  kalihára 'ant'
  sampúlo 'ten'
  sisá?bu 'a thousand'

Compare stress patterns with vowel-initial suffixes, such as the locative nominalizer
  -aN.

  a?bótoro 'gamble' vs. tinró 'sleep'
  pa?botóraN 'casino' vs. tinróaN 'bed, bedroom'

  lámberé 'long' vs. lóhe 'many'
  lambéraN 'longer' vs. lohéaN 'more'

See derivation, next page.

Also: when appendix-type words reduplicate, that appendix is converted to a 'glottal stop', in accord with W-level restrictions.
  For example: boto? 'gamble' boto?bótoro 'gamble without serious intent'
\( \Omega \)-conversion: \( (W, P): \Omega \rightarrow \sigma \)  
\( (P, P) \) rule of \( V \)-spreading.

**Luganda** (Uganda; Bantu)\(^9\)

\[
\begin{array}{cccccccc}
 p & t & d & k & i & u \\
b & d & j & g & e & o & a \\
w & l & y & & & & \\
m & n & ñ & N & & & \\
f & s & & & & & \\
v & z & & & & & \\
\end{array}
\]

**W-level**: no more than two moras per syllable (Tucker).

\begin{align*}
\text{M-level} & \quad \text{W-level} & \quad \text{P-level} \\
ba \text{ lab } a & \quad ba \text{ lab } a & \quad ba \text{ la } ba \quad \text{‘they see’} \\
ba \text{ n lab } a & \quad ba \text{ n dab } a & \quad baa \text{ nda } ba \quad \text{‘they see me’} \\
ba \text{ a lab } a & \quad ba \text{ a lab } a & \quad baa \text{ la } ba \quad \text{‘they saw’} \\
ba \text{ a n lab } a & \quad ba \text{ n dab } a & \quad baa \text{ nda } ba \quad \text{‘they saw me’}
\end{align*}
W-level: coda licenses (nasal, tone)
P-level: coda licenses nothing but tone), but it can associate with a consonant.

Generalization: the coda cannot license -- distinctively of articulation. In Firthian terms, the coda system does not license articulation (though the onset does).

Hausa (Afroasiatic; Nigeria, Niger)
Like Luganda, but the coda can support the sonorant (i.e., those without a distinctive point of articulation (capital letter marks ingressive)

| continuant | [cont] kaskoo 'bowl' | kasàakee 'carpenter' |
| glides     | [rhotic] turmii 'mortar' | turàamee 'three' |
|            | [lateral] gulbii 'stream' | gulâaber 'tongue' |
|            | [trill] kuRfoo 'whip' | kuRàafer 'four' |
|            |                        | Kaimii 'spur' |
|            |                        | Kyauree 'door' |
|            |                        | Kyawàar 'five' |
| nasals     | homorganic | dumBuu 'whip' | dumBàay 'daughters' |
|            | [nasal] kundii 'pad of paper' | kundày 'daughters' |
|            |                        | zankoo 'crest' |
|            |                        | zankàa 'seven' |

(in generalizations concerning plural formation class, c differences from all others)

Klingenheben's Law effects: *K,#P > w/ -- $

talawcii 'poverty' cf. talaka 'poor person'
zuwcìyaa 'heart' zukaataa 'hearts'
juwjìi 'rubbish heap' jibaajee 'pl.'
zuwcìyaa 'heart' zukaataa 'hearts'
Baunaa 'buffalo' Bakaanee 'pl.'
gwauroo 'bachelor' gwagwaaree 'pl.'
taushii 'drum' tafaashee 'pl.'
kyaurro 'arrow-shaft' kyamaaree 'pl.'

Inalterability effects:
Geminates give rise to labials and velars in codas
garukkàa 'pens' kakkaRànta 'reread'
bababbaku 'be well roasted' etc.

In conjunction with a harmonic theory of rule application, inalterability effects.

4. Quantity-sensitive systems, both tonal and accentual coda licensing.
5. English:


(5) Fudge (Syllables, JL 1969); Fujimura Syllables as concatenated demisyllables...1976; and others); Halle and Vergnaud (Three Dimensional Phonology, JL 1 R 1, 1980).


(8) "The Phonology of Selayarese" Marianne Mithun and Hasan Basri, **Oceanic Linguistics** 25:210-54 (1986).

(9) See also Aronoff, Arsyad, Barsi and Broselow "Tone Configuration in Macassarese Reduplication", Parasession on Autosegmental and Metrical Phonology, CLS 1987.


Licensing, Inalterability, and Harmonic Rule Application
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(1) our present view of the syllable, and what is central to that view;
(2) the notion of coda weakening, from both a static and a processual point of view; that traditional notion motivates the idea of the syllable coda as a weak licenser of distinctive features or autosegments;
(3) a range of possible syllable types, including especially the range of languages which permit geminates and nasal clusters intervocally but little else in the way of coda material ("Prince-languages")
(4) licensing, with a harmonic theory of rule application, provides an account of inalterability phenomena;
(5) the notion of quantity-sensitivity is a special case of coda-licensing.

1. The Syllable

Current work has largely focused on:
(1) major simplifications that emerge for the study of accent systems when viewed from a syllabic perspective;
(2) the fact that rules of epenthesis and vowel-deletion are typically governed by the extent to which their input or outputs satisfy syllabification requirements of the language in question.

We propose: a model in which the phonological syllable serves as a level of organization of phonological information, a level at which no more than one occurrence of a distinctive feature may occur per syllable. The syllable is not primarily a set of ordered (syntagmatic) slots; it is a unit of information organization, within which each distinctive feature may be specified no more than once.

The syllable is composed of those features, and the features are licensed by that syllable node. Each feature must be autosegmentally licensed by a licenser such as the syllable node, and each such licensor can license only one occurrence of a given feature.

(1)
2. Coda weakening

This may sound too restrictive: cf. the two contrasts in voicing found in the four words pad, pat, bad, and bat. If we take voicing to be a privative feature, with the unmarked value being that which is found in a voiceless consonant, we find the four-way contrast in (2).

(2)

\[
\begin{align*}
\text{a)} & \quad & \text{Coda} \quad \text{/pat/} \\
& & \quad x \quad x \quad x \\
\text{b)} & \quad & \text{Coda} \quad \text{/bat/} \\
& & \quad x \quad x \quad x \\
& & \quad [+voice]
\end{align*}
\]

\[
\begin{align*}
\text{c)} & \quad & \text{Coda} \quad \text{/pad/} \\
& & \quad x \quad x \quad x \\
& & \quad [+voice] \\
\text{d)} & \quad & \text{Coda} \quad \text{/bad/} \\
& & \quad x \quad x \quad x \\
& & \quad [+voice] \quad [+voice]
\end{align*}
\]

The coda is an organizational constituent that allows (or licenses) just a reduced set of features, and we shall indicate that subset licensed by the coda in braces, as in (3). We may think about the coda as a degenerate syllable, in a sense.

(3)

\[
\begin{align*}
\text{Coda} \\
\quad \{P \text{ of } A\} \\
\quad \{\text{voice}\} \\
\quad \{\text{round}\} \\
\quad \text{syllable}
\end{align*}
\]

(4) Licensing Criterion
Each distinctive feature in a representation must be licensed by its closest licenser, as in (3). Each licenser may license no more than one occurrence of each feature.
a. There are licensors:
   - **primary licenser** is the syllable (σ), which licenses all the contrastive features of the language.
   - **secondary licensers**, which license a subset of the contrastive features of the language.
     - Coda (C)
     - Appendix (word-initial, word-final) Ω
     - Morphological Μ (cases: English -th, French latent consonant)

b. Each licenser can license no more than one occurrence of a feature that it licenses.

c. In a well-formed structure [at W-level], all autosegments are licensed (by their nearest licenser).

It is important to bear in mind that autosegmental licensing is distinct from association: a given autosegment may associate to a position without being licensed by that position, just in case that autosegment is licensed by some other licenser. This is sketched in (5).

(5)

3. **Weak Coda Licensers** -- Prince-languages
   
   (6) a) apa  
   (6) b) appa  
   (6) c) ampa  
   ata  
   atta  
   anta  
   aka  
   akka  
   anka  

   In such languages, no consonant may appear in a coda that has a distinctive point of articulation that is not itself shared with the following onset.

   (7)
(8) Selayarese (Indonesia; Austronesian)
Word-medially, permits intervocally only
  single consonant  [sâ:po]  'house'
geminates  [séppâ]  'missing front teeth'
nasal clusters  [sómmâpo]  'carry over shoulder'
? + voiced C  [ta:ga:râN]  'get stained'

Word-initially, no clusters
Word-finally, only
  light open syllable  [sâssâ]  'wash'
  velar nasal  [pó:ôN]  'tree'
  glottal stop  [sássâ?]  'lizard'

W-level: Coda licenses {nasal};
  Appendix licenses {continuant,liquid, lateral,
  consonantal}, i.e., s,r,l.
P-level: coda licenses {nasal, consonantal}

4. Inalterability

(9) Hausa (capital letter marks glottalization)
continuant  [cont]  kaskoo 'bowl'  kasàakee 'bowls'
sonorant  [rhotic]  turmîi 'mortar'  turàamee 'pl.'
  [lateral]  gulbîi 'stream'  gulàabee 'pl.'
  [trill]  kuffoo 'whip'  kufàafee 'pl.'
glides
  Kaymîi 'spur'  Kayàamee 'pl.'
  Kaywree 'door'  Kyawàaree 'pl.'
nasal  homorganic
  [nasal]  dumBuu 'whip'  dumBàayee 'pl.'
  kundii 'paper wad'  kundàayee 'pl.'
  zankoo 'crest'  zankàayee 'pl.'

(10) Klinghenheben's Law1:
    *K,*P > w/  ---$
    *T  > ð/  ---$
  talawcii 'poverty'
  zuwciyaa 'heart'
  juwjii 'rubbish heap'
  zuwciyaa 'heart'
  Bawnaa 'buffalo'
  gwauroo 'bachelor'
  tawshii 'drum'
  kyawroo 'arrow-shaft'

    cf. talaka 'poor person'
  zukaataa 'hearts'
  jibaajee 'pl.'
  zukaataa 'hearts'
  Bakaanee 'pl.'
  gwagwaaree 'pl.'
  tafaashee 'pl.'
  kyamaaree 'pl.'

(11) Geminates give rise to labials and velars in codas, which do not
undergo Klinghenheben's Law:
  garukkàaa 'pens'
  kakkaRânta 'reread'
  babbabbaku 'be well roasted'
5. Quantity-Sensitivity

(12)a.

\[ \begin{array}{c}
\text{Row 0} \\
\text{coda \{grid\}} \\
\end{array} \]

References


