Kinande Tone as layered and gradient

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Main claim

Harmonic Layer Theory allows for a unified grammar of Kinande tone.

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Harmonic Layer Theory allows for a unified grammar of Kinande tone.
The complex patterns can be derived using two basic assumptions.

- Tones differ in underlying activity.
- These activities change monotonously across three morphophonological layers (≈levels, strata).

Introduction

Kinande tone complexities

Depending on the context, a high tone in Kinande (Bantu, DR Congo) can:

- shift one TBU to the left,
- spread one TBU to the left,
- compete with other tones for insertion.

High tones in Kinande I

(1) Stable and shifting high tones (Jones, 2014, 294,49)

a. tù-ká-hùm-à
we-CONT-hit-CONT
'we are hitting'

b. è-rí-tùm-à
AUG-INF-send-INF
'to send'

High tones in Kinande II

(2) Single and doubling high tones (Jones, 2014, 49,175)

a. è-rí-tùm-à
AUG-INF-send-INF
'to send'

b. è-rí-mú-tùm-à
AUG-INF-3SG.O-send-INF
'to send him'

High tones in Kinande III

(3) Competing tones (Jones, 2014, 170,286)

a. è-rí-hùm-ìr-á]$_{\phi}$
AUG-INF-send-APPL-INF
'to send for'

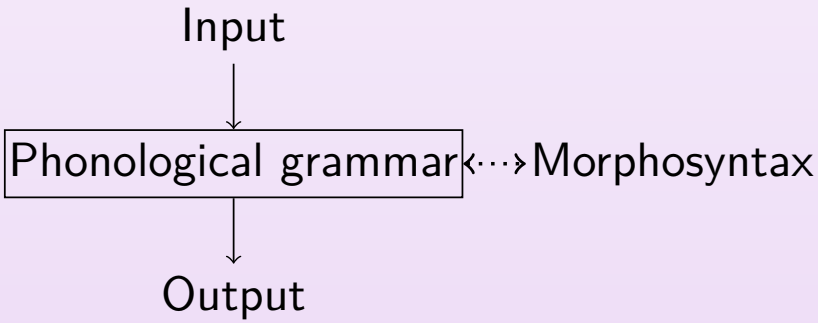
b. è-rí-hùm-ír-à]$_{\iota}$
AUG-INF-send-APPL-INF
'to send for'

c. tù-á-húm-ìr-àà]$_{\phi}$
1PL-REC.PST-hit-APPL-REC.PST
'we hit for recently'

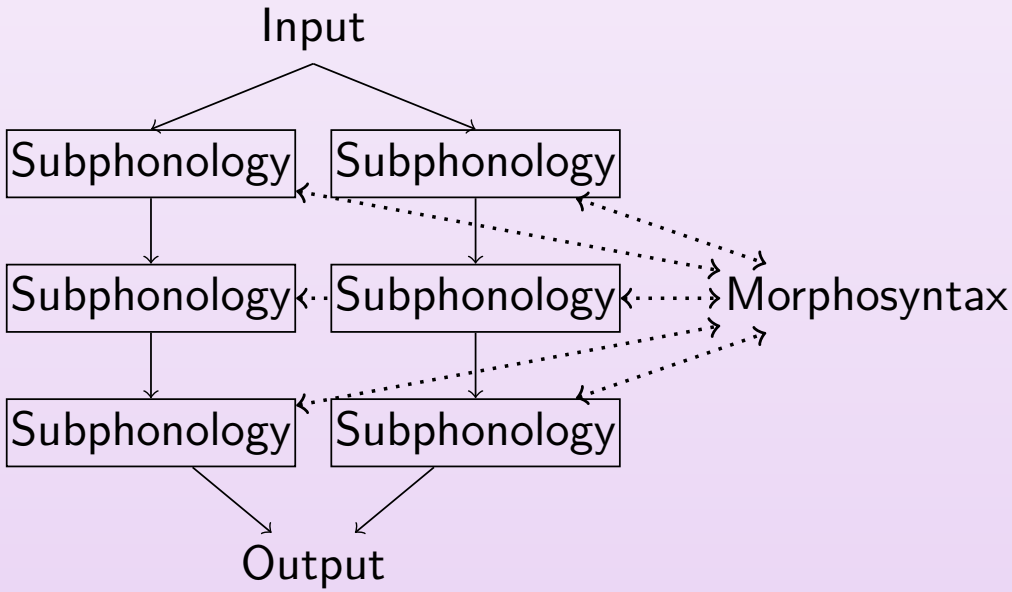
Unified grammar vs. multiple subgrammar approaches

- Theories of phonology can either posit
- a single grammar that applies to all inputs (e.g. Standard Parallel Optimality Theory (Prince & Smolensky, 1993)) or
- a set of different subgrammars, which are disjunctively or serially ordered (Stratal OT (Bermúdez-Otero, 2008; Kiparsky, 2015), Lexical Phonology (Kiparsky, 1982, 1985), Cophonology Theory (Orgun, 1996; Inkelas & Orgun, 1995)).

(4) Unified grammar



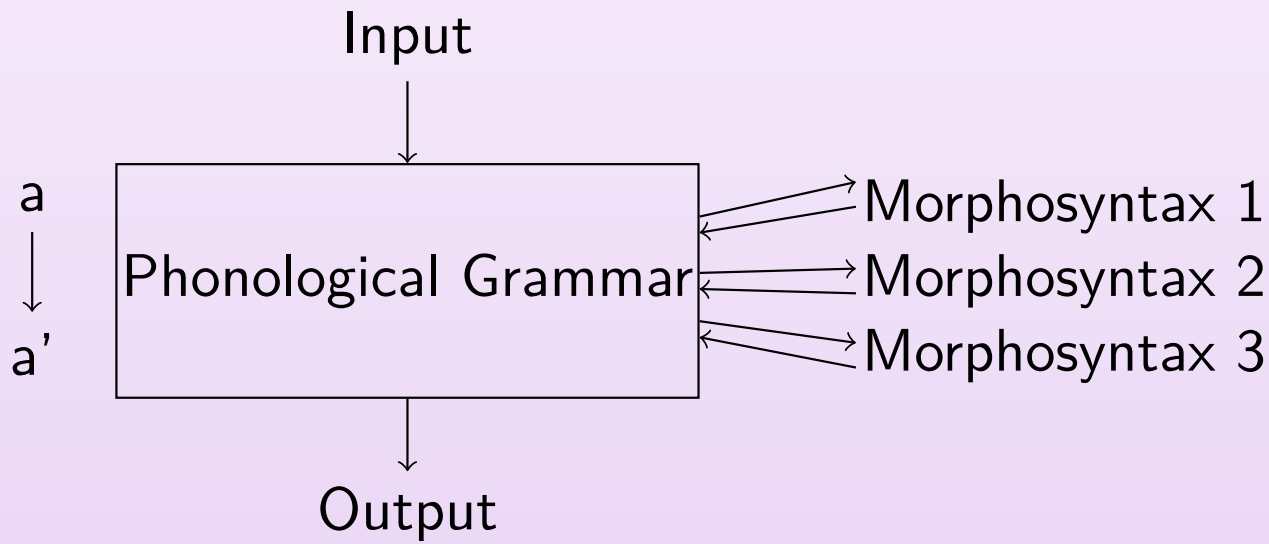
(5) Multiple subgrammars



Harmonic Layer Theory

- Harmonic Layer Theory (Trommer, 2019; Trommer & Zimmermann, 2021) posits a single unified grammar but allows for domain-specific processes because representations change by application of grammar.
- The unified grammar thus applies uniformly at different layers (≈Strata/Levels) but representations change.
- More concretely, gradient activation (cf. Goldrick & Smolensky, 2016) monotonously changes across three morphosyntactially defined layers.

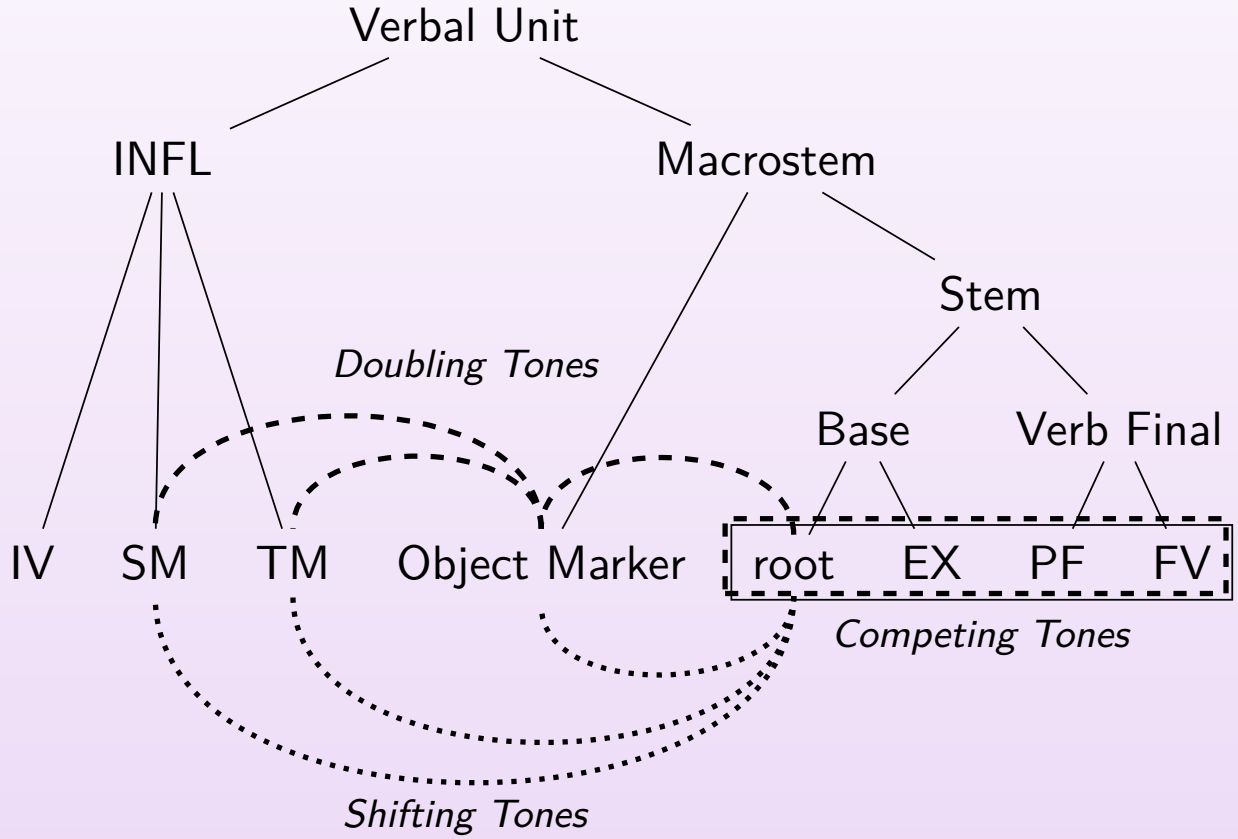
(6) Harmonic Layer Theory



Kinande tone in detail

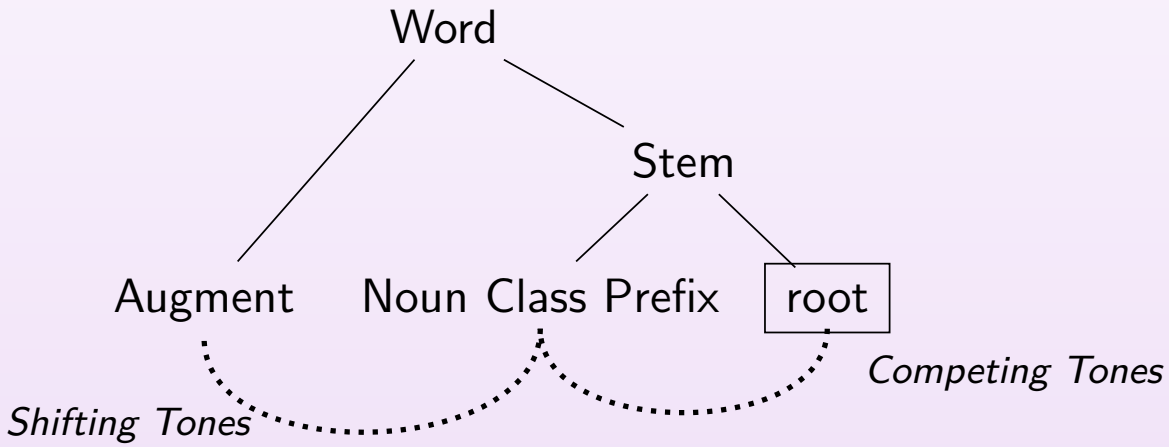
Kinande tone in detail: overview I

(7) Morphological structure of Kinande verbs (Black, 1995)



Kinande tone in detail: overview II

(8) Morphological structure of Kinande nouns (Mutaka, 1994, 212)



Kinande tone in detail: stem tone shift I

- The high tones of verb roots and noun roots in Kinande often show up on a preceding root.
- Previous analyses have used stem-specific rules/rankings to derive these data (Black, 1995; Jones, 2014).

(9) Shifting tones (Black, 1995, 9)

a. è-rì-hùm-à
AUG-INF-hit-INF
'to hit'

b. è-rí-tùm-à
AUG-INF-send-INF
'to send'

c. ò-kʊ́-bò̀kò
AUG-NC.15-arm
'arm'

Kinande tone in detail: stem tone shift II

- Some roots, however, are exceptional in that their tones do not shift (Jones, 2011, 2014).

(10) Non-shifting tones (Jones 2011, 289; Jones 2014, 37)

a. è-ry-ómbòl-à
AUG-NC5-sneak-INF
'to sneak'

b. è-r-ít-à
AUG-NC5-kill-INF
'to kill'

c. è-kì-kómbè
AUG-NC7-cup
'cup'

Kinande tone in detail: stem tone shift III

- Additionally, shifting sometimes also applies across word boundaries (Hyman & Valinande, 1985; Jones, 2014).

(11) Shifting across word boundaries (Jones, 2014, 73)

a. à-b-ò nìɲà
AUG-NC2-DEM mother
'those mothers'

b. à-b-ó tàtàà
AUG-NC2-DEM father
'those fathers'

Kinande tone in detail: macrostem tone doubling I

- High tones attached to an object marker and some grammatical high tones occupy two TBUs.
- Previous analyses have used this to motivate a macrostem-specific ranking/rule (Black, 1995; Jones, 2014).

(12) Single and doubling high tones (Jones, 2014, 49,175)

a. è-rí-tùm-à
AUG-INF-send-INF
'to send'

b. è-rí-mú-tùm-à
AUG-INF-3SG.O-send-INF
'to send him'

c. tù-á-húm-ìr-àà
1PL-REC.PST-send-REC.PST
'we sent for recently'

Kinande tone in detail: macrostem tone doubling II

- Crucially, not all tones originating or surfacing inside the macro-stem domain double.

(13) Exceptions to macro-stem doubling (Jones, 2014, 49,37,15)

a. è-rí-tùm-à
AUG-INF-send-INF
'to send'

b. è-kì-kómbè
AUG-NC7-cup
'cup'

c. ò-kù-gúlù]$_D$
AUG-NC15-leg
'leg'

Kinande tone in detail: phrasal tone competition I

- ϕ-phrase finally, some words show up with a high tone on the final TBU.
- ι-phrase finally, these show up with low tone on the final TBU in declaratives or a high tone on the final TBU in questions.
- Alternating words additionally have a high tone on the penultimate TBU.
- Mutaka (1994) and Jones (2011) use this an argument for two phrasal strata.

(14) Phrase-final alternations in verbs (Jones, 2014, 170,171)

medial	ϕ-final	D-final	
a. -tùm-ìr-à	-tùm-ìr-á	-tùm-ír-à	'to send for'
b. -tùm-ír-á-à	-tùm-ír-á-à	-tùm-ír-á-à	'we sent for recently'
c. -húm-ìr-à-à	-húm-ìr-à-à	-húm-ìr-à-à	'we hit for recently'

Kinande tone in detail: phrasal tone competition II

(15) Phrase-final alternations in nouns (Jones, 2014, 21,110,138)

	medial	ϕ-final	D-final	Q-final	
a.	-gùlù	-gùlú	-gúlù	-gúlú	'leg'
b.	-kómbè	-kómbè	-kómbè	-kómbé	'cup'
c.	-hèkà	-hèkà	-hèkà	-hèká	'truck'

- Hyman & Valinande (1985) further note that tone shift also results in competition if it applies across words.

Harmonic Layer analysis

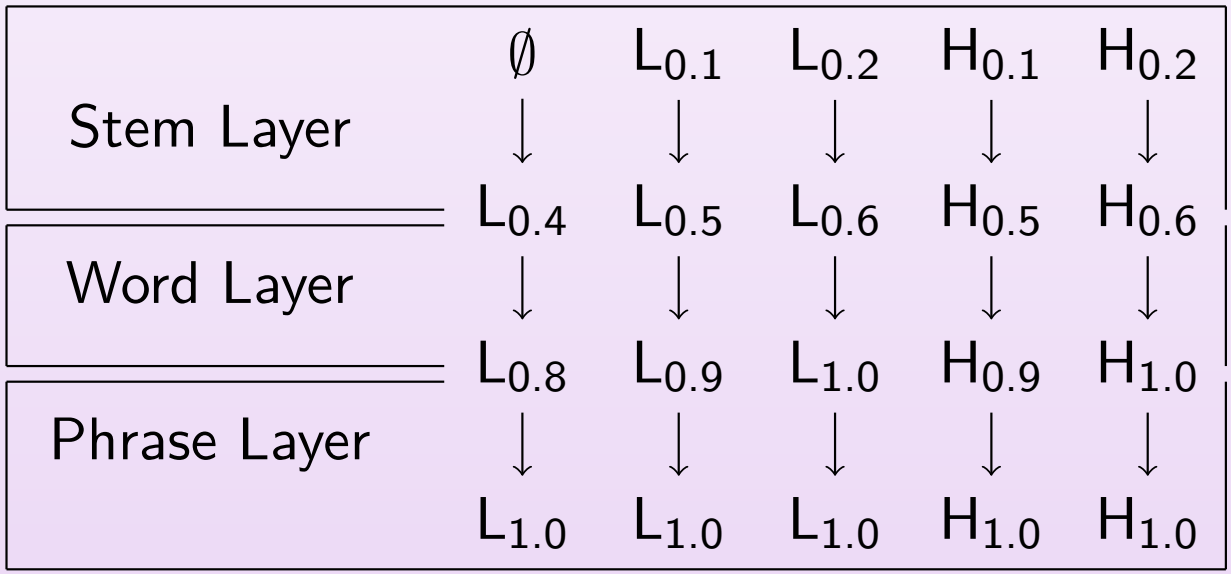
Harmonic Layer analysis

The Harmonic Layer Analysis is based on two crucial assumptions.

- Lexical and grammatical tones differ in their underlying activity.
- At each morphophonological layer at most 0.4 activity can be added.

This allows us to unify all phonological processes as docking in different contexts.

(16) Step-wise epenthesis and strengthening



Analysis: step-wise epenthesis

- The step-wise epenthesis is ensured by two high-weighted constraints.
- SPECIFY(Tone) requires as much insertion of activity as possible, ΔDEP0.4 restricts it.

(17) Constraints for step-wise epenthesis

a. ΔDEP0.4 ∞
Count one violation for insertion of activity x-y>0.4, where y is the output activation in the output and x is its input activition if applicable, else x=0.

b. SPECIFY(Tone) 100
Count 1-x violation for any TBU specified with a tone with activity X if applicable, else x=1.

Analysis: docking I

- Shifting can be analyzed as the realization of a floating tone on the preceding TBU (cf. Black, 1995).
- This is enforced by a constraint against tautomorphemic docking.

(18) ALTERNATION
Count x violation for an epenthetic association line between a tone with activity x and a tautomorphemic TBU (cf. Wolf, 2005; van Oostendorp, 2007).

Analysis: docking II

(19) Stem-layer evaluation with docking and default insertion

		ALTER	MAX	*H	$\mathcal{H} =$
	$H_{0.2}$ I: ku- bo ko	40	12	1	
☞a.	$H_{0.6}$ $L_{0.4}$ $L_{0.4}$ ku- bo ko			-0.6	-0.6
b.	$L_{0.4}$ $L_{0.4}$ $L_{0.4}$ ku- bo ko		-0.2		-2.4
c.	$L_{0.4}$ $H_{0.6}$ $L_{0.4}$ ku- bo ko	-0.6		-0.6	-24.6

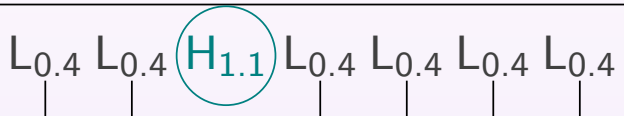
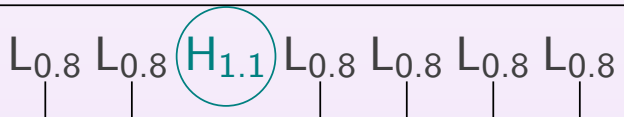
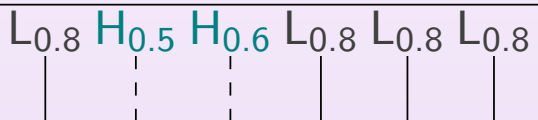
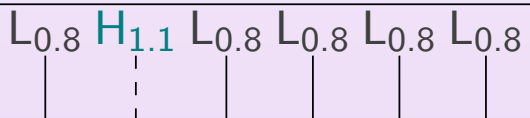
Analysis: overactive docking I

- Doubling tones result from underlying activation of more than 1, which is disallowed in the output.
- This also means that object prefixes add activation (cf. appendix).

(20) *Overactive
Count one violation for a tone with activity above one.

Analysis: overactive docking II

(21) Word-layer overactive docking and strengthening

		*Overa	Alter	Max	*H	$\mathcal{H}$=
		∞	40	12	1	
a.		-0.1!			-1.1	-∞
☞b.				-0.8	-1.1	-9.6
c.		-0.1!			-1.1	-∞

Analysis: competitive docking I

- At the phrasal layer, TBUs are already specified with a greater amount of activity in the input, leading to competition between lexical tones and phrasal tones, which themselves differ in activation.
- This competition is governed by two constraints: MAX prefers stronger tones and *H prefers low tones.

(22) MAX(Tone)
Count x-y violation for any input tone with activity y, if it has an output correspondent with activity x, else x=0.

(23) *H
Count x violation for any high tone with activity x.

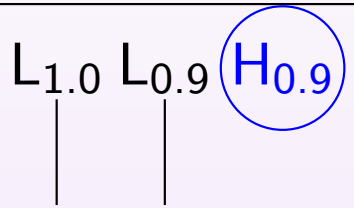
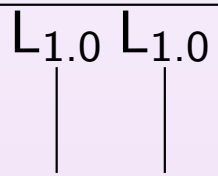
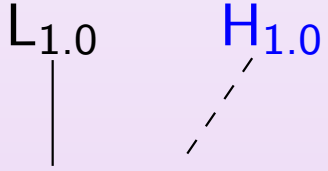
Analysis: competitive docking II

(24) Weak ϕ-tones dock onto alternating root /gulu/

		ALTER	MAX	*H	
I: $\mathcal{W}=$	$L_{0.8}$ $L_{0.8}$ $H_{0.9}$ gu lu	40	12	1	$\mathcal{H}=$
a.	$L_{1.0}$ $L_{1.0}$ gu lu		-0.9		-10.8
☞ b.	$L_{1.0}$ $H_{1.0}$ gu lu		-0.8	-1.0	-10.6

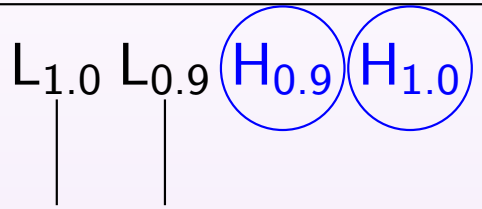
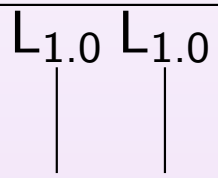
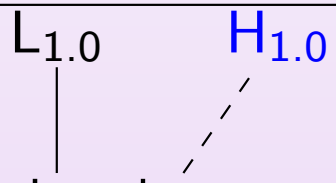
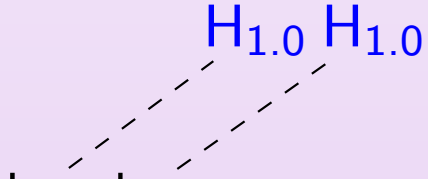
Analysis: competitive docking III

(25) Stable root tones block weak ϕ-tone /heka/

	ALTER	MAX	*H	
$\mathcal{W}=$ 	40	12	1	$\mathcal{H}=$
☞ a. 		-0.9		-10.8
b. 		-0.9	-1.0	-11.8

Analysis: competitive docking IV

(26) Strong ι-tones overwrite stable root tones /heka/

		ALTER	MAX	*H	
	 $\mathcal{W} =$	40	12	1	$\mathcal{H} =$
a.			-1.9		-22.8
☞b.			-1.8	-1.0	-22.6
b.			-1.9	-2.0	-24.8

Analysis: unified weighting I

- In sum, Harmonic Layer Theory provides a unified analysis of Kinande tone as docking in different contexts.
- The result of docking depends on the underlying activity of the tone and the context it is inserted in.

(27) Constraint weighting

Constraint	weight	purpose
*Pure	∞	blocks survival of pure activation
*Overactive	∞	triggers splitting
ΔDep0.4	∞	blocks total insertion
Specify	100	trigger insertion
Alter	40	blocks tautomorphemic blocking
Max	12	blocks deletion of strong tones
*H	1	favors epenthetic/boundary low tones

Analysis: unified weighting II

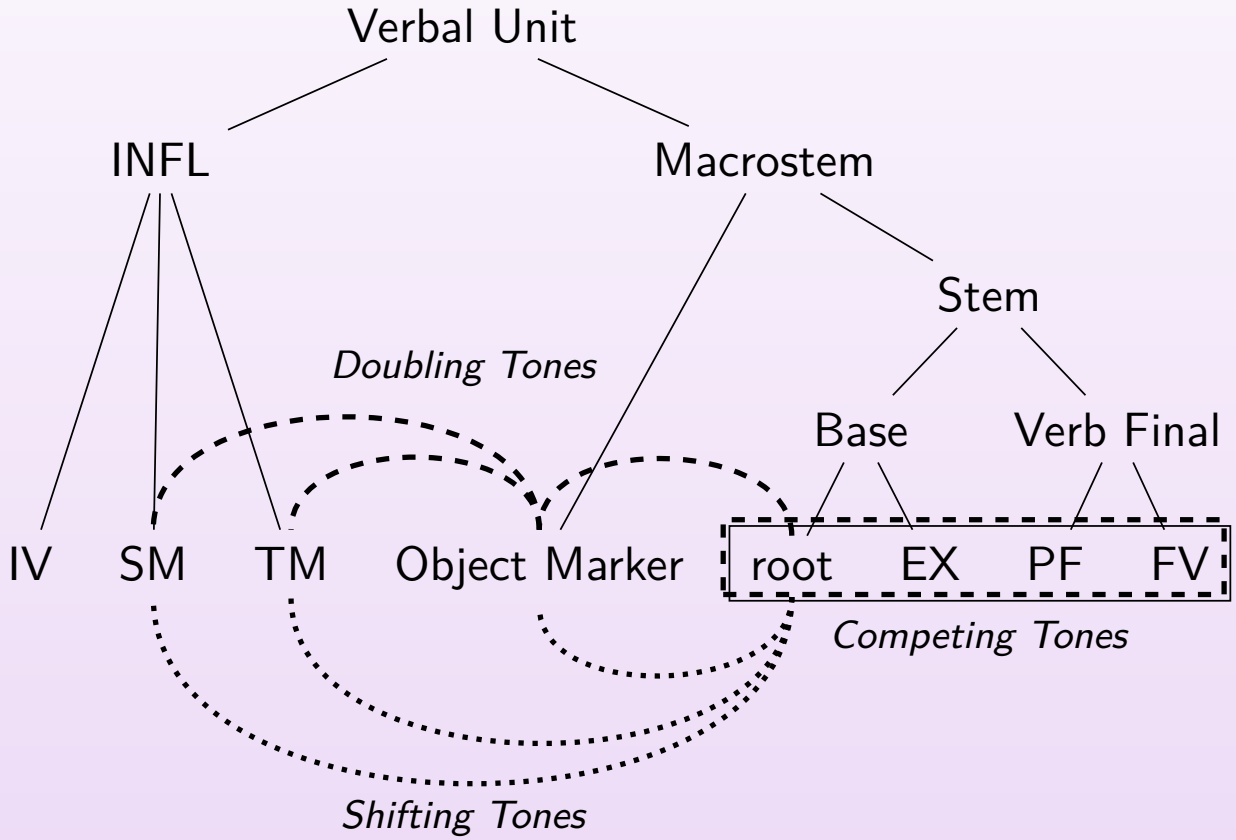
- This grammar predicts different outcomes for different underlying tones at different layers.

(28) Tone URs and their contexts

UR	Context	Resulting process
T_x	any layer	none
$T_{a\leq 1}$	any layer	tone shifting
$T_{a>1}$	word layer	tone doubling
$T_{a\leq 1}$ $T_{a\leq 1}$	phrasal layer	tone competition

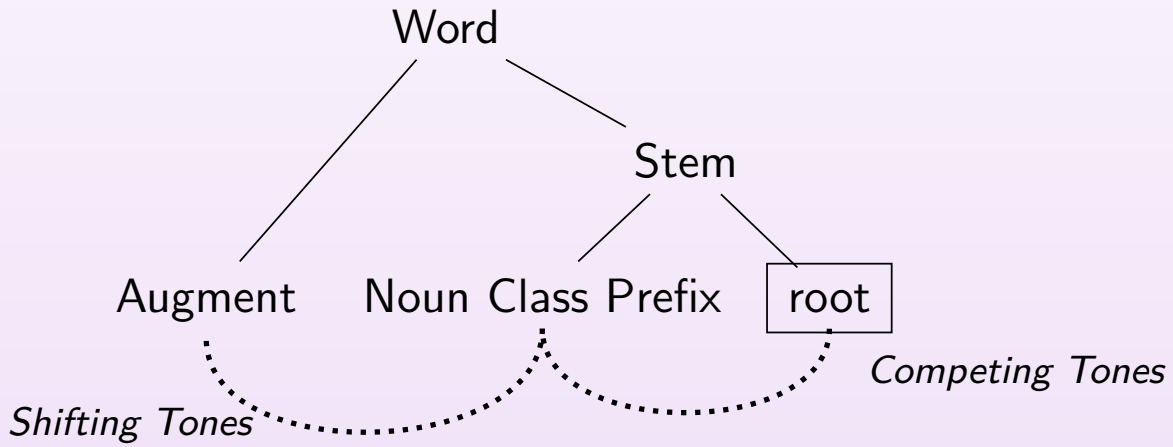
Analysis: complexities revisited I

(29) Morphological structure of Kinande verbs (Black, 1995)



Analysis: complexities revisited II

(30) Morphological structure of Kinande nouns (Mutaka, 1994, 212)



Medium Domain Hypothesis

Medium Domain Hypothesis I

- Against the background of the Strong Domain Hypothesis (Kiparsky, 1982, 1985) and the Weak Domain Hypothesis (Mohanan, 1989), the predictions of Harmonic Layer Theory can be summarized as the Medium Domain Hypothesis.
- Domain-specific processes have to be applicable at a continous stretch of morphophonological layer that starts at the earliest layer or ends at the latest layer.
- This prediction bears some similarity to the *ABA generalization in morphology (Wiese, 2008; Bobaljik, 2012).

(31) Medium Domain Hypothesis
A domain-specific process can neither be applicable nor not be applicable in a discontinous stretch of morphophonological layers.

Medium Domain Hypothesis II

(32) Comparison of hypotheses on domain-specific processes

applicability	Strong DH	Medium DH	Weak DH
YNN	✔	✔	✔
NYN	✖	✖	✔
YYN	✔	✔	✔
NNY	✖	✔	✔
YNY	✖	✖	✖
NYY	✖	✔	✔

Multiple Subgrammar approaches

Multiple subgrammar approaches to Kinande tone

- Mutaka (1994) posits four stratal subgrammars with several domain-specific rules scattered among them along with morpheme-specific exceptional triggering of so called 'subroutine' rules.
- Black (1995) posits two domain-specific rules for shifting and doubling tones and four morpheme-specific rules for non-shifting and non-doubling ones.
- Jones (2014) proposes an analysis using six phonological subgrammars with different rankings for doubling and shifting tones and two sets of morpheme-specific constraints for grammatical tone on verbs and phrasal tone.

Conclusion

Conclusion

- Previous analyses posited several subgrammars to account for the complexities of Kinande tone.
- I have shown that Harmonic Layer Theory provides a unified analysis by equipping tones with gradient underlying activity which changes across morphophonological layers.
- A possible prediction is the Medium Domain Hypothesis, which excludes any process from being applicable or non-applicable in a discontinuous stretch of strata.

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Harmonic Layers in Kinande grammatical tone

Grammatical tone in Kinande provides additional challenges:

- a tonal paradigm with at least 8 different patterns,
- tone doubling on object markers,
- exceptional behaviour of some extensions and prefixes (ignored here).

Object marker tone doubling I

- Object marker tone doubling follows from the constraint weighting, if we assume that object markers are equipped with pure activation
- Pure activation is associated with a morphological exponent but not with a phonological object on its tier (cf. Goldrick & Smolensky, 2016).
- Pure activation is not allowed in surface representations and therefore forced to fuse with lexical tone.
- This fusion would lead to a tone with an activity of greater than on, which in turn results in splitting of tones.
- Therefore, any tone that docks onto an object marker will split unto a preceding TBU.

Object marker tone doubling II

(33) Pure activation on OM triggers H splitting

I: e ri mu hum a	*Overa ∞	Alter 40	Max 12	*H 1	$\mathcal{H}$=
☞a. $L_{0.4}$ $H_{0.6}$ $H_{0.5}$ $L_{0.4}$ $L_{0.4}$ — e ri mu hum a				-1.1	-1.1
b. $L_{0.4}$ $L_{0.4}$ $H_{1.1}$ $L_{0.4}$ $L_{0.4}$ — e ri mu hum a	-0.1			-1.1	-∞
c. $L_{0.4}$ $L_{0.4}$ $H_{0.6}$ $H_{0.5}$ $L_{0.4}$ — e ri mu hum a		-0.5		-1.1	-21.1
d. $L_{0.4}$ $L_{0.4}$ $H_{0.6}$ $L_{0.4}$ $L_{0.4}$ — e ri mu hum a			-0.5	-0.6	-6.6

Grammatical tone paradigm I

- Verbal roots fall in two classes depending on their ability to trigger a high tone on the preceding prefix.
- Additionally, different grammatical forms differ in their tonal melodies.
- Simple tone forms generally act like nouns in that no additional grammatical tones show up.
- In other forms, up to two binary high tone spans show up, on the penultimate and antepenultimate TBU and/or on the root and an adjacent TBU.
- Remote past forms have only low tones.
- Imperative tones differ from complex tones in that doubling only applies once.
- Forms with grammatical tones are stable in phrasal contexts.

Grammatical tone paradigm II

(34) Grammatical tone paradigm for verbs (Black, 1995; Jones, 2014)

	Ⓗ ('to send')				no Ⓗ ('to hit')				Phr.
Simple (INF)	a. è-**rí**-		tùm	-ìr-à	g. è-rì-		hùm	-ìr-à	
Complex (PST)	b. tù-à-		tùm	**-ír-á**-à	h. tù-**á**-		**húm**	-ìr-à-à	stable
Remote PST	c. tù-à-		tùm	-ìr-à-à	i. tù-à-		hùm	-ìr-à-à	stable
IMP	b. tù-à-		tùm	**-ír-á**-à	h. tù-**á**-		**húm**	-ìr-à-à	stable?
Simple+OM	d. è-**rí**-	**mú**-	tùm	-à	j. è-rì-	mù-	hùm	-à	
Complex+OM	e. tù-**á**-	**mú**-	tùm	**-ír-á**-à	k. tu-a-	**mú**-	**húm**	-ìr-à-à	stable
Remote+OM	f. tù-à-	mù-	tùm	-à-à	l. tù-à-	mù-	hùm	-à-à	stable
IMP + OM	a. **tú**-	**mú**-	tùm	-ìr-à-è	b. tù-	**mú**-	**húm**	-ìr-à-è	stable?
	prefixes	OM	root	suffixes	prefixes	OM	root	suffixes	

Grammatical tone paradigm III

- This can be analyzed in the present analysis if grammatical tones consist of tonal circumfixes (Trommer, 2022).
- Complex tone has to include a high tone with an activity >1 flanked by low tones that account for the position of the binary high tone span.
- Analogously, remote tone is marked by a low tone circumfix that blocks any intervening high tones.
- As a slight modification of the present account, verbs with a floating high tone have to be equipped with an associated low tone in order to allow for correct positioning.
- Imperative tones differ in that they include two high tones, which can block double doubling by complete overwriting.

Grammatical tone paradigm IV

(35) Complex tone circumfix, without OM

a. Complex tone circumfix on (H) verb roots

L_1- (H) L -H_2 L_3

→ L_1- ~~(H)~~ L -H_2 ~~L_3~~

→ L_1- L -H_1 H_1 L_1

b. Complex tone on toneless verb roots

L_1- ∅ -H_2 L_3

→ L_1- -H_2 L_3

→ ~~L_1~~- -H_1 H_1 L_1 L_1 L_1

c. Complex tone on (H) verb roots with OM

L_1- $_1$- (H) L -H_2 L_3

→ ~~L_1~~- $_1$- (H) L -H_2 ~~L_3~~

→ H_1 H_1- L -H_1 H_1 L_1

Grammatical tone paradigm V

(36) Overwriting blocks double doubling in IMP+OM

L_1 H_1- $_1$ Ⓗ L -H_1 L_3

→ ~~L_1~~- $_1$- H_1- ~~Ⓗ~~~~L~~ -H_1 ~~L_3~~

→ H_1H_1- L -$H_1H_1L_1$