Harmonic Phonology

1. Harmonic Phonology. March 1989.
2. Levels and Harmonic Phonology. October 1989.
3. The syllable and autosegmental licensing. November 1989.
4. Licensing, inalterabilityy, and harmonic rule application. 1989.

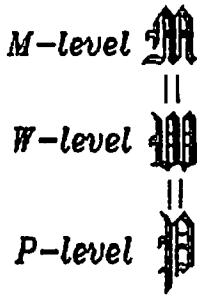
Levels and Harmonic Phonology

John Goldsmith
University of Chicago
26 October 1989

To recapitulate[1]:

A highly stratified[2], 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".



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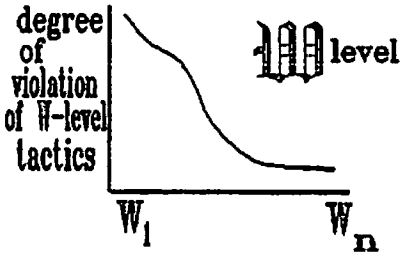


Harmonic application: within a level (W-level, here). Rules apply if and only if they increase the fit between the representation and the tactics of the level.

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

Historical Overview of the problem

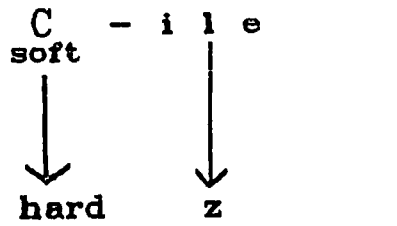
(1) Classical SPE view of rule application, with extrinsic ordering; rules triggered by structural description being met. Two sources of the metaphor: Post production systems, and regular historical sound change.

(2) Long-time recognition of difference between types of ordering (Chafe[3]) -- bleeding relations of priority different from feeding orders, e.g.; each in turn different from priories which are neither feeding nor bleeding, i.e., relation of stress and epenthesis in many languages.

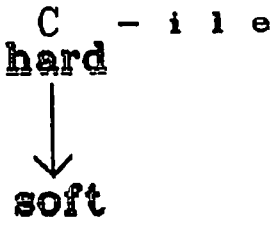
(3) Arguments requiring simultaneous application of two rules, R_1 and R_2: Haya stem softening.

In essence: coronal continuants + y are "soft" Cs.

Past tense suffix is -ile



baz - ile ⇒ bal - ize



bal - ile ⇒ baz - ile

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

Two examples:

A) epenthesis, in order to achieve proper syllabification.

Yokuts: CVX syllables

Nonfuture		Dubitative	
a. xat-hin	/xat-hin/	xat-al	/xat-al/
b. bok'-hin	/bok'-hin/	bok'-ol	/bok'-al/
c. dos-hin	/do:s-hin/	do:s-ol	/do:s-al/
d. logiw-hin	/logw-hin/	logw-ol	/logw-al/

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?
picena		"he Xx me"	progressive
		kepceno?	kepcenano?
hoe			
notxo?	notxono?	wentoxo?	wentoxono?
		kentoxo?	kentoxono?
lick			
netlo?	netleno?	wentalo?	wentaleno?
netale		kentalo?	kentaleno?
make it a fire			
naxco?	naxceno?	wenxaco?	wenxaceno?
		kenxaco?	kenxaceno?

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/
xeico? weiceno? kexeico?

C Consonant deletion in Lardil[5]: to achieve well-formed word-final syllables (looking ahead, licensing units):

Consonants

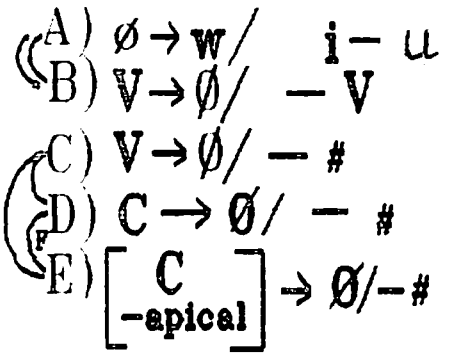
Labial	Dental	Apico-alveolar	Lamino-alveolar	Domal	Velar
p	t*	t	t'	t.	k
m	n*	n	n'	n.	N
		l	l'		
		r		r.	
w			y		

Uninflected	Nonfuture	Future	Gloss
a)			
kentapal	ketapal-in	kentapal-ur.	dugong
ket*ar	ket*ar-in	ket*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
wiwal	wiwala-n	wiwala-r.	bush mango
karikar	karikari-n	karikari-wur.	butter-fish
yiliyil	yiliyili-n	yiliyili-wur.	oyster (sp.)
yukar	yukarpa-n	yukarpa-r.	husband
wulun	wulunka-n	wulunka-r.	fruit (sp.)
wut.al	wut.alt'i-n	wult.alt'i-wur.	meat
kantukan	kantukantu-n	kantukantu-r.	red
karwakar	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

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

Feeding/C-feeding:
distinct levels
relation



Or: for rules C, D, E:

Nonharmonic (M,W) rule

M: V #
| i.e., V→∅ / — #
W: ∅

Harmonic (W,W) rule

C→∅ / — #

along with licensing condition:

word-final coda Ω licenses only apical point of articulation.

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

(5) Continuing modifications of "structural description" paradigm:
- o Well-formedness Condition in early autosegmental phonology
- o Somerstein (1975)[6] on phonotactically motivated rules [7] -- 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[8].

Lexical Phonology (Kiparksy 1982[9]) 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.

o Syllabification (noted above in Yokuts examples; and cf. Ito 1989) work on syllabification consistently requires application "when necessary"; e.g., Lapointe and

Feinstein[10]. Same point often made in work on metrical grid ('move x, motivated by stress clash'[11])

o More recently: OCP effects (McCarthy, Yip[12])

o Inalterability and integrity effects (Schein, Steriade, Hayes[13])

(6) Work on predicting rule ordering (Koutoudas et al.[14], 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.)[15] In some cases, predicts non-canonical (e.g., counterfeeding) orders. Cf. Lardil discussion above.

(2) Allows for capturing generalization aross 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

o 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:

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 Scandanavian.
(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), Kisseberth 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 Condition[17]

(5) Inalterability effects (linking harmonic application with licensing)[18]
Hausa (Afroasiatic; Nigeria, Niger)
(capital letter marks ingressives)

continuant	[cont]	kaskoo 'bowl'	kasàakee 'bowls'
sonorant	[rhotic]	turmii 'mortar'	turàamee 'pl.'
	[lateral]	gulbii 'stream'	gulàabee 'pl.'
	[trill]	kuRfoo 'whip'	kuRàafee 'pl.'
glides		Kaimii 'spur'	Kayàamee 'pl.'
		Kyauree 'door'	Kyawàaree 'pl.'
nasal	homorganic		
	[nasal]	dumBuu 'whip'	dumBàayee 'pl.'
		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[19] : *K,*P > w/ -- $

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

Inalterability effects (reprise from "Licensing" talk):
Geminates give rise to labials and velars in codas:
garukkàa 'pens' kakkaRànta 'reread'
babbabbaku 'be well roasted' etc.

References

(1) "The Syllable and Autosegmental Licensing"; also, Autosegmental and Metrical Phonology: A New Synthesis, John Goldsmith. Oxford:Basil Blackwell, Ltd. 1990. Also, Goldsmith, "Licensing, Inalterability, and Harmonic Application", CLS 25 (Chicago Linguistics Society).

(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.

(4) Charles Kisseberth (On the Functional Unity of Phonological Rules, Linguistic Inquiry 1970).

(5) "Deep and Surface canonical disparities in relation to analysis and change: An Australian example. " Kenneth Hale. 1973. Current Trends in Linguistics 11. See also Karina Wilkinson, "Prosodic Structure and Lardil Phonology," LI 19.2 1988, who makes some similar points.

(6) Sommerstein, Alan H. 1974. On phonotactically motivated rules. Journal of Linguistics 10:71-94.

(7) See also Singh, Rajendra. 1987. Well-formedness Conditions and Phonological Theory. In Phonological 1984, ed. W. Dressler et al 1987; also Paradis, Carole. On Constraints and Repair Strategies, The Linguistic Review, 1990, and a reply to it by Singh, to appear in The Linguistic Review.

(8) E.g., "On the Bases of Radical Underspecification", K.P. Mohanan, ms., Stanford University, 1989.

(9) See Paul Kiparsky, Lexical Phonology and Morphology , in I.-S. Yang, ed., Linguistics in the Morning Calm, Seoul: Hanshin. pp. 3-91. 1982, or From cyclic phonology to lexical phonology. In van der Hulst and Smith Structure of Phonological Representations 1982, Part I. See also Kiparsky 1985: Some consequences of Lexical Phonology, in Phonology Yearbook 2. London: Cambridge University Press. See also the critique of these approaches in Goldsmith (1990) (cf. fn. 1 above).

(10) 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.

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

(12) McCarthy, John. 1986. OCP Effects: Gemination and Antigemination. LI 17: 207-63. See also Yip, Moira. 1988. The Obligatory Contour Principle and Phonological Rules: A Loss of Identity. LI 19: 65-100, and discussion in Goldsmith (1990, Chapter 6).

(13) Kenstowicz, Michael and Charles Pyle. 1973. On the phonological integrity of geminate clusters. In Kenstowicz and Kisseberth, eds., Issues in phonological theory. 27-43. The Hague:Mouton. Also:Hayes, Bruce. 1986a. Inalterability in CV Phonology. Language 62: 321-51. Also: Schein, Barry and Donca Steriade. 1986. On Geminates. LI 17: 691-744.

(14) Koutsoudas, Andreas, Gerald Sanders, and Craig Noll. 1974. "The application of phonological rules." Language 50:1-28.

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

(16) 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.

(17) Cf. Tone and Accent, and Getting the Two Together. John Goldsmith, Berkeley Linguistic Society, 1986.

(18) Goldsmith "Licensing, Inalterability, and Harmonic Rule Application" CLS 1989.

(19) P.Newman and B.A. Salim, "Hausa Diphthongs" Lingua 1981.

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John Goldsmith
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To recapitulate[1]:

A highly stratified[2], autosegmentalized model with two types of rules:
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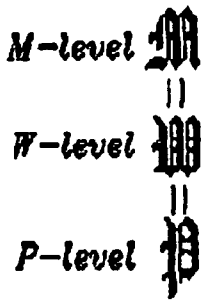

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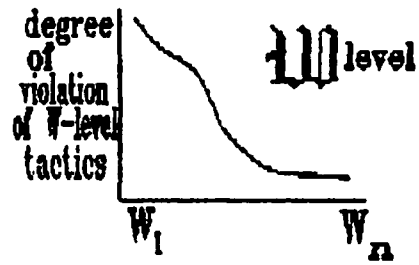

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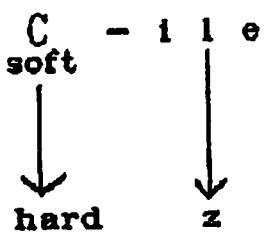
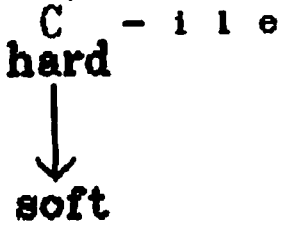


baz - ile ⇒ bal - ize



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- o 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'[8])
- o More recently: OCP effects (McCarthy, Yip[9])
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(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:
   - o "elsewhere" condition
   - o 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 counter-feeding situations) how the learner determines what the structural description for a rule should be.)[13] In some cases, predicts non-canonical (e.g., counterfeeding) orders.
Cf. Lardil[14]:

Consonants

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		r		r.	
w			y		

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yar.put	yar.put'-in	yar.put*-ur.	snake,bird
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pirNen	pirNen-in	pirNen-kur.	woman
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wulun	wulunka-n	wulunka-r.	fruit (sp.)
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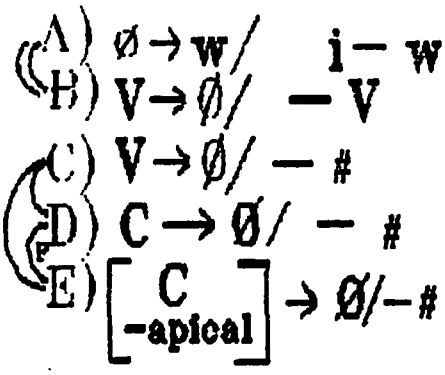

Or: for rules C, D, E:

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W: ∅

Harmonic (W,W) rule

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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:

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 Scandanavian.
(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), Kisseberth and Abasheikh (1974), Goldsmith (1988)) and KiHunde (Goldsmith 1986), in which only syllables in prosodically prominent positions can be long.[15]

- Second examples: Tone-Accent Association Condition[16]

(5) Inalterability effects (linking harmonic application with licensing)[17]
Hausa (Afroasiatic; Nigeria, Niger)
(capital letter marks ingressives)

continuant	[cont]	kaskoo 'bowl'	kasàakee 'bowls'
sonorant	[rhotic]	turmii 'mortar'	turàamee 'pl.'
	[lateral]	gulbii 'stream'	gulàabee 'pl.'
	[trill]	kuRfoo 'whip'	kuRàafee 'pl.'
glides		Kaimii 'spur'	Kayàamee 'pl.'
		Kyauree 'door'	Kyawàaree 'pl.'
nasal	homorganic		
	[nasal]	dumBuu 'whip'	dumBàayee 'pl.'
		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[18] : *K,*P > w/ -- $

talawcii 'poverty' cf. talaka 'poor person'

zuwciyaa 'heart'	zukaataa 'hearts'
juwjii 'rubbish heap'	jibaajee 'pl.'
zuwciyaa 'heart'	zukaataa 'hearts'
Baunaa 'buffalo'	Bakaanee 'pl.'
gwauroo 'bachelor'	gwagwaaree 'pl.'
taushii 'drum'	tafaashee 'pl.'
kyauroo 'arrow-shaft'	kyamaaree 'pl.'

Inalterability effects:

Geminates give rise to labials and velars in codas:

garukkàa 'pens' kakkaRànta 'reread'

babbabbaku '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

(1) "The Syllable and Autosegmental Licensing"; also, Autosegmental and Metrical Phonology: A New Synthesis. Basil Blackwell, 1989.

(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.

(4) Sommerstein, Alan H. 1974. On phonotactically motivated rules. JL 10:71-94.

(5) Charles Kisseberth (On the Functional Unity of Phonological Rules, LI 1970). See also Singh, Rajendra. 1987. Well-formedness Conditions and Phonological Theory. In Phonological 1984, ed. W. Dressler et al 1987; also Paradis, Carole. In press. On Constraints and Repair Strategies, The Linguistic Review.

(6) See Paul Kiparsky, Lexical Phonology and Morphology , in I.-S. Yang, ed., Linguistics in the Morning Calm, Seoul: Hanshin. pp. 3-91. 1982, or From cyclic phonology to lexical phonology. In van der Hulst and Smith Structure of Phonological Representations 1982, Part I. See also Kiparsky 1985: Some consequences of Lexical Phonology, in Phonology Yearbook 2. London: Cambridge University Press.

(7) 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,op. cit., Part II.

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

(9) McCarthy, John. 1986. OCP Effects: Gemination and Antigemination. LI 17: 207-63. See also Yip, Moira. 1988. The Obligatory Contour Principle and Phonological Rules: A Loss of Identity. LI 19: 65-100.

(10) Kenstowicz, Michael and Charles Pyle. 1973. On the phonological integrity of geminate clusters. In Kenstowicz and Kisseberth, eds., Issues in phonological theory. 27-43. The Hague:Mouton. Also:Hayes, Bruce. 1986a. Inalterability in CV Phonology. Language 62: 321-51. Also: Schein, Barry and Donca Steriade. 1986. On Geminates. LI 17: 691-744.

(11) Koutsoudas, Andreas, Gerald Sanders, and Craig Noll. 1974. "The application of phonological rules." Language 50:1-28.

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

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

(14) "Deep and Surface canonical disparities in relation to analysis and change: An Australian example. " Kenneth Hale. 1973. Current Trends in Linguistics 11. See also Karina Wilkinson, "Prosodic Structure and Lardil Phonology," LI 19.2 1988, who makes some similar points.

(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 shorteningin Palestinian Arabic: a metrical perspective Lingua 68:339-56.

(16) Cf. Tone and Accent, and Getting the Two Together. John Goldsmith, Berkeley Linguistic Society, 1986.

(17) Goldsmith "Licensing, Inalterability, and Harmonic Rule Application" CLS 1989.

(18) P.Newman and B.A. Salim ("Hausa Diphthongs" Lingua 1981).

The Syllable and Autosegmental Licensing

John Goldsmith
The University of Chicago
28 November, 1989

o A phonological theory is composed of statements about three things:
  A. Representations
  B. Levels
  C. Rules

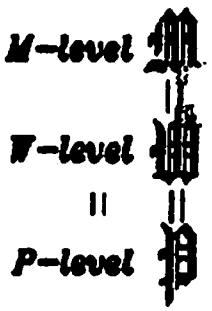
A. Representations[1]
- o tiered autosegmental structure
- o metrical grid
- o syllable structure

B. Levels[2]
- o Morphological — M-level
- o Word level — W-level
  well-formedness conditions (tactics) such as syllabification
- o Phonetic level — P-level
  (secondary syllabification tactics)

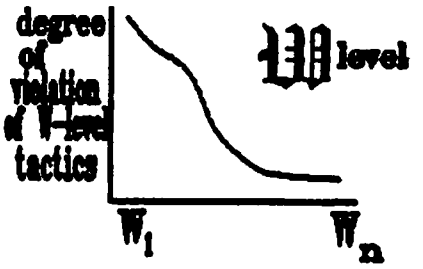
C. Rules[3]

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.)



<-- (M,W) rules (apply simultaneously, with no intermediate representations)
<---------- (W,W) rules (free reapplication, with pure harmonic function)
<-- (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.

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., Klingenheben's Law in Hausa: obstruents become closest sonorant (w, r); Korean: laryngeal features neutralized in coda position)

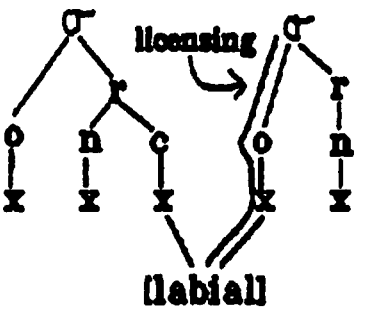
A means for stating formally what the 'system' is of a syllable position (here, coda):

1. There are licensers:
   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.
   - o Coda (C)
   - o Appendix[5] (word-initial, word-final) Ω
   - o Morphological M (cases: English -th, French latent consonants, ASL cases[6])
2. Licensing Criterion:
   a. Each licenser 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 licenser).

Geminate/nasal-cluster languages[7]

Permit only single consonants (apa), geminates (appa), or homorganic nasal clusters (ampa) intervocalically.

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



Selayarese[8] (Indonesia; Austronesian)

Word-medially, permits intervocalically only

single consonant	[sáːpo] 'house'
geminates	[sáppo] 'missing front teeth'
nasal clusters	[sómːpo] 'carry over shoulder'
? + voiced C	[ta?garaN] 'get stained'

Word-initially, no clusters

Word-finally, only

light open syllable	[sássa] 'wash'
velar nasal	[póː?oN] 'tree'
glottal stop	[sássa?] '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'
bótolo 'bottle'
pótolo 'pencil'
sússulu 'burn'
kikiri 'metal file'
lámbere 'long'
bérasa 'rice'
pá?risi 'painful'

with non-canonical antepenultimate stress -- but these words only end in (s,l,r)

and the regular forms like

kaliha:ra 'ant'
sampú:lo 'ten'
sisá?bu 'a thousand'

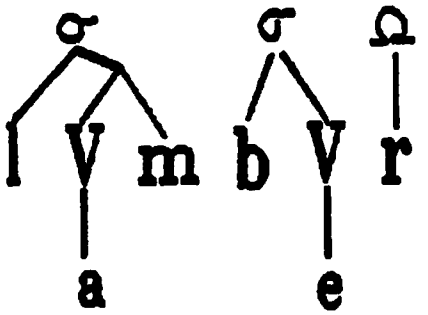
Compare stress patterns with vowel-initial suffixes, such as the locative nominalizer
-aN.

a?bótoro	'gamble'	vs.	tínro	'sleep'
pa?botóraN	'casino'		tinróaN	'bed, bedroom'
lámbere	'long'	vs.	lóhe	'many'
lambéraN	'longer'		lohéaN	'more'

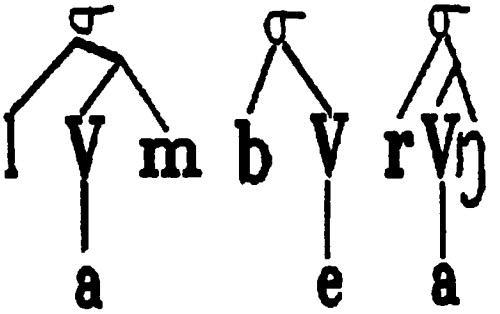
See derivation, next page.

Also: when appendix-type words reduplicate, that appendix is converted to a 'glottal stop', in accord with W-level restrictions.
For example: botor 'gamble' boto?bótoro 'gamble without serious intent'

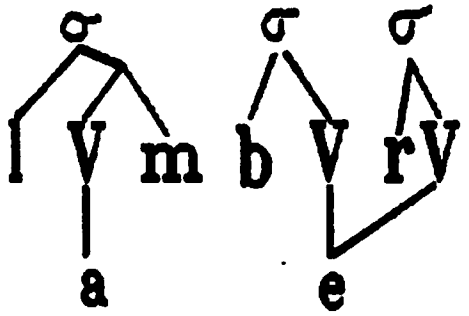
W-level



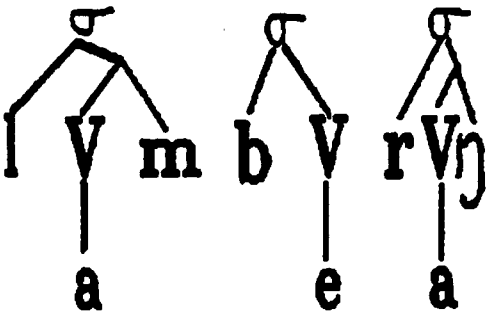
W-level



P-level



P-level



Ω-conversion: (W,P): Ω -> σ
(P,P) rule of V-spreading.

Luganda (Uganda; Bantu)[10]

p	t	d	k	i	u
b	d	j	g	e	o a
w	l	y			
m	n	ñ	N		
f	s				
v	z				

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

M-level	W-level	P-level
ba lab a	ba lab a	ba la ba 'they see'
ba n lab a	ba n dab a	baa nda ba 'they see me'
ba a lab a	ba a lab a	baa la ba 'they saw'
ba a n lab a	ba n dab a	baa nda ba 'they saw me'

W-level: coda licenses (nasal, tone)
P-level: coda licenses nothing (but tone), but it can associa
with a consonant.

Generalization: the coda cannot license -- distinctively
articulation. In Firthian terms, the coda system does n
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 ingressives)

continuant sonorant	[cont] [rhotic] [lateral] [trill]	kaskoo 'bowl' turmii 'mortar' gulbii 'stream' kuRfoo 'whip' Kaimii 'spur'	kasàakee turàamee gulàabee kuRàafe Ka
glides		Kyauree 'door'	Kyawàar
nasal	homorganic [nasal]	dumBuu 'whip' kundii 'wad of paper' zankoo 'crest'	dumBàay kundàay zankàay

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

Klingenheben's Law effects[11] : *K,*P > w/ -- $

talawcii 'poverty' cf. talaka 'poor person'

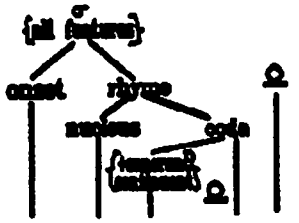
zuwciyaa 'heart'	zukaataa 'hearts'
juwjii 'rubbish heap'	jibaajee 'pl.'
zuwciyaa 'heart'	zukaataa 'hearts'
Baunaa 'buffalo'	Bakaanee 'pl.'
gwauroo 'bachelor'	gwagwaaree 'pl.'
taushii 'drum'	tafaashee 'pl.'
kyauroo 'arrow-shaft'	kyamaaree 'pl.'

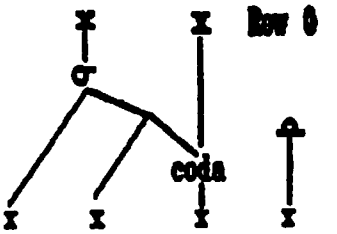
Inalterability effects:
Geminates give rise to labials and velars in codas
garukkàa 'pens' kakkaRànta 'reread'
babbabbaku 'be well roasted' etc.

In conjunction with a harmonic theory of rule appli
inalterability effects[12].

4. Quantity-sensitive systems, both tonal and accentu
coda licensing.

5. English:





(1) Autosegmental and Metrical Phonology: A New Synthesis, John Goldsmith. Basil Blackwell, Ltd. 1990. Also, "Licensing, Inalterability and Harmonic Rule Application", John Goldsmith, in CLS 25 (Chicago Linguistics Society, 1989).

(2) 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)); Lexical phonology (Strauss, Kiparksy, Mohanan; cf. Goldsmith (1990)).

(3) "On phonotactically motivated rules" Alan H. Somerstein, Journal of Linguistics 10:71-94 (1974); "Well-formedness Conditionsand Phonological Theory" Raj Singh, Phonological 1984 (CUP); WFC of autosegmental phonology (Goldsmith (1976)); C. Paradis (Linguistic Review, in press).

(4) Phonemics Pike (1947) ('phonological/phonetic syllable'); Kiparksy (Lexical Morphology and Phonology, 1982) cites McCarthy (On Stress and Syllabification, 1979) as offering syllabification as a WFC on words; but he does not say that (cf. p. 453). Selkirk (The Syllable, in van der Hulst and Smith SPH II, 1982): "we think of them as [WFCs] on underlying phonological representation". Kisseberth (On the Functional Unity of Phonological Rules, LI 1970). Theo Vennemann (On the Theory of Syllabic Phonology, Linguistische Berichte 18:1-18, 1972).

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

(6) See "Secondary Licensing and the Non-dominant Hand in ASL Phonology", Diane Brentari and John Goldsmith, presented at 1989 Workshop on ASL Phonology; to appear in a book edited by Geoffrey Coulter, proceedings of the workshop.

(7) "Phonology with Tiers" Alan S. Prince, Language Sound Structures (1984). See also Ito (1986, 1989).

(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.

(10) "The Syllable in Luganda: A Prosodic Approach" A.N. Tucker Journal of African Languages 1:122-66 (1962). "Compensatory Lengthening and Consonant Gemination in Luganda" G.N. Clements (1985).

(11) P.Newman and B.A. Salim ("Hausa Diphthongs" Lingua 1981).

(12) Kenstowicz, Michael and Charles Pyle. 1973. On the phonological integrity of geminate clusters. In Kenstowicz and Kisseberth, eds., Issues in phonological theory. 27-43. The Hague:Mouton. Also:Hayes, Bruce. 1986a. Inalterability in CV Phonology. Language 62: 321-51. Also: Schein, Barry and Donca Steriade. 1986. On Geminates. LI 17: 691-744.

Licensing, Inalterability, and Harmonic Rule Application

John Goldsmith
The University of Chicago

(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 intervocallically 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.

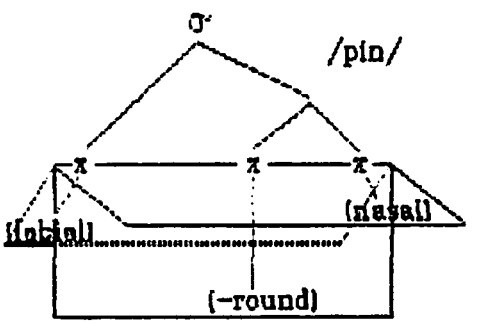
1. The Syllable

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 licenser can license only one occurence of a given feature.

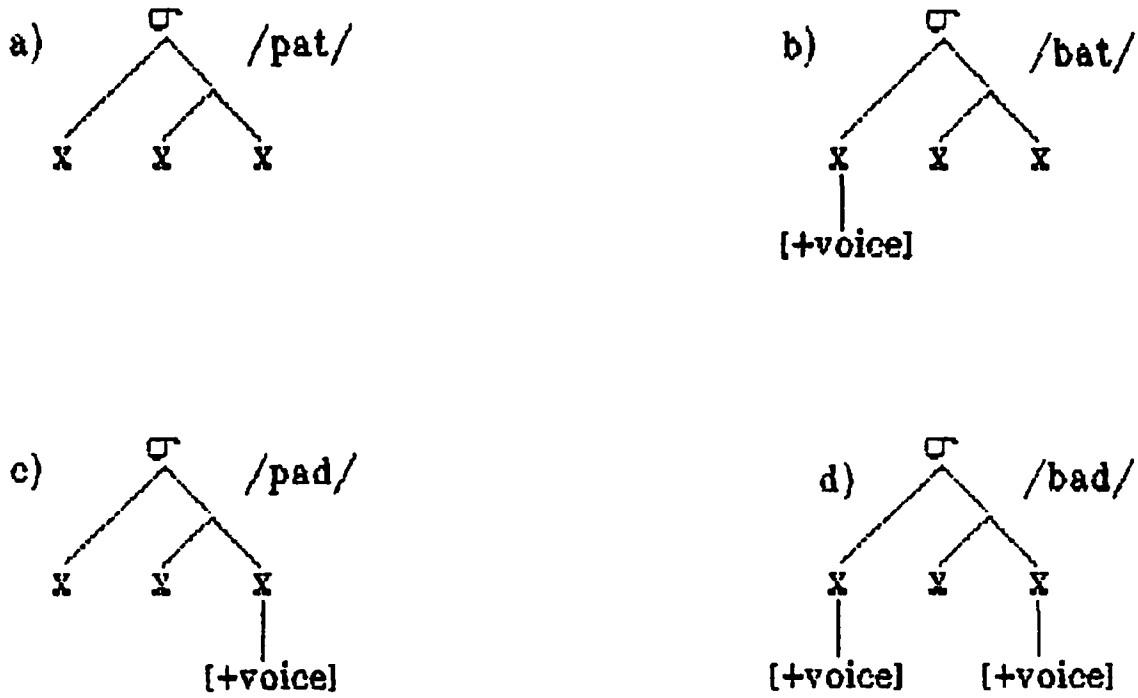
(1)



2. Coda weakening

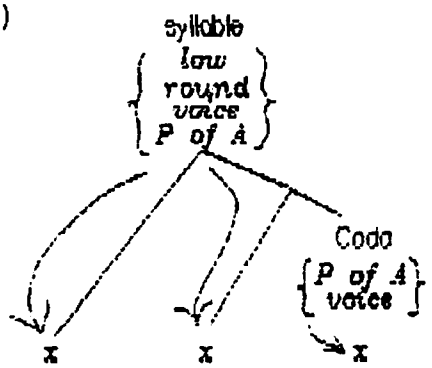
This may sound too restrictive: cf. the two contrasts in voicing found in the four words pad, pat, bad, and bat. If we take voicing to be a privative feature, with the unmarked value being that which is found in a voiceless consonant, we find the fourway contrast in (2).

(2)



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)



(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 licensers:
   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.
   - o Coda (C)
   - o Appendix (word-initial, word-final) Ω
   - o Morphological M (cases: English -th, French latent consonant)

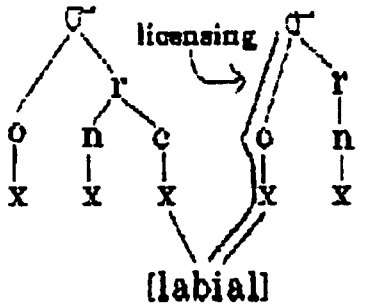
b. Each licenser can license no more than one occurrence of a feature that it licenses.

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

o o o

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)

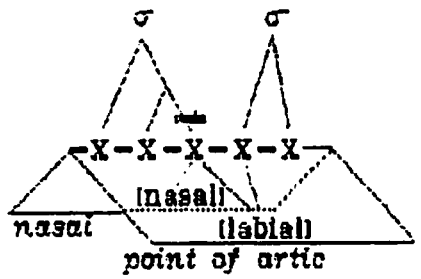


3. Weak Coda Licensers -- Prince-languages

(6) a) a p a b) a p p a c) a m p a
a t a a t t a a n t a
a k a a k k a a N k a

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 intervocalically only

single consonant	[sá:po]	'house'
geminates	[sáppo]	'missing front teeth'
nasal clusters	[sóm:po]	'carry over shoulder'
? + voiced C	[ta?gáraN]	'get stained'

Word-initially, no clusters

Word-finally, only

light open syllable	[sássa]	'wash'
velar nasal	[pó:?oN]	'tree'
glottal stop	[sássa?]	'lizard'

W-level: Coda licenses {nasal};
Ω 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]	turmii 'mortar'	turàamee 'pl.'
	[lateral]	gulbii 'stream'	gulàabee 'pl.'
	[trill]	kuřfoo 'whip'	kuřàafee 'pl.'
glides		Kaymii 'spur'	Kayàamee 'pl.'
		Kyawree 'door'	Kyawàaree 'pl.'
nasal	homorganic		
	[nasal]	dumBuu 'whip'	dumBàayee 'pl.'
		kundii 'paper wad'	kundàayee 'pl.'
		zankoo 'crest'	zankàayee 'pl.'

(10) Klingenheben's Law[1] : *K,*P > w/ --$
*T > ř/ --$

talawcii	'poverty'	cf. talaka 'poor person'
zuwciyaa	'heart'	zukaataa 'hearts'
juwjii	'rubbish heap'	jibaajee 'pl.'
zuwciyaa	'heart'	zukaataa 'hearts'
Bawnaa	'buffalo'	Bakaanee 'pl.'
gwauroo	'bachelor'	gwagwaaree 'pl.'
tawshii	'drum'	tafaashee 'pl.'
kyawroo	'arrow-shaft'	kyamaaree 'pl.'

(11) Geminates give rise to labials and velars in codas, which do not undergo Klingenheben's Law:

garukkàa	'pens'
kakkaRànta	'reread'
babbabbaku	'be well roasted'

5. Quantity-Sensitivity

(12)a. b.

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