PARALLELISM AND PLANES IN OPTIMALITY THEORY: EVIDENCE FROM AFAR

by

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ABSTRACT

In this dissertation I show that the representations in Optimality Theory must be extended to allow multiple planes. The variable-position affixes in Afar occur as either prefixes or suffixes depending on the initial segment of the verb root. If the root begins with [i], [e(e)], [o(o)] or [u], the affix is a prefix (e.g., *t-okm-e#* (2-eat-perf) 'You (sg.) ate'); if it begins with [a] or a consonant, the affix is a suffix (e.g., *rab-t-e#* (die-2-perf) 'You died'). Additionally, plural not only appears as a prefix or a suffix, but when a suffix it can either precede or follow aspect (*rab-n-e#* (die-pl-perf) 'I died' vs. *rab-e#-n* (die-perf-pl) 'They died'). A parallel model in Optimality Theory is unable to account for the different order of affixes in forms such as *rab-n-e#* vs. *rab-e#-n*. The Multiplanar Model, which posits that output representations consist not only of a word plane but also an affix plane is able to account for this data. The representations for the two forms are: [y-e-n], [rab-e-n] and [n-e], [rab-n-e]. In the first case, plural is specified as the rightmost morpheme by morphological constraints. Even though /y/, the third person marker, cannot surface on the word plane, it satisfies ONSET on the affix plane. This contrasts with the second case, where ONSET, being higher ranked than PLURAL (R), requires that plural occurs to the left of aspect to fill the onset position on the affix plane. I then show a serial monoplanar model can also account for this data. Finally, I compare the serial and multiplanar models, arguing that phonological evidence supports the Multiplanar Model.

1. INTRODUCTION

Parallelism of constraint satisfaction has been argued to be a central, if not crucial, property of Optimality Theory (Prince & Smollensky 1993, McCarthy & Prince 1993, etc.). Here, however, I show that the adoption of parallelism in Optimality Theory (OT) requires the use of multiplanar representations. Specifically, this work examines affixes in Afar whose position in a string is variable. An example of this is shown with the second person marker in (1) which appears as a prefix on some verbs and as a suffix on others.

(1) Variable-position Affixes

ookom ('win')	*nak* ('drink milk')
t-ookom-ē	nak-**t**-ē
2-win-perfect [B123]	drink milk-2-perfect [B125]
You (sg.) won.	*She drank milk.*

In this thesis I suggest that these affixes surface alternately as prefixes or suffixes in order to satisfy syllabification constraints in the language. Multiplanar representations account for the differing order of morphemes in forms such as those in (1) and also to account for contrasts such as *y-uktub-e-n* (3-read-aspect-plural [B123]) vs. *nak-n-e* ((drink milk-plural-aspect) [B125]). In particular, note that aspect (*e*) precedes plural (*n*) in the former verb but follows it in the latter. The analysis of these is problematic in Optimality Theory. The constraint

hierarchy for *y-uktub-e-n* must require that plural (*n*) be the rightmost morpheme whereas the constraint hierarchy for *nak-n-e* must require that aspect (*e*) be the rightmost morpheme. This phenomenon can be accounted for in a nonlinear Multiplanar Model where a set of affixes occupies its own plane. The idea is that the affixes are aligned by morphological constraints in the order shown in (2).

(2) Affix order from morphological constraints

a. person - aspect - plural: **y-e-n**
b. aspect - plural: **e-n**

Higher ranked ONSET, however, overrides the order of aspect and plural and forces plural leftmost to provide an onset just in case the affix plane would otherwise not have an onset.

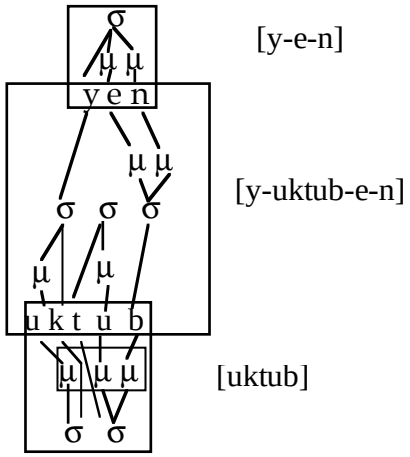
(3) Affix order with ONSET ranked above morphological constraints

a. person - aspect - plural: **[y-e-n]**
b. plural - aspect: **[n-e]**

The multiplanar analysis allows plural to precede aspect just in case an onset is needed on the affix plane. For *y-uktub-e-n*, a representation like that in (4) is proposed, where the person marker, [y],

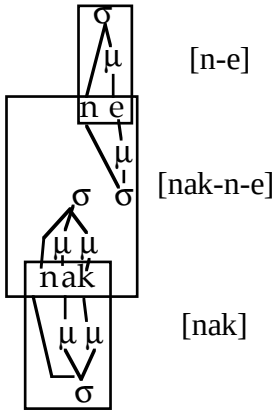
serves as the onset to both the affix plane and the word plane, and the order of the relevant affixes is that aspect precedes plural.

(4) y-uktub-e-n
3-write-perf-pl
They wrote. [B123]



In [rab-n-e], the plural, [n], surfaces preceding aspect in order to fill the required onset position on the affix plane. In other words, the order is forced by a higher-ranked phonological constraint to be [n-e] instead of [e-n].

(5) nak-n-e
drink milk-pl-perf
We drank milk. [B125]



This analysis is important because it is the first to show that OT requires three-dimensional representations. The emphasis in OT has been to move away from the use of input representations to account for linguistic generalizations (McCarthy 1995, Hammond 1995, etc.), e.g., the move away from CV tiers in nonconcatenative languages (Gafos 1995). Here I propose that the necessary representations are indeed found in the output, not in the input.

The layout of this thesis is as follows. In Chapter 1 I provide the empirical and theoretical frameworks. First I introduce Afar and its phonology and morphology. I then introduce Optimality Theory and its basic tenets, along with a discussion of Correspondence Theory and Generalized Alignment.

In Chapter 2 I analyze two prosodic phonological phenomena which play a role in the analysis of the variable-position affixes. First, as I argue that the variable-position affixes occur in various positions due to syllabification constraints, specifically ONSET and constraints which require CVX syllable structure, I motivate the constraints needed to account for syllabification. I argue that the location of variable-position affixes is due not only to morphological constraints, but to the fact that these affixes can provide onsets for syllables that would otherwise violate ONSET. I then analyze a phenomenon where [y]s do not occur after consonants. This is important to the analysis of the variable-position affixes because one of these affixes is a /y/ and its distribution is different from that of the other variable-position affixes.

In Chapter 3 I turn to an analysis of the variable-position affixes themselves. I argue that an OT model assuming parallelism of constraint satisfaction requires that Afar have at least three planes: one for roots, one for affixes and one for words.

In Chapter 4 I show the alternative within OT is to posit a model that consists of at least two levels. I then show the Multiplanar Model is preferable. First, it makes strong predictions about where the effects of phonological constraints are observed. These predictions are consistent with the data from Afar. Second, it is able to capture the fact

that consonant co–occurrence constraints hold not only within roots but across affixes as well. Finally, it does not suffer from theoretical defects found in the Levels Model: the planes are morphologically defined and therefore could maximally have one level per morpheme. The Levels Model is not defined morphologically, however, and there is no a priori reason there could not be a different level for each constraint, making it a serial model. Finally, the Levels Model requires additional unmotivated constraints not required in the planar model.

Background

In the following sections I introduce the phonology and morphology of Afar.

Afar

Afar is an East Cushitic language spoken in Ethiopia, Djibouti and Eritrea. Greenberg (1963) classifies East Cushitic as a sister family to Semitic, Berber, Chadic and Egyptain. Hayward (1973) divides East Cushitic into two groups of languages: Highland East Cushitic and Lowland East Cushitic. Among the lowland East Cushitic languages are Afar, Saho, Oromo (Galla) and Somali.

There are three major sources of data on Afar. The first is Hayward's dissertation (1973), a tagmemic analysis of Afar. Second is

Bliese's grammar (1981) of Afar's phonology, morphology and syntax. Finally, there is Parker & Hayward's dictionary (1986).

Phonemics

In this section I introduce the basic sound system of Afar. First I illustrate the consonant and vowel inventories, then I discuss restrictions on the vowel and consonant qualities found in verb roots.[1]

Sounds

Afar has ten vowels: [a], [i], [e], [u], [o] and their long counterparts [aa], [ii], [ee], [uu] and [oo] as shown in (6).[2]

(6) The Vowels of Afar

a. [a]	abē *I did*. [B110]	[aa]	aalat *instrument, tool* [PH27]
b. [i]	idfiqē *I paid.* [PH133]	[ii]	ifiilē *I picked up tiny things one by one.* [PH133]
c. [e]	efqē *I gave a drink to, irrigated.* [PH95]	[ee]	eexegē *I knew, acknowledged* [PH95]

[1]All data in this dissertation have been brought into alignment with Parker and Hayward's (1986) transcription system. I have chosen this system because it was adopted as the official orthography of the Afar in 1986 (Bliese, personal communication).

[2] The macron in these and other examples represents a high level tone.

d. [u]	[uu]	
uqrufē	uduurē	
I rested. [PH201]	*I returned.* [PH202]	
e. [o]	[oo]	
okmē	oobokē	
I ate. [B110]	*I was born.* [PH177]	

Length in vowels is contrastive and is used to distinguish word meanings as shown in (7).

(7) Contrastive Vowel Length

a.	bāxa	baāxa
	son [PH10]	*clean/smooth place for sitting down* [PH10]
b.	kutā	kuutā
	bitch [PH10]	*dogs* [PH10]

Afar has the 17 consonants shown in (8). Most of the symbols are straightforward, but a few deserve further mention here. According to Parker & Hayward (1986), [x] "is a voiced post-alveolar plosive" (represented in the IPA by [ɖ̟]), though it may occur as a flap when it occurs intervocalically (Parker & Hayward 1986:214). [q] and [c] are both pharyngeal fricatives: [q] is voiced and [c] is voiceless. The IPA symbols for these are [ʕ] and [ħ] respectively.

(8) Afar Consonants

		Bila-bial	Labio-dental	Dental	Alve-olar	Retro-flex	Palatal	Velar	Pharyn-geal	Glottal
Stop	*-vc*			t				k		
	+vc	b		d		x		g		
Nasal		m		n						
Fricative	*-vc*		f		s				c	h
	+vc								q	
Lateral				l						
Flapped /Rolled						r				
Glide		w					y			

All of these can appear singularly or as part of a geminate (Parker and Hayward 1986:215), though not all occur with equal frequency and in all parts of speech. As was the case with vowels, length in consonants is contrastive. Examples of single and geminate consonants are illustrated in (9).

(9) The Consonants of Afar

[b]
bakaarē
be thirsty [PH66]

[bb]
gabbatē
test, tempt [PH107]

[m]
meemē
drop rain, shower [PH167]

[mm]
sammiyē
scrape off, skim off [PH187]

[w]

duwē
herd, tend a flock [PH88]

[ww]

hawwasuusē
keep watch over [PH120]

[f]

fiikē
sweep, scrape [PH102]

[ff]

efferē
be unable [PH95]

[t]

tufē
spit [PH200]

[tt]

huntutturē
walk steadily [PH122]

[d]

daadē
enter into a trance state as when a medium utters predictions [PH76]

[dd]

duddubē
swell [PH87]

[n]

nookē
settle on haunches [PH175]

[nn]

itminniyē
hope, plan [PH139]

[l]

lokē
make a dough [PH156]

[ll]

kallacē
beg, plead [PH143]

[s]

saadē
become verdant after drought [PH183]

[ss]

esserē
ask, beg [PH97]

[x]

gaaxē
guard, protect [PH106]

[xx]

koxxoxxiyē
be haughty, proud [PH149]

[r]

ruubē
send [PH183]

[rr]

errē
go with herds from one place to another [PH97]

[y]	[yy]
yiqē *twist dried sisal fibers into a cord [PH213]*	engeyyē *move, swing* [PH96]
[k]	[kk]
kuulē *travel by night* [PH152]	ekkē *become, happen* [PH95]
[g]	[gg]
guurē *move away from one's gub* [PH118]	liggayē *go without supper, be supperless* [PH155]
[c]	[cc]
doocē *skinning an animal by thrusting hands between flesh and skin* [PH86]	saccaara *large wooden box* [PH186]
[q]	[qq]
qeegē *lean, lean over* [PH59]	laqqinnoowē *become hot* [PH153]
[h]	[hh]
hiqē *crumble off, dry off* [PH121]	sahhaloyisē *make easy* [PH186]

Co-occurrence Restrictions

Not all of the sounds discussed above can co-occur with each other in verb roots. There are co-occurrence restrictions both on the quality of vowels within a root and on the quality of consonants within a root. I discuss each of these in turn.

Vowel Quality

Not all vowel qualities may co-occur within a root (Bliese 1981:218). The vowel qualities within Afar are subject to certain restrictions, detailed below. Identical vowels may co-occur.

(10) Identical Vowel Qualities in Roots

[u]

uqbud *worship* [PH201]	ubbudud *cover oneself* [PH202]	ucussul *completely measure in cubits from head to toe* [PH203]

[i]

iribbis *disturb, make a noise* [PH137]	ikcin *like, love, be pleased with* [PH134]	itqissif *feel sad,* [PH138] *become sorry about*

[o]

odoor *revolve, spin* [PH176]	kormodood *bulge, swell* [PH150]	sonkoxox *flexing the stomach muscles* [PH193]

[e]

ekeelef *contradict, oppose* [PH95]	ebeebex *catch up with* [PH94]	eteeq *obey* [PH97]

[a]

dabbaqaan *be in labour* [PH113]	qambaxxaag *do sthng in a hurry* [PH103]	magalgaal *mediate* [PH168]

The "roots" in these examples are taken from the entries for the first person singular perfect form from Parker & Hayward's dictionary (1986). Because of ablaut processes which change the quality of root vowels it is necessary to use a form in which the vowels are the same as they are in the input. For this reason, Parker & Hayward chose the first person singular perfect. The vowel qualities in these forms are identical to the vowel qualities in the input. The only affix is an [e(e)] suffix which marks perfect aspect. The roots presented here are Parker & Hayward's entries without the perfect suffix. These forms may not represent actual inputs, however, as there is a phenomenon in Afar where the second vowel of the word does not surface when it occurs in a sequence of three light syllables (i.e., wager-n-ē (reconcile-pl-perf: *We reconciled*) vs. wagr-ē (reconcile-perf: *I reconciled*) [Z14]). For discussion of second vowel syncope, see (Bliese 1981, Parker & Hayward 1986, McCarthy 1986, and Zoll 1993). In the roots listed below, the absence of vowels in certain positions may be due to the vowel syncope phenomenon, so the roots as listed here may not exactly coincide with the input form. This is not relevant to the points being made here, however.

Differing vowel qualities may also co–occur within a root; however, one vowel quality must be [a(a)] and there can be no more

than one other vowel quality in the root (Parker & Hayward 1986:215; Bliese 1981:218).[3] So, for example, the forms in (11) are not be possible roots.

(11) Impossible Roots in Afar

*CaCeCoC	*CiCeC
*CuCiCaC	*CiCuC
*CeCaCuC	*CoCuC

Examples of possible roots are given in (12).

(12) Non-identical Vowel Qualities Within a Root

[i...a] ilaaq *deprecate* [PH135]	[a...i] maaqil *neglect* [PH157]
liggay *go without supper, be supperless* [PH155]	qaniinik *run fast* [PH56]
[u...a] ruffaak *knead* [PH183]	[a...u] nakur *be fed up* [PH174]
ugguqaaw *become mouldy* [PH203]	laqaymuum *wilt, wither ND* [PH153]

[3]There are some exceptions to this in that there are a few roots with two vowels neither of which is /a/. These are not discussed here. I have found no morphologically-simplex roots with more than two vowel qualities. Also, Hayward asserts that non–low vowels can co-occur with each other but they must agree in backness within a morpheme. (Hayward 1973:68). Hayward provides the following examples: *toobuy* (no gloss given) and *beeteetik* 'rush, swing somebody off their feet'.

[o...a]	[a...o]
robbaaq *bounce sthg* [PH182]	saacoor *stroke* [PH184]
boolaat *be inferior, be weak* [PH73]	balahoor *protect from catastrophe* [PH67]
[e...a]	[a...e]
fellaaq *split* [PH102]	dareem *suspect* [PH81]
seelab *be a eunuch* [PH190]	hambareer *covet, desire, long for* [PH119]

Consonants

There are restrictions on which consonants may co-occur within a root as well. For example, if an [l] is found in a root, an [r] will not be found in the same root. If a [k] is found in a root, a [g] will not be found in that same root. "While we may find literals [roots] of the sort /qaxax-, maxcax-, xaxxib-; daad-, deedal-, tatr-, itqit-, tummaat-, tittaa/ etc., we do not find morphs [roots] with a form such as */dux-, texin-, tamad-, dafat- / etc." (Hayward 1973:68-69). Parker & Hayward characterize these restrictions as follows. "Within any morpheme all consonants are either identical or non–homorganic, where homorganicity is defined in terms of the following four sets: (i) the liquids l, r; (ii) the gutturals q, c, h; (iii) the velars g, k; (iv) the coronal

stops t, d, x" (Parker & Hayward 1986:215).[4] In other words, within a root, only one quality from a set of consonants may be found, where a set refers to one of the four phonetic groupings in (13).[5]

(13) Consonant Co-occurrence Restrictions

a.	Coronal Stops:	d, t, x
b.	Liquids:	l, r
c.	Dorsal Stops:	k, g
d.	Pharyngeals/Glottals:	c, q, h

All other consonants, listed in (14), are free to occur with each other or with any of the consonants in (13).

(14) Unrestricted Consonants

b, m, w, f, n, s, y

Examples of allowable root sequences are illustrated in Figure (15).

(15) Examples of Allowable Consonant Sequences

[b]

[...b...dd...l]	[...b...k...n]	[...b...r...k]
ibiddil	ubkun	ebeerek
change [PH132]	*bury, plant* [PH202]	*surrender* [PH94]

[4]Hayward (1973) also includes a fifth set, /b, f, w/.

[5] There are a small number of exceptions to this, but these are not discussed here.

[c]

[...c...b...s]
icbis
imprison [PH134]

[...c...d...r]
icdir
spend the evening [PH134]

[...c...k...m]
uckum
judge [PH203]

[d]

[...d...l...m]
udlum
be unjust towards sb [PH202]

[...d...r...s]
udrus
learn [PH202]

[...d...d...r]
adaadar
be in a harassed state [PH30]

[f]

[...f...d...g]
ifdig
release [PH133]

[...f...t...n]
iftin
make trouble between people [PH134]

[...f...l...k...q]
ifilkiq
remove scales (of fish) [PH134]

[g]

[...g...b...d]
igibd
be difficult for, be hard on [PH134]

[...g...n...q]
igniq
lose hope, be fed up [PH134]

[...gg...q...w]
ugguqaaw
become mouldy [PH203]

[h]

[h...m...b...r...r]
hambareer
covet [PH119]

[h...b...b...g...t]
habuubugut
blaze [PH119]

[...h...l...l]
ihlil
become close friends... [PH134]

[k]

[...k...c...n]
ikcin
like, love, be pleased with [PH134]

[...k...t...b]
uktub
write [PH203]

[...k...l...f]
ekeelef
contradict [PH95]

[l]

[...ll...t]	[...l...h...l]	[l...b...t...nn]
illeet	olhol	labaatānna
get sore from the rubbing of a pack/rope [PH135]	*be skinny* [PH176]	*twenty* [PH153]

[m]

[...mm...n]	[...m...rr...q]	[m...n...k...x...x]
ummuun	umurruq	munkuxuux
appear as a speck in the distance [PH204]	*finish* [PH204]	*be sleepless* [PH171]

[n]

[...n...g]	[n...k...r]	[...n...d...f...f...l]
eneg	nakur	ondofoofol
fill [PH96]	*be fed up* [PH174]	*be made to stumble* [PH176]

[q]

[...q...b...d]	[...q...gg...b]	[...q...kk...n]
uqbud	iqiggib	iqikkin
worship [PH201]	*be amazed* [PH132]	*attempt, try* [PH132]

[r]

[...r...bb...s]	[...r...g...d]	[...r...q...n]
iribbis	irgid	orqon
disturb [PH137]	*dance in line (men)* [PH137]	*have honey/butter smeared on the mouth* [PH177]

[s]

[...ss..k..t]	[...s...g...r...r...q]	[...s...k...mm...q]
ossokoot	esgereereq	uskummuq
appreciate, be happy with [PH178]	*lay out a dead person* [PH97]	*pack in* [PH206]

[t]

[...t...c...rr...r]	[...t...l...k]	[...t...q...tt...r]
itcirrir	utluk	itqittir
be freed [PH139]	*lose the way* [PH206]	*be perfumed* [PH139]

[w]

[...w...d...n]	[w...g...s...t]	[...w...kk...l]
uwdin	wugsut	iwikkil
weigh [PH206]	*retch* [PH212]	*hand oneself over to God* [PH139]

[x]

[...x...gg...l]	[...x...m...q]	[x...g...r]
ixiggil	ixmiq	xagur
milk [PH133]	*become sure* [PH133]	*look after* [PH90]

[y]

[...y...s]	[...y...n...t]	[y...b...r]
eyes	uynaat	yabar
improve [PH98]	*become wet* [PH206]	*use carefully* [PH212]

In this section I have introduced the phonemic inventory of Afar. Both vowels and consonants exhibit short and geminate versions. Each also has restrictions on the qualities that can be found in verb roots. Vowels within roots must be identical or a single quality may be found co–occurring with /a(a)/. Two consonants may not be from the same class, where the four classes are as follows: 1. d, t, x; 2. l, r; 3. k, g; and 4. c, q, h. Both vowel and consonant restrictions are addressed again in Chapter 4 when co–occurrence restrictions in root

and affix planes are discussed and in Chapter 3 when the lack of an onset on [a]-initial words is explained.

Morphology

In this section I introduce the reader to the morphology of Afar. First, I discuss the general morphology. Second, I illustrate the concept of morphological classes proposed by previous scholars of Afar.

General Morphology

In indicative sentences, the matrix verb must be marked for person, aspect and number. In the third person, it must also be marked for gender. A representative paradigm for number and gender in the perfect aspect is shown in (16). Additionally, these forms all end in a clitic, *-h*, because, according to Parker & Hayward, "all affirmative forms of these paradigms terminate in the clitic *-h*, which indicates that the forms in question would appear in clauses in which none of the predicate arguments is focused" (Parker & Hayward 1981:279).[6]

[6] Throughout this dissertation a 'V' in a gloss indicates an epenthetic vowel. The final [h] in these examples is discussed further in Chapter 3.

(16) Number and Gender in the Perfect

fak-ē I opened/have opened [PH263]

1s	fak-e-h open-perf-focus *I opened*	1p	fak-n-e-h open-pl-perf-focus *We opened*
2s	fak-t-e-h open-2-perf-focus *You (sg.) opened*	2p	fak-t-ee-n-i-h open-2-perf-V-focus *You (pl.) opened*
3ms	fak-e-h open-perf-focus *He opened*	3p	fak-ee-n-i-h open-perf-pl-V-focus *They opened*
3fs	fak-t-e-h open-3f-perf-focus *She opened*		

As shown by the forms in (16), the order of morphemes is generally constant, with the exception of plural and aspect, where plural precedes aspect in first person (n-ē) but follows it in second and third person (*ee-n-ī*). In this paradigm the root always occurs leftmost, second person and third feminine (if present) occur next, with aspect following person but preceding plural (except in first person). In other words, the affixes are suffixes, and they generally have the order: person (*t*) - aspect (*e(e)*) - plural (*n*) - focus (*h*). (The differing order of morphemes will be discussed later in this dissertation). Also, throughout this section when a morpheme such as person is discussed, it may exhibit more variation than discussed in this section. For

example, the second person marker may surface as [t] as in the examples above, but it can also surface as [s] as in *bar-is-s-ē* (learn-caus-2-perf: *You taught.* [B130]). Variations such as this, when relevant, are discussed in Chapter 4.

In addition to being marked with person, aspect and plural, Afar verbs may optionally be marked with what Bliese terms "focus" affixes: the intensive, passive, benefactive and causative.[7] These are illustrated in (17a-d) respectively.

(17) "Focus" Affixes in Afar

a. baka-kkaa-r-it-ē (root: bakar)
thirst-intens-root C-benef-perf
I (or he) was very thirsty. [B128]

b. sir-riim-ē
advise-passive-perf
He was advised. [B137]

c. qaad-it-ē
pity-benef-perf
pity for your own benefit [PH244]

d. bar-is-s-ē
learn-caus-2-perf
You taught. [B130]

---

[7] These might also be called derivational affixes. The passive, causative, and benefactive show similar distributional properties to the person and number affixes in that all of these are variable-position affixes. The latter are discussed further in this dissertation; the former are not. For discussion of the former, see (Bliese 1981, Fulmer 1990). Although Bliese refers to these as "focus" affixes, these are different from the *-h* glossed as "focus" in the previous examples. This *-h* is discussed in Chapter 3.

These affixes may occur in different combinations but they all occur inside (i.e., closer to the root) the person, plural and aspect markers.

(18) Affix Order

ged-da-ys-it-t-aa-n-a-m
go-intens-caus-benef-2-impf-pl-V-nom
(do you also want) to go [B139]

All examples thus far have been in the indicative mood. Bliese discusses four other moods: the imperative, jussive, subjunctive, and consultative. I discuss these below.

The consonant-initial imperatives are simply a verb root, as shown in (19), though a long vowel may shorten if it is in the final syllable of the root. "The imperative singular *hay* 'put' may be added for emphasis after either a singular or plural imperative" (Bliese 1981:139).

(19) Singular Consonant-initial Imperatives

āb (hāy)	sō l (hāy)
do [B139]	*stand* [B140]

In vowel-initial verbs, mid vowels (/e(e)/ or /o(o)/) raise. The initial vowel may be [a(a)] or it may be the same as the other root vowels.

(20) Singular Vowel-initial Imperatives

akūm or ukūm (hāy) (root: okom)
eat! [B139]

uxmūm (root: uxumum)
wring! [B140]

The plural imperative is marked by an [a] suffixed to the singular imperative.[8]

(21) Plural Imperatives

āb-a (hāy)	sōol-a (hāy)
do-pl	stand-pl
do! [B139]	*stand!* [B140]

Jussives have a suffixed *-ay* and penultimate stress. They are marked for person, number and tense.

---

[8] Bliese (1981:139) also claims that all long vowels in vowel-initial singular imperatives shorten if they are not stressed. I have not found any data that can confirm or refute this. In the rest of this section I talk only about the morphology of consonant-initial verbs. In the next section I discuss some of the morphological differences between vowel-initial and consonant-initial verbs.

(22) Jussives

kat-t-ōo-n-ay	bar-īs-ay
leave-2-pres-pl-jussive	learn-caus-jussive
May you leave (it) [B142]	*Let me (or him) teach* [B143]

The subjunctive is typically found in subordinate clauses but it is also found in "matrix sentences meaning 'may' or 'wish' " (Bliese 1981:144). It is marked with a suffixed *-u* and penultimate stress. Like the jussive, it is marked for person, number and tense.

(23) Subjunctives

xaan-t-ōo-n-u	gūf-t-u
buy-2-pres-pl-subj	arrive-2,3f-subj
May you (pl) buy it [B144]	*May you (or she) arrive* [B144]

The "[c]onsultative is a question form of mood used only in matrix sentences of the first person with the meaning 'Shall I' or 'Shall we'" (Bliese 1981:146). It is marked with a final long [òò] which has a falling tone across both moras. I mark this with an grave accent on each mora.

(24) Consultative

ab-n- òò	sool- òò
do-pl-consul	stand-consul
Shall we do (it)? [B146]	*Shall I stand?* [B146]

As shown in this section, Afar verbs must be marked for mood, person, number, aspect and in the third person, for gender.

Verb Classes

Additionally, different groups of verbs exhibit different morphology and Parker & Hayward divide verbs into four classes to reflect this. The four classes of verbs are: statives, compounds, vowel-initial regular verbs and consonant-initial regular verbs.[9] Although this dissertation focuses only on the latter two classes of verbs, I first introduce the former two classes for completeness.

The statives are adjectival verbs, corresponding to adjectives in many languages.

(25) Statives

meqe 'I am good' [PH268][10]

1s	miqiy-o-h good-pres-focus *I am good*	1p	miqi-n-o-h good-pl-pres-focus *We are good*
2s	miqi-t-o-h good-2-pres-focus *You (sg.) are good*	2p	miqit-oo-n-u-h good-pres-pl-V-focus *You (pl.) are good*

[9] Bliese (1981:155-161) makes a similar classification of verbs although he does not talk about compounds as a separate class.

[10] Parker and Hayward (1986:281, fn. 23) state that the underlying root vowel is /e/ and that some speakers use an [e(e)] throughout the word. The raising by some speakers is morphological as it does not occur with all similar verbs.

3ms	meq-e-h good-pres-focus *He is good*	3p	moq-oo-n-u-h good-pres-pl-V-focus *They are good*
3fs	meq-e-h good-pres-focus *She is good*		

Compounds are formed by combining uninflected verbal forms with semantic content with either of two different inflected verbal forms with no semantic content. The form *exce* is used with transitive verbs and *hee* with intransitive verbs. Examples of compound verbs are shown in (26).

(26) Compounds *rūffa-exce* 'to be happy/joyful'[11] [PH270]

1s	rūffa-exceh	1p	rūffa-inneh
2s	rūffa-inteh	2p	rūffa-inteenih
3ms	rūffa-iyyeh	3p	rūffa-iyyeenih
3fs	rūffa-inteh		

Neither of these classes of verbs exhibit the variable-position phenomenon addressed here, and they are not discussed further. Instead, this dissertation focuses on the two classes of regular verbs.

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[11]"In verbs like *rúffa-exce* it is usual for the first vowel of the compounding verb to undergo assimilation to the preceding [a] vowel...and for DVR [Double Vowel Reduction <LF: closed-syllable vowel shortening>] to apply, so that in normal speech forms such as *rúffa-exceh* and *rúffa-inteh* would be pronounced *rúff[a]xceh* and *rúff[a]nteh*

The two classes of regular verbs are distinguished from each other by their phonological form and their morphology. Verbs containing roots beginning with [e], [i], [o] and [u] belong to a single class which I will refer to as vowel-initial verbs, whereas verbs containing roots beginning with [a] or a consonant also form a single class, which I refer to as consonant-initial verbs.[12] In the remainder of this section I discuss some of the differences between these two classes. I show that vowel-initial verbs inflect for aspect and mood in part through ablaut and in part through prefixes, whereas consonant-initial verbs inflect for aspect and mood with suffixes. First I discuss the imperfect which exhibits ablaut and suffixes in vowel-initial verbs but only suffixes in consonant-initial verbs. Second, I illustrate the subjunctive, which is similar to the imperfect but differs in that the same suffix occurs on both vowel-initial verbs and consonant-initial verbs, while only vowel-initial verbs exhibit ablaut.

In consonant-initial verbs the imperfect is formed with an [a(a)] suffix which shortens in closed syllables and in word–final position.[13]

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respectively" (Parker & Hayward 1986:281).

[12] I discuss the reason that [a] groups with consonants in Chapter 3.

[13] Closed-syllable vowel shortening and word-final vowel shortening are discussed in Chapter 2.

(27) Consonant-initial Verbs: IMPERFECT

a.	rab-aa-n-ā die-impf-pl-focus *You die* [B114]	b.	digr-ā play-impf *I play* [B114]
c.	kaql-a-n wash-impf-pl *They wash* [B123]	d.	mool-ā shave-impf *I shave* [FM9]

In vowel-initial verbs, however, there is no [a(a)] suffixed to the root. Rather, an [e(e)] is suffixed to the root, the first root vowel becomes [(a)a], and any mid vowels in the root raise, with other vowels unchanged.[14]

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[14]In the glosses in (28), impf/verb indicates that the first vowel of the root is [a(a)] in the imperfect and -impf- refers to the suffixed [e(e)] that also appears in the imperfect. When the input vowels of a vowel-initial root are subject to ablaut and/or raising I list the underlying root in parentheses to the right of the example. Like Parker and Hayward, as the quality of the vowels are unpredictable in the perfect, I assume the root in the perfect is the input root except that it may be missing a vowel due to second vowel syncope as discussed earlier in this chapter. Also, there is some dispute as to the exact characterization of the imperfect. Mahaffey says that in the imperfect only root-internal mid front vowels raise. I do not have the data to prove him right or wrong as all of the examples I have found of root-internal mid vowels are front vowels.

Mahaffey lists the verb root in (146) as having a short vowel in the initial syllable (emenē) (1952:10).

According to Parker & Hayward, the imperfect for vowel-initial verbs always changes the first vowel to [a]. They assert that the other vowels of the stem may become [a(a)], or may stay the same (Parker & Hayward:1986:253). For Bliese, Parker & Hayward and Mahaffey, however, there is an [e(e)] suffixed to vowel-initial verbs and minimally, the first vowel changes to [a(a)]. Also, for all of the authors, consonant-initial verbs are marked for the imperfect by suffixing [a(a)].

perfect	imperfect	gloss	source
y-okm-e	y-akm-e	*eat*	[PH253]
y-ungul-e	y-angul-e	*copy*	[PH253]
y-oys-ooww-e	y-ays-aaww-e	*extricate*	[PH253]

(28) Vowel-initial Verbs: IMPERFECT

a. y-abl-ee-n-ī (ubul)
3m-impf/see-impf-pl-focus
They see [B114]

b. y-aamin-ē (eemen)
3m-impf/believe-impf
He believes [B114]

c. t-aduur-ee-n-i-h (uduur)
2-impf/return-impf-pl-V-focus
You are returning [PH259]

d. aalim-ē (eelem)
impf/remember-impf
I remember [FM10]

The subjunctive is another process which has different instantiations on vowel-initial verbs versus consonant-initial verbs. In consonant-initial verbs, the subjunctive is marked with a *-u* suffix.[15]

(29) Consonant-initial Subjunctives

a. rab-u
die-subj
May I, he die [B144]

b. fīl-n-u
comb-pl-subj
May we comb [B144]

c. xaan-t-oo-n-u
buy-2-impf-pl-subj
May you (pl) buy [B144]

d. cul-us-u
enter-caus-subj
May I, he pitch [B144]

Vowel-initial verbs also suffix *-u*, but all root vowels surface as [a(a)].

(30) Vowel-initial Subjunctives

a. t-abbax-u (ibbix)
2-hold-subj
May you hold [B145]

c. y-aabāk-u (oobok)
3-sprout-subj
May it sprout [B145]

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y-ismit-e y-asmit-e *make certain* [PH253]
y-engel-e y-angagl-e *be joined to* [PH253]

[15] I have glossed the [oo] in (29c) and (30d) as imperfect following Bliese. It may be more appropriately glossed as 'present', however.

b. n-abal-u (ubul)
pl-see-subj
May we see [B145]

d. t-aaxag-oo-n-u (eexeg)
2-know-pres-pl-subj
May you (pl.) know [B145]

As already noted, these verb classes are defined phonologically: vowel-initial verbs begin with a non-low vowel ([i], [e(e)], [o(o)], [u]) and consonant-initial verbs begin with [a] or a consonant.[16]

In this section I have introduced two classes of regular non-stative verbs. I have shown that although these classes are subject to the same morphological processes, the phonological instantiation of these processes differs depending on the initial segment of the verb root they apply to. This was seen, for example, with the imperfect, where in one set of verbs, an [a(a)] was suffixed, whereas with another set of verbs, the first vowel of the root became [a(a)], mid vowels in the root were raised, and an [e(e)] was suffixed. Previous work has attributed variable-positional effects to the differences in the verb classes (Bliese 1981, Parker & Hayward 1986). In this thesis I show that it is not the class of the verbs per se that determines the location of the affixes, but simply the initial segment of the verb.

[16] There are a few exceptional verbs that take suffixes even the root begins with a non-low vowel. These are discussed in Chapter 3.

In the next section I discuss the theory in which the Afar data in this dissertation is analyzed, Optimality Theory.

Theoretical Background

In this section I provide the theoretical background needed for this analysis of the variable-position affixes. Specifically, I introduce Optimality Theory, including the theories of Generalized Alignment (McCarthy & Prince 1993b) and Correspondence Theory (McCarthy & Prince 1995). I also discuss the theories of morphological planes (tiers) as used by McCarthy (1981, 1979) and Halle & Vergnaud (1987), as the analysis presented here requires morphological planes.

Introduction to Optimality Theory

The theoretical framework adopted here is Optimality Theory (OT) (Prince & Smolensky 1993, McCarthy & Prince 1993, etc.). It is a theory where all possible outputs are generated from an input, with the ultimate output being the one which best satisfies a hierarchy of constraints specifying the forms that outputs must take. OT has three main components: GEN, CON and EVAL. GEN takes an input and generates all possible analyses of it as output. CON consists of a set of ranked constraints which specify permitted characteristics of outputs.

EVAL compares the candidate outputs produced by GEN against these constraints.

The constraints are ranked hierarchically with higher-ranked constraints having greater priority. For each constraint, in order of priority, forms with a greater number of violations are non-optimal and are omitted from further consideration. For example, given the input *haad-n-ē* and two constraints, BIMORAIC SYLLABLE, which specifies that syllables are maximally bimoraic, and MAX (μ), which specifies that moras cannot be deleted from the input, it is possible to get either the ranking of constraints shown in (31) or the ranking of constraints shown in (32). As demonstrated in (31), the leftmost constraint is the higher-ranked constraint. In this case, as BIMORAIC SYLLABLE is highest ranked, it will decide between the possible outputs if it is relevant. It is, in fact, as it chooses between the outputs. (31b) violates BIMORAIC SYLLABLE as the first syllable, *haad*, is trimoraic. (31a) on the other hand, has no violations of BIMORAIC SYLLABLE and is therefore the optimal output. Notice that the lower ranked MAX (μ) is irrelevant as the optimal output is already chosen by the higher ranked constraint, BIMORAIC SYLLABLE.

(31) BIMORAIC SYLLABLE >> MAX (μ)

		haad-n-e	BIMORAIC SYLLABLE	MAX (μ)
☞	a.	had.ne		*
	b.	haad.ne	*!	

If these constraints are ranked in the opposite order, a different output is optimal, as shown in (32). (32b) is optimal because although it violates the lower ranked BIMORAIC SYLLABLE, it does not violate the higher ranked MAX (μ).

(32) MAX (μ) >> BIMORAIC SYLLABLE

		haad-n-e	MAX (μ)	BIMORAIC SYLLABLE
	a.	had.ne	*!	
☞	b.	haad.ne		*

Both GEN and EVAL are part of universal grammar. "Gen contains information about the representational primitives and universally irrevocable relations: for example, that the node σ may dominate a node *Onset* or a node μ (implementing some theory of syllable structure), but never *vice versa* " (Prince and Smolensky 1993:4). EVAL is universal in that it contains all possible constraints: "interlinguistic variation is to be explained primarily as the result of differences in the ranking of constraints", in other words, it is CON

that varies across languages (McCarthy & Prince 1993:5). This was shown in (31) and (32), where in (31) BIMORAIC SYLLABLE >> MAX(μ), producing *had.ne* as the optimal output, but in (32), MAX (μ) >> BIMORAIC SYLLABLE producing *haad.ne* as the optimal output.

Crucial to OT are: the viability of constraints, the ranking of constraints, the characterization of inputs and outputs and the parallelism of constraint satisfaction. These are discussed below. In the newer version of OT, Correspondence Theory, correspondence between elements is required. I discuss Correspondence Theory in the following section.

First, constraints are violable: if an output candidate violates a given constraint, it does not mean that the form is necessarily non-optimal. For example, in Afar there is a constraint requiring that word-final vowels are short. I refer to this constraint as Final Short Vowel and discuss it in detail in Chapter 2. For now, all that is important is that a word-final vowel must be short. For this constraint to have an effect in choosing the optimal output, it must be ranked above the constraint which disallows deletion of a mora (MAX (μ)). This is seen in (33). (33a) is nonoptimal because it violates FSV: it ends in a long vowel. (33b) does not violate FSV and is therefore the optimal form. This does not mean, however, that (33b) does not violate any

constraints. It violates MAX (μ). In other words, constraints are viable: a word can violate constraints and still be optimal. This example illustrates the concept of viability as well as the concept of ranking. (33a) and (33b) both violate constraints but (33a) is nonoptimal because it violates a higher-ranked constraint than does (33b).

(33) FSV >> MAX (μ)

			FINAL SHORT VOWEL	MAX (μ)
	a.	abee	*!	
☞	b.	abe		*

Notice that if the constraint hierarchy were reversed, say for a language Afar', the opposite result would be obtained.

(34) MAX (μ) >> FSV

			MAX (μ)	FINAL SHORT VOWEL
☞	a.	abee		*
	b.	abe	*!	

Up to this point I have illustrated the concepts of violability and ranking. Before discussing other properties of OT, I first discuss the conventions used in OT tableaux. Following McCarthy & Prince (1993a:6), I use the following conventions.

Left–to–right column order mirrors the domination order of the constraints

Violation of a constraint is marked by *.

Satisfaction is indicated by a blank cell.

The sign ! draws attention to a fatal violation, the one that is responsible for a candidate's nonoptimality. It highlights the point where the candidate in question loses to other more successful candidates.

The symbol ☞ draws attention to the optimal candidate.

Shading emphasizes the irrelevance of the constraint to the fate of the candidate. A loser's cells are shaded after the fatal confrontation; the winner's, when there are no more competitors.

The properties of OT are further exemplified in an example from Tagalog. This analysis comes from McCarthy & Prince (1993b:10-12). Tagalog has an affix, -*um*-, which can attach as a prefix, as an infix after the first consonant of the word, or as an infix after the first two consonants of the word, as shown in (35).

(35) Distribution of Tagalog -um-

	Root	um + Root	Gloss
a.	aral	um-aral	'teach'
b.	sulat	s-um-ulat	'write'
c.	gradwet	gr-um-adwet	'graduate'

The idea behind McCarthy & Prince's analysis is that the position of -*um*- changes in order to create the most optimal type of syllable. For example, the input *um + salat* yields [sumulat] because it violates

less of the language's syllable constraints than other possible orders: in particular, because it has less codas. This is shown below.

For this analysis, McCarthy & Prince introduce two constraints: NOCODA and ALIGN-UM.

(36) Tagalog Constraints (McCarthy & Prince 1993b:42)

a. NOCODA
Syllables are open

b. ALIGN-UM
ALIGN ([um]$_{Af}$, L, Stem, L)

NOCODA is a constraint requiring that syllables be open. This means that, for each output, every coda is a violation of NOCODA.[17] For example, if CVC.CVC is an output, it would have two NOCODA violations. ALIGN-UM specifies that *-um* is a prefix.

I now show how this analysis works. Possible outputs for the input *um + salat* are shown in (37). The first and third outputs cannot be optimal as they each have two violations of NOCODA (the 'm' and 't'), whereas the other outputs each have only one violation. This and the following examples illustrate that the optimal output can violate

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[17] NOCODA could also be formulated in terms of Generalized Alignment, Align (σ, R; V, R) . This was pointed out to me by Terry Langendoen. The emphasis here is on the use of alignment constraints to position the variable-position affixes and no attempt is made

the highest ranking relevant constraint. All that is necessary is that it have less violations of this constraint than the nonoptimal forms. This can be seen by comparing the optimal form in (37) with the first and third output forms which are non-optimal. All three forms violate NOCODA, but the optimal form has less violations.

Also shown in (37), it is possible for the optimal output to have the same number of violations of the highest-ranking relevant constraint as another output. Although NOCODA rules out some forms as nonoptimal, four outputs have a single NOCODA violation, including the optimal output. Of the remaining candidates then, the second output listed, *sumulat*, has the least ALIGN-UM violations, one. (Following McCarthy & Prince, I represent violations of alignment constraints by the segments between the item to be aligned and the edge of the item it is to be aligned with).

(37) /um+sulat/

Candidates	NOCODA	ALIGN-UM
.UM.su.lat	**!	ø
☞ .sU.Mu.lat.	*	s
.su.UM.lat	**!	su
.su.lU.Mat.	*	su!l
.su.laUMt.	*	su!la
.su.la.tUM.	*	su!lat

to establish whether all constraints presented here can be formalized in terms of Generalized Alignment.

This analysis extends to *-um* when it is attached to a vowel–initial form such as *aral*. This is shown in (38). The second output is nonoptimal because it has two NOCODA violations, more than any of the other possible outputs. Among the rest of the candidates, the optimal output is the first one, because it is the only one with no violations of ALIGN-UM.

(38) /um + aral/

Candidates	NOCODA	ALIGN-UM
☞ U.Ma.ral.	*	ø
.a.UM.ral.	**!	a
.a.rU.Mal.	*	a!r
.a.ra.UMl.	*	a!ra
.a.ra.lUM.	*	a!ral

A similar situation obtains when *-um-* is added to *gradwet*. If *-um-* either is leftmost or only one segment into the stem, there are more NOCODA violations than in the other outputs. Of the remaining outputs, *grumadwet* has the least violations of ALIGN-UM and is therefore the optimal output.

(39) /um + gradwet/

Candidates	NOCODA	ALIGN-UM
.UM.grad.wet	***!	ø
.gUM.rad.wet	***!	g
☞ .grU.Mad.wet.	**	gr
.grad.wU.Met.	**	gra!dw

The optimal form, then, is the one which has the least violations of the highest ranked relevant constraint. This is the optimal output or surface form for the input.

I now turn to inputs and outputs and parallelism.

Among the crucial properties of OT are the characterizations concerning inputs and outputs. I discuss each in turn. "A fundamental tenet of Optimality Theory is richness of the base: the lexicon consists of anything in that there are no language-particular constraints on lexical forms" (McCarthy 1995:33). Despite the possible variation in inputs, it is the responsibility of the constraint hierarchy to determine the correct output. Given the input, the output candidates are created by GEN "freely exercising the basic structural resources of the representational theory" (Prince & Smolensky 1993:5). In other words, from the input, GEN generates all possible output candidates.

These outputs must respect the universal properties of GEN (for example, there are no outputs where a mora dominates a syllable

node). But if a given input is fed into GEN for two different languages, the same candidates will be output. The difference in optimal forms for different languages comes from the order in which the constraints are ranked.

McCarthy & Prince also claim that parallelism is a principle of OT. By parallelism they mean that all of the outputs are evaluated simultaneously by the entire constraint hierarchy. They do not mean that all properties of languages are computed in parallel. Constraints may be grouped into morphologically-defined levels (much like the levels in lexical phonology (Kiparsky 1982a, 1982b, 1985, etc.)). The output of one level then serves as input to the next level. For example, in McCarthy & Prince's (1993a) analysis of Axininca Campa the constraint hierarchy is first applied to the [prefix + root] combination. The output of this hierarchy is then submitted to another hierarchy which then applies to the [[prefix + root] + suffix] combination. Within a level, however, all constraints must apply in parallel.

Correspondence Theory

The particular incarnation of OT adopted here is Correspondence Theory. In Correspondence Theory, "rankable constraints apply to correspondent elements, demanding completeness

of correspondence, preservation of linear order under correspondence and the like... " (McCarthy 1995:5).

Correspondence is defined as follows.

(40) Correspondence
Given two strings, S_1 and S_2, correspondence is a relation $\Re$ from the elements of S_1 to those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as correspondents of one another when $\alpha \Re \beta$.

There are also several constraints (or families of constraints) which are relevant to the phenomena being discussed here. In their discussion of Correspondence Theory, McCarthy & Prince (1995) discuss faithfulness constraints which ensure that the output corresponds to the input. Within the faithfulness constraints is a family of constraints which ensure completeness of mapping: the MAX constraints. The MAX constraints ensure that for each element in the input, there is a corresponding element in the output. In other words, they prohibit phonological deletion and are similar to the PARSE constraints in the previous incarnation of OT. There are similar constraints governing the correspondence of base and reduplicant and input and reduplicant, but as there is no discussion of reduplication in this dissertation, these are not relevant to the analysis discussed here and are not examined further. As in (41), other things being equal, a form where all of the

segments in the input are also in the output is preferred to one where segments in the input are missing in the output.

(41) MAX prohibits deletion

	CVCVCV	MAX
a.	CVCCV	*!
☞ b.	CVCVCV	

The MAX constraints may refer to the deletion of a consonant (MAX (C)), a vowel (MAX (V)), a mora (MAX (μ)), etc. A major difference between the MAX constraints and their predecessors, the PARSE constraints, is that with the PARSE constraints, segments were not literally deleted from the output. With the MAX constraints, however, segments are deleted from the output. I return to this distinction in the discussion of MAX (y) in Chapter 3.

There is also a family of constraints requiring that any segment in the output has a corresponding segment in the input, DEP. DEP prohibits phonological epenthesis. These constraints are similar to the FILL constraints in pre-correspondence OT. Like the MAX constraints, the DEP constraints are a family of constraints: DEP (C), DEP (V), etc.

(42) DEP prohibits epenthesis

	CVCCVC	DEP
a.	CVC𝕍CVC	*!
☞ b.	CVCCVC	

Generalized Alignment

A subtheory of OT assumed here is that of Generalized Alignment. McCarthy and Prince (1993b) propose the theory of Generalized Alignment (GA) within OT to encompass cases where processes refer to the edges of constituents, e.g., when a constraint imposes a requirement at the edge of a foot.

In particular, McCarthy & Prince propose to account for the ways various phonological and morphological effects are produced through the alignment of the edges of phonological, morphological and syntactic constituents by a family of constraints they call Generalized Alignment, shown in (43).

(43) GENERALIZED ALIGNMENT (GA)

Align(Cat1, Edge1, Cat2, Edge2) =def
∀ Cat1 ∃ Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide,
where
Cat1, Cat2 ∈ PCat ∪ GCat (Prosodic and Grammatical categories)
Edge1, Edge2 ∈ {Right, Left}

Basically, (54) states that the edges of two categories must be aligned, where the categories being referred to may be phonological, morphological or syntactic, and the edge may be either the right or left edge. PCAT and GCAT are, respectively, the set of phonological and

grammatical categories proposed in linguistic theory. The Tagalog constraint discussed earlier, ALIGN-UM, is an example of a Generalized Alignment constraint. It specifies that the left edges of two GCATS must be aligned: the affix and the stem.

In this section I have shown that the position of morphemes in a word can be controlled by the use of Generalized Alignment constraints which require that edges of constituents be aligned. As these are constraints, they are viable. In fact, Tagalog illustrates a case of a variable-position affix similar to the variable-position affixes in Afar, where the position of a morpheme is governed not only by a morphological constraint but also by a higher-ranked phonological constraint.

Morphological Planes

I now turn to previous cases in the literature where morphological planes have been proposed: models by McCarthy (1979, 1981) and Halle & Vergnaud (1987).

The Morphemic Tier Hypothesis

Another notion needed in this analysis is the idea of morphological tiers or planes. McCarthy (1981, 1979) argues that morphemes must be segregated on separate planes to account for many

of the morphological and phonological phenomena found in Arabic and other Semitic languages. His model is designed to capture the fact that groups of words like those in (44) seem to share a common morpheme. In this case, the morpheme seems to be "k, t, b".

(44) Morphologically-Related Forms (McCarthy 1979:374)

a.	kataba	'he wrote'
b.	kattaba	'he caused to write'
c.	kaataba	'he corresponded'
d.	takaatabuu	'they kept up a correspondence'
e.	ktataba	'he wrote, copied'
f.	kitaabun	'book (nom.)'
g.	kuttaabun	'Koran school (nom.)'
h.	kitaabatun	'act of writing (nom.)
i.	maktabun	'office (nom.)'

In lists of words such as those in (44), there is an intuition that these words are in some way related in that the root consonants cluster around a semantic field.

Standard theory, at that time, viewed a morpheme as "a string of segments delimited by the symbol '+' which contains no internal '+' " (McCarthy 1979:375). Words like English *undo* were analyzed as two morphemes with a morpheme boundary between them (*un + do*). Boundary theory cannot account for the Arabic data, however, because it cannot represent the root consonants as a single morpheme. In order for the vowels to be morphemes separate from the consonants, they

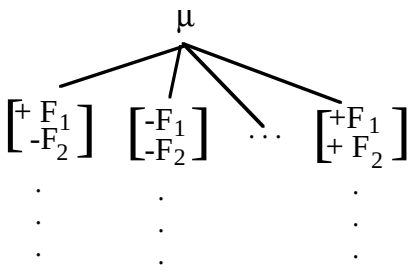
would have to be separated by boundaries, as shown in (45). This representation, however, specifies that each vowel and each consonant is a different morpheme.

(45) Standard Theory Morphemic Analysis

k + a + t + a + a + b

To resolve this problem, McCarthy proposes a non-linear representation using autosegmental phonology. He represents "a morpheme as an ordered string of 1 x *n* feature matrices associated autosegmentally with a root node μ" (McCarthy 1979:376).

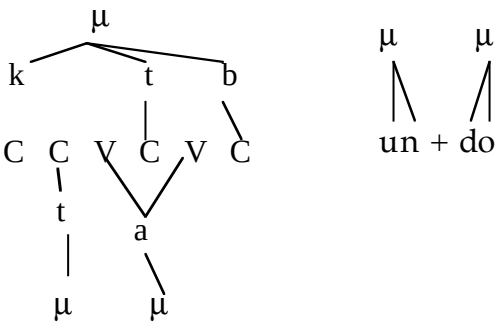
(46) μ Notation



The node μ indicates that the string is a morpheme. It bears various types of morphological information such as diacritics, whether the morpheme is a root or affix, and other information specific to the

morpheme. Both nonconcatenative and concatenative systems are easily expressed in this notation.

(47) Concatenative and Non-concatenative languages in [μ] notation



McCarthy's proposal entails that "[e]ach language has the option of restricting every tier to autosegments which are members of a particular morpheme or morpheme class" (McCarthy 1981:383). In other words, each morpheme occupies its own autosegmental plane. This captures the fact that discontinuous sequences form a single morpheme, because they occupy a plane together and are the only morpheme on that plane.

McCarthy presents two types of arguments in support of his position. First, he argues that discontinuous sequences such as 'k...t...b' in the previous examples do in fact constitute a single morpheme. Second, he contends that the only way to capture this fact is to segregate morphemes into separate planes. I present each of these in turn.

McCarthy states that his most compelling argument for analyzing the consonants as a single morpheme is that it provides for the basic organization of the Arabic lexicon around the root. Verbs in Arabic can be organized into 15 derivational classes called binyanīm (sg. binyān). Except for the first binyan, the forms in most binyanim are derived from some other binyan or from nouns of the same root as shown in (48). There is no relationship between the source and the output except for the root consonants. Formally this means that whatever sort of rule relates a derived verb to its source, that rule will have to ignore the formal characteristics of the source except for the root consonants.

(48) Derivational Sources for Binyanim (McCarthy 1979:378)

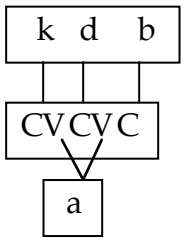
	Derived Form		Derivational Source	
a.	*Second Binyan*		*First Binyan*	
	ʕallam	*teach*	ʕalim	*know*
	kaððab	*consider a liar*	kaðab	*lie*
	Noun			
	marraḍ	*nurse*	mariiḍ	*sick*
	kabbar	*say battle-cry*	ʔalaahu ʔakbar	*Allah is great*

b. *Tenth Binyan* *First Binyan*

stawjab	*consider necessary*	wajab	*be necessary*
staslam	*surrender oneself*	ʔaslam	*surrender*
stawzar	*appoint as vizier*	waziir	*vizier*

The solution for this is trivial in the theory proposed by McCarthy: the consonants are on a single plane.

(49) Identifying morphemes by the planes they occupy



In additional to the derivational relationships, McCarthy cites language games as evidence that the consonants form a single morpheme. The language game referred to comes from the Bedouin Hizazi dialect of Arabic. In this game, the consonants of the root may be permuted in any order as illustrated in (50). Non-root consonants and the CV template remain unchanged. The vowels are subject to regular phonological effects and they change accordingly.

(50) difaʕna *we pushed* (root: dfʕ) (McCarthy 1979:379)

a. daʕafna
b. fidaʕna
c. ʕadafna
d. faʕadna
e. ʕafadna

McCarthy shows that vowels also form a single morpheme. In (51) the vowel 'a' signals active forms and the sequence 'u i' indicates the passive.

(52) Vowel quality as a morpheme

Active	Passive	Gloss
katab	kutib	*write*
faʕal	fuʕil	*to do*

The sequence of vowels and consonants also constitute a morpheme, as shown in (53), where within a binyan, forms share the same sequence of C's and V's.

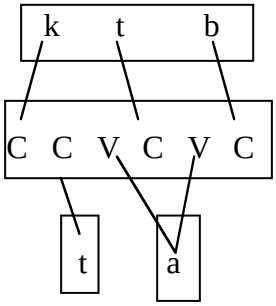
(53) CV template as a morpheme (McCarthy 1979:378)

Second	Third	Fourth
ʕallam *teach*	kaatab *correspond*	ʔajlas *seat*
kaððab *consider a liar*	saafar *travel*	ʔaʔkal *feed*

Once McCarthy establishes that the root consonants, vowels and CV template constitute a single morpheme, he then proceeds to the arguments that the best way to represent this is by segregating each morpheme on its own plane. The two types of arguments come from morpheme structure constraints and phonological rules.

If Arabic morphemes occur on separate planes, morpheme structure constraints can be accounted for. For instance, Greenberg (1968) observes that, with a single exception, no root of a verb contains both q and h, the voiced and voiceless pharyngeals respectively" (McCarthy 1981:379). If a root occupies all of and only a single plane, it is possible to state these constraints. This is shown in Figure (64). Since the root consonants form their own plane with other consonants on other planes, it is possible to specify constraints, in this case root co-occurrence constraints, without considering other consonants in the linear string of the word.

(54) Morpheme Structure Constraints



The second type of argument comes from phonological rules. In standard phonological theory, phonological rules restricted to a morpheme or morpheme class had to refer to the + boundary and perhaps also to some morphological diacritic features. In a nonconcatenative system, the + boundary is unavailable, so these rules could not be formulated. This is not a problem with μ notation, as shown below.

McCarthy identifies a template from the eighth binyan where there is a *-t-* infix between the first and second root consonants. He discusses an assimilation rule peculiar to the eighth binyan which targets this /t/, but no other /t/'s which might occur in this position in other binyanim. This is shown below. The *-t* infix occurs after the first segment of the root, as shown in (55).

(55) The /t/ Infix (McCarthy 1981:380)

/frq/	–>	ftaraq	*to part*
/ʕrd/	–>	ʕtaraD	*to place something before one*

When the first consonant of a root is a glide, there is a geminate [tt] instead of the glide followed by a [t].

(56) Assimilation Following a Glide (McCarthy 1981:380)

/wʕd/	–>	ttaʕad	*to receive a promise*
/ysr/	–>	ttasar	*to pay with a dreydl*

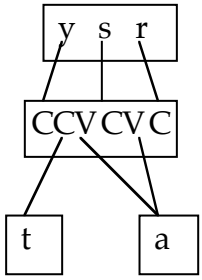
It is only in this morphological environment, however, that this assimilation takes place. If the glide and the /t/ are both part of the root, no assimilation rule applies.

(57) Identifying the /t/ Infix (McCarthy 1981:380)

/wtd/	–>	ʔawtaad	*tent pegs*
/ytm/	–>	yaytim	*to be an orphan*

The grammar must therefore be able to identify the *-t* infix of the eighth binyan exclusively. This is not possible with boundary theory as the /t/ occurs within the linear string defining another morpheme, the root, but it can be done if each morpheme has its own plane.

(58) Identifying the /t/ Infix

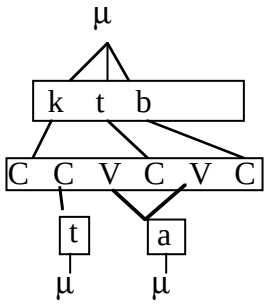


A similar situation obtains with the reflexive. The first [t] in *ktatab* is the reflexive morpheme. With a single plane, it is impossible to derive the correct order of morphemes without violating the No Crossing Constraint (Goldsmith, 1976; Pulleyblank, 1983; Hammond, 1988, etc.). Whether the reflexive is ordered before or after the root morpheme, an ill-formed representation results, as shown in (69).

(59) Violation of the No Crossing Constraint

Segregating the morphemes onto separate planes allows a well–formed representation like that in (70).

(60) Segregation of Morphemes onto Separate Planes

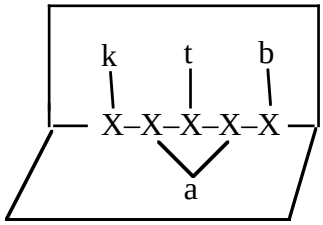


McCarthy, then, shows that Arabic morphology is best accounted for by an analysis which places morphemes on separate planes where each morpheme has its own plane.

Planes in Concatenative Languages

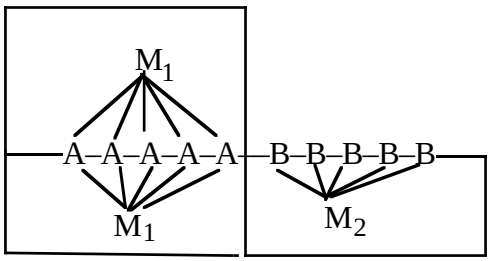
Arabic is not the only case in the literature where morphological planes have been proposed. Halle and Vergnaud (1987) also offer a nonlinear analysis for the representation of morphemes. They represent McCarthy's analysis as shown in (61), where, for languages with nonconcatenative morphology, different morphemes are on different planes and these morphemes are connected through their attachment to a skeletal morpheme.

(61) Halle and Vergnaud's Model of Arabic (Halle & Vergnaud 1987:79)



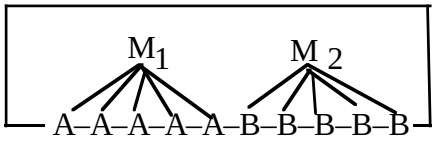
Halle and Vergnaud then extend this idea to languages with concatenative morphology. Specifically, they propose that there are two types of morphemes: those which are on a plane separate from the root and those which occur on the same plane as the root. Rules apply to the first morpheme (the root). For morphemes which occur on separate planes, an affix is added and the rules apply to the string consisting of the root and the affix (62). If there is another affix which occurs on a separate plane, it is then added to the string and the process is repeated.

(62) Morphemes which Generate their own Planes



Other morphemes differ from this in that they are affixed on the same plane (63) and the rules only apply once: to the entire string of the root and affixes.

(63) Morphemes which do not Generate Planes
(Halle & Vergnaud 1987:79)



In what follows, I discuss Halle & Vergnaud's motivation for these representations using their analysis of Vedic Sanskrit. In Vedic there are some affixes which are added on the same plane as the root and others which are added on a separate plane.[18] For affixes that generate their own planes, if the last syllable is accented, stress falls on this syllable.

(64) Stress on Accented Suffixes in Vedic Sanskrit
(Halle & Vergnaud 1987:85)

rath + ín + e	*charioteer*	(dat. sg.)
mitr + ín + e	*befriended*	(dat. sg.)

[18] These are commonly referred to as recessive and dominant suffixes respectively.

If there are no accented plane-generating suffixes, stress falls on the first syllable. In parentheses are the roots followed by unaccented plane-generating suffixes.

(65) Sanskrit with no accented dominant suffixes (H&V 1987:85)

a.	(sár + as) + vat + i + vant	*accompanied by Sarasvati*
b.	(práti + cyav + iyas) + i	*more compressed*
c.	(cí + kar + ay + isa) + ti	*wants to cause to make*

In Vedic, non-plane-generating suffixes follow plane-generating suffixes and have no effect on stress if there is at least one plane-generating affix in the string.

Halle and Vergnaud account for this difference by assigning stress only when a new plane is generated or at the word level. Accents are not copied onto a new plane. The stress rules assign stress to the leftmost accented syllable or to the initial syllable if there are no accented syllables. This means that, on the last plane, stress will be either on the initial syllable or on the last accented plane-generating suffix. Since stress rules place stress on the leftmost syllable and non-plane-generating suffixes occur to the right of plane-generating suffixes, the latter suffixes will not be stressed. This is shown in (66). In (66a), *rath* occurs in its own plane. As *in* is a plane generating suffix, it generates its own plane. *e* is not a plane-generating suffix and

therefore does not generate its own plane. Stress falls on the accented *in*. The analysis for (66b) is similar. *as* is a plane-generating suffix but *i* and *vant* are not. The difference here is that *as* is not accented, so stress falls on the root.

(66) Planes in Vedic Sanskrit

a.

rath	
rath	ín + e

b.

sar	
sár	as + i + vant

In this section I have introduced two theories of serial morphological planes. In the next section I discuss parallel planes in OT.

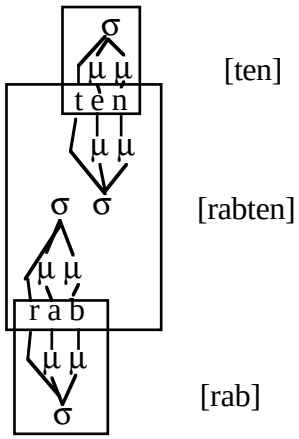
Morphological Planes and Optimality Theory

The analysis presented here proposes that Afar can be analyzed as consisting of three morphologically-defined planes: roots, affixes, and words.[19] Roots and affixes are syllabified independently, on their

[19]In this thesis I examine only those affixes which might be termed "inflectional" affixes. Whether the "derivational" affixes of Afar fall into the same class as the inflectional affixes or whether they occupy some other plane is not addressed here.

own planes, and are also syllabified together on a third plane, the word plane. Constraints apply simultaneously to each of these planes. A given input, then, produces multiplanar outputs. For example, (67) illustrates one possible output for an input consisting of a root, *rab*, the second person morpheme *-t-*, the perfect aspect marker *-e(e)*, and the plural marker *-n-*. On the affix plane, the top box, the three affixes, *-t-*, *-e,* and *-n-* are syllabified together. In the bottom plane, the root is syllabified. Finally, these planes are syllabified together onto the word plane, shown in the middle box.

(67) A Representation for {rab, t, ee, n}



The analysis proposed here for Afar is similar to both McCarthy's and Halle and Vergnaud's analyses in that different morphemes occupy three-dimensional planes. Specifically, the root occupies a single plane and the affixes together occupy a single plane. A word is

created by syllabifying these planes together. This idea is discussed further in Chapter 3.

In this section I have suggested that the theoretical apparatus necessary to account for the variable-position phenomena in Afar is a Multiplanar Model. The proposal here shares features with both McCarthy's (1979; 1981; 1986) and Halle & Vergnaud's (1987) proposals and is the first to propose that planes are required in OT. It is similar to McCarthy's in that both proposals have multiple planes which are morphologically defined, and in both the root occupies a single plane by itself. The proposal here differs from McCarthy's in that roots in Afar consist of both consonants and vowels whereas roots in Arabic consist only of consonants. Additionally, McCarthy proposes that each affix occupies its own plane, whereas here it is proposed that all affixes are grouped together on a single plane. Finally, this model is not derivational, as are both McCarthy's and Halle & Vergnaud's. All affixes are present in the input. It is different from Halle & Vergnaud's model in that there is no distinction between plane-generating and non-plane-generating affixes. Affixes always occur simultaneously on their own planes and on the word plane.

Huave

With the exception of Tagalog, the only other case of variable-position affixes that have previously been analyzed in the OT literature are found in Huave, a language isolate of Oaxaca, Mexico. Noyer (1993) argues that this phenomenon requires a serial analysis within the OT framework. In Chapter 5 I show that, like Afar, Huave is amenable to a parallel model with the addition of planes in OT. Here I present Noyer's analysis.

Noyer argues that the alternating locations of affixes in Huave is the result of the fact that these affixes have no linear morphological specification, i.e., they are not specified as either prefixes or suffixes. Phonological constraints determine the linear position of the affixes in the surface string.

The relevant Huave facts are as follows. According to Noyer, all Huave verbs have a "theme-vowel" which is either prefixed or suffixed to the root. Examples of these are shown in (68).

(68) Theme Vowels in Huave (Noyer 1993:3, 4)

a. **a**-rond
TH-hang
(s)he hangs [something]

b. rond-**o**-m
hang-TH-nonpast
(s)he is hanging

c. **a**-ts'ak [acáaig]
TH-unfasten
I place [round object]

d. **a**-ts'ey-iw' [aceyíu]
TH-hang
(s)he hangs [something]

e. **i**-wit' [iwít]
2-raise
you (sg.) raise

f. t-**e**-sond'-in [tesohndíin]
past-2-remove-pl
you (pl.) removed

The focus of his paper is on the affixes which attach to the aforementioned theme vowels. These affixes—past, nonpast and first person—always attach outside the theme vowel, whether the theme vowel is a prefix or a suffix.

(69) Huave Variable-position Affixes (Noyer 1993:5)

a. t-**a**-wit'
past-TH-raise
(s)he raised (it) up

b. wit'-**i**-t
raise-TH-past
(s)he rose up

c. ap-m-**a**-wit'
fut-nonpast-TH-raise
(s)he will raise (it) up

d. ap-wit'-**i**-m
fut-raise-TH-nonpast
(s)he will rise up

e. sa-n-**a**-wit'
fut-1-TH-raise
I will raise (it) up

f. sa-wit'-**i**-n
fut-rise-TH-1
I will rise up

Noyer's goal is to motivate the attachment properties of these affixes from general phonological properties. To do this, he first observes that "Huave words normally end in closed syllables" (Noyer 1993:5), with exceptions being either from a closed class of pronouns or Spanish loanwords. Noyer proposes a constraint prohibiting final open syllables to account for this fact.

(70) Final Coda (Noyer 1993:6)

*... V#

Huave syllable structure is maximally CVVC so final -VCC# syllables will contain an unlicensed consonant. He uses an additional constraint, PARSE, to prevent a variable-position affix from occurring next to a consonant at a word edge (*CC... or *...CC) and forming an illicit syllable.

(71) PARSE (Noyer 1993:8)

All segments are prosodically licensed.

He proposes that the fact that the affixes are not specified as being either prefixes or suffixes and the PARSE constraint being ranked below FINAL-CODA are what account for the position of the theme attaching affixes. If the theme vowel attaches right adjacent to a root, the variable-position affix must occur to the right of it or a fatal FINAL-CODA violation will occur.

(72) Suffixed Theme Vowels (Noyer 1993:8)

			FINAL-CODA	PARSE
	a.	(t)wit'-i	*!	*
☞	b.	wit'-i-t		

If the theme vowel is prefixed to the root, however, the variable-position affix must precede it. If the variable-position affix follows the root, it will not be able to syllabify and a fatal PARSE violation would result.

(73) Prefixed Theme Vowels (Noyer 1993:8)

			FINAL-CODA	PARSE
☞	a.	t-a-wit'		
	b.	a-wit'-t		*!

Variable-position affixes, Noyer claims, are both prefixes and suffixes because they are able to be: they have no attachment properties specified. Tagalog, however, shows that some variable-position affixes may be prefixes and Afar shows that some variable-position affixes must be specified as suffixes.

Additionally, Noyer's analysis of more complex variable-position data in Huave, discussed further in Chapter 5, requires serialism: some affixes must be added to the string before others are added. In Chapter 5 I show that the use of morphological planes in Huave, as is the case with Afar, eliminates the need for a serial analysis. As I argue that planes are necessary in order to maintain the claim of parallelism in OT, it is necessary for me to show that the Huave data can be analyzed in a parallel model as well.

Dissertation Overview

This thesis contains four additional chapters. The next chapter examines the prosodic phonology of Afar that is relevant to the variable-position affixes. Specifically, I discuss syllables and the absence of [y] following consonants. According to McCarthy & Prince, phonology that controls morphology must be ranked above it (McCarthy & Prince 1993a:102). The phonological constraints which control the variable-position morphology must therefore be ranked above the morphological constraints that govern the variable-position affixes. Syllabification and the absence of [y] both contribute to the exact manifestation of the variable-position affixes.

In Chapter 3 I turn to the variable-position affixes. I introduce the affixes and the constraints an OT account requires. I show that the variable-position affixes create a paradox for a monoplanar version of OT which requires parallelism. I then show that the paradox can be resolved through the use of multiple morphological planes.

In Chapter 4 I show that a linear Multiplanar Model cannot account for the Afar data. I then demonstrate that an analysis is available for variable-position affixes in a Levels Model of Optimality Theory. I compare the Multiplanar and Levels Models, arguing that the Multiplanar Model is the preferred one.

In Chapter 5 I reanalyze Huave variable-position morphology to show that it is amenable to a parallel analysis. I also reanalyze an Arabic example to show that, instead of each affix occupying its own plane as proposed by McCarthy (1979), it can be analyzed within the more restrictive model proposed here, where all affixes occupy a single plane. Additionally, I show that Arabic is amenable to a parallel analysis rather than the serial analysis proposed by McCarthy (1981, 1979). I then compare this model to the Optimal Domains Theory of Cole and Kisseberth (1994). Finally, I suggest that this model may eliminate the need for the levels proposed by McCarthy and Prince for Axininca Campa (McCarthy & Prince 1993).

2. RELEVANT PHONOLOGY

In this chapter I discuss two phonological phenomena which interact with the variable-position affixes: syllabification and the absence of [y] following a consonant. First I discuss the constraints needed to account for the syllabification system as these interact with morphological constraints to determine the surface location of the variable-position affixes. Next I turn to a constraint which disallows the appearance of [y] after a consonant. This constraint accounts for the absence of the third person masculine marker on consonant–initial verbs.

Syllables

In this section I present the syllabification system of Afar and the constraints needed to account for it. First I examine the structure of syllables and discuss the range of syllable types found in Afar, including the fact that not all syllable types are found in all positions of a word. I then offer an OT account of what are and are not possible syllable types and analyze phenomena where long vowels shorten in closed syllables and also in word final position. For both I show how they can be accounted for in Optimality Theory, including analyses for exceptions.

The Structure of Syllables

In Afar, there are no word-initial or word-final consonant clusters, word-internal clusters consist of a maximum of two consonants and there are no sequences of more than two vowels (Hayward 1976:69, Parker & Hayward 1986:215).[20] Additionally, all vowel sequences must contain identical vowels (Hayward 1976:69). From this it appears that surface syllables in Afar are minimally V and maximally CV_1V_1C (Bliese 1981:2) and that the allowable syllable types are those listed in (74).

(74) Afar Syllable Types

V	**a**.be *do, make* [PH28]
CV	mee.**xe** *choose, select* [PH167]
V V	**oo**.go.re *beat, hit, strike* [PH177]
CVV	e.**gee**.re *bail out (of water)* [PH95]
VC	**ab** *do, make* [PH28]
CVC	sol.**ten** *You stood* [B123]

[20]Bliese (1981:2) notes that one word with an internal three consonant sequence has been found: *i**str**aaxā* 'well-being'.

VVC	**oob**.be *hear, listen* [PH177]
CVVC	u.**ruud** *knead (imperative)* [PH21]

As illustrated in (74), a variety of syllable types occur in Afar. Not all of these occur in all positions of a word as shown by the chart in (75), where * indicates that a specific syllable type does not occur in that position.[21]

(75) Syllable Structure in Verbs

	Initial	Medial	Final
V	**u**.cus.su.lē *measure in cubits* [PH203]	*	*
V V	**oo**.go.qe *bury, cover up* [PH177]	*	*
VC	**ok**.me eat [PH176]	*	**ab** do [PH28]
VVC	**oob**.be *hear, listen* [PH177]	*	**eex** *suck the breast* [PH94]

[21]When VV is root-initial in the input, it must be a mid vowel (either [ee] or [oo]). There are no non-derived stems beginning with [ii], [uu], or [aa]. There are, however, derived verbs beginning with [aa], but none beginning with [ii] or [uu].

CV	**ra**.ce *flow, spring up* [PH180]	daa.**li**.ci.te *be defeated, fear* [PH76]	mee.**xe** *choose, select* [PH167]
CVV	**mee**.xe *choose, select* [PH167]	e.**gee**.re *bail out (of water)* [PH95]	daf.**fee** *sit down/up* [PH78]
CVC	**tek**.ri.se *eat enriched food* [PH199]	wa.**dey**.nā *witness, f.* [PH207]	kaq.**lan** *They wash* [B123]
CVVC	**maad**.dē *She, you flew* [B226]	yas.**kaax**.xeē.nim *They will honor* [B109]	u.**ruud** *knead* (*imper*) [PH21]

As can be seen in (75), all of the disallowed syllable types are vowel-initial medial or final syllables. In the following section I show how the absence of these syllables can be accounted for in OT. First, however, I introduce the necessary constraints that have been motivated elsewhere in the literature.

In addition to the MAX and DEP constraints discussed in Chapter 1, several additional constraints are needed for the phenomena discussed in this chapter. I discuss each in turn.

In Afar, where there are no complex codas or onsets and no diphthongs, *COMPLEX is required. *COMPLEX disallows complex onsets and codas, including geminate onsets and geminate codas which are

fully dominated by a syllable node, as well as diphthongs and geminate nuclei.[22]

(76) *COMPLEX
No more than one element may be immediately dominated by a syllable position.

ONSET requires that syllables have onsets. It disallows medial onsetless syllables and it combines with another constraint, introduced later, to limit onsetless syllables in initial position.[23]

(77) ONSET: * σ[V
Every syllable has an onset (Prince & Smolensky 1993:25; McCarthy & Prince 1993:30; Fig. 43)

I first discuss the absence of vowel-initial syllables in medial and final position. The absence of medial onsetless syllables can be accounted for with the ONSET constraint. This leaves a problem however: ONSET also rules out vowel-initial syllables at the beginnings of words, where onsetless syllables do occur. McCarthy & Prince (1993a) deal with the problem of accounting for the presence of initial onsetless

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[22] *COMPLEX must actually consist of three constraints for Afar: *CMP (C), *CMP (V_1V_1) and *CMP (V_1V_2). *CMP (C) must be relatively high ranked as there is only one output in Afar which violates this. *CMP (V_1V_1) must be ranked below MAX (μ), however, as Afar allows long vowels. Additionally, *CMP (V_1V_2) must be ranked above *CMP (V_1V_1) as Afar has geminate vowels but not diphthongs. This distinction is not pursued further in this dissertation, unless required for the point being made.

syllables but the absence of medial and final onsetless syllables in Axininca Campa through the ranking of two constraints: ONSET and ALIGN-L.[24] ALIGN-L (as shown in (78)) requires that the left edge of a morpheme in the input must be aligned with the left edge of a prosodic word.

(78) ALIGN-L

$_{Input}$[Morpheme = [PrWd

The left edge of an input morpheme corresponds to the left edge of a Prosodic Word.

Using " | " to mark the relevant morphological edge, and " [" to mark the relevant prosodic edge, McCarthy & Prince show that an epenthetic consonant (represented by **T** in Fig. 79) would intervene between the edges, thereby violating ALIGN-L (McCarthy & Prince 1993:33; Fig. 51). Notice that the relevant concepts are morphological edge and prosodic edge. This will be important in Afar because the edge of a prefix is a morphological edge, thereby satisfying ALIGN-L.

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[23] ONSET could also be formalized as an ALIGN constraint: ALIGN (σ, L, C, L)

[24] The pre-Correspondence Theory formulation of this constraint is a problem for Correspondence Theory. I have reformulated the ALIGN-L constraint from McCarthy and Prince (1993) to be consistent with the tenets of Correspondence Theory.

(79) Failure of Prothesis, from /oti-aanc^{h}i/ 'to put in'
(McCarthy & Prince 1993:33; Fig. 52)

	Candidates	ALIGN-L	ONSET	DEP
☞ a.	[|oti~		*	
b.	[𝕋 |oti~	*!		*

Additionally, McCarthy & Prince show that deleting the initial vowel of the stem cannot be used to satisfy ONSET as the morphological and prosodic edges will again be misaligned, as [t] is not the initial segment of an input morpheme.

(80) Unparsed Initial Onsetless Syllable
|<o>[ti𝕋aanc^{h}i

The same holds in Afar. If ALIGN–L dominates ONSET, then all syllables will require onsets except word-initially. For initial syllables, ALIGN–L will prevent the two possible ways of making the initial syllable consonant initial and thereby providing it with an onset: epenthesis and deletion. That this type of analysis works for Afar is shown in (81).

(81) The Ranking of ALIGN-L and ONSET (*ufuurē* 'boil' [PH202])

	Candidates	ALIGN–L	ONSET
a.	|[fuu.re	*!	
b.	[ℂ|u.fuu.re	*!	
☞ c.	[|u.fuu.re		*

(81a) violates ALIGN-L because [f], a medial segment, is aligned with the left edge of the prosodic word. *ℂu.fuu.re* (81b) violates ALIGN-L because an epenthetic consonant, which is not part of the morphological stem, is aligned with the left edge of the prosodic word. This leaves *u.fuu.re* as the optimal form, as the only constraint it violates is the lower ranked ONSET. Notice this explains why there are some vowel-initial syllables in final position, as repeated in (82).

(82) Vowel-initial Final Syllables

VC	ab *do* [PH28]
VVC	oob *descend (imperative)* [PH217]

The only case where final syllables may be vowel-initial is where final syllables constitute the entire verb, i.e., where they are also initial syllables and are therefore constrained by ALIGN–L.

If vowel-initial syllables are allowed at the beginnings of verbs and verbs may consist of a single syllable, then there should be verbs

consisting of only V or VV, just as there are words consisting of only VC and VVC, but there are not (83). (83a) is excluded by a minimal word constraint (discussed later in this chapter), but there is nothing yet to rule out (83b).

(83) Impossible Verbs

a. *[V]

b. *[VV]

Notice that these syllable types are not ruled out by ONSET if they constitute the entire verb, as it should still be possible to have verbs which consist only of a vowel.

The constraint that accounts for the fact that VV is unattested is a constraint on the form of a verb root. The smallest verbal output form generated by the grammar, a single syllable (the imperative), is an output consisting of only a verb root. All verb roots in Afar are consonant final: any verb ending in a vowel has been suffixed. (84) illustrates examples of possible (consonant-final) and impossible (vowel-final) roots.

(84) Possible and Impossible Roots

	Imperative (= root)	Gloss	Impossible Root
a.	ab	*do* [B139]	*a
b.	akum (okom)	*eat* [B139]	*aku
c.	sol	*stand* [B140]	*so
d.	uxmum	*wring* [B140]	*uxmu
e.	gey	*get* [B140]	*ge

Therefore, when the output consists of only a single syllable, it must be a bare root, which must be consonant final. This can be accounted for with a constraint requiring that the right edge of a root align with a consonant.[25] I discuss this below.

A constraint aligning the right edge of a morphological entity with a consonant is used by McCarthy & Prince (1994a) in their analysis of Makassarese. I briefly discuss their Makassarese analysis, then show how a similar constraint achieves the desired result in Afar.

Makassarese has epenthesis which suffixes a -V**ʔ** sequence to a consonant–final stem. Basically, McCarthy & Prince argue that coda consonants must be placeless, so the vowel is epenthesized to make stem–final consonants onsets rather than codas. The consonant, ʔ, is then epenthesized.

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[25]This could also be done with a constraint like the following which requires that the final syllable of a verbal root have a coda. ALIGN CODA: ALIGN (ROOT, R, C, R).

(85) Epenthesis in Makassarese

/rantas/	rántasa**ʔ**	‘dirty’	
/teʔter/	téʔtere**ʔ**	‘quick’	[téttereʔ]
/jamal/	jámala**ʔ**	‘naughty’	

McCarthy & Prince claim that ʔ epenthesis is due to a constraint, FINAL-C, that requires that a word end in a consonant; asserting that the “requirement that some constituent end in a consonant is attested fairly commonly” (McCarthy & Prince 1993b:22).

(86) FINAL-C
Align (PrWd, Right, Consonant, Right)
“Every PrWd is consonant-final”

The relevance of this analysis for the Afar data concerns the use of the FINAL-C constraint in the phonology of Afar. In this case, however, instead of aligning the right edge of a prosodic word with a consonant, the right edge of a root must be aligned with a consonant (87).

(87) FINAL-C
ALIGN (Root, Right, Consonant, Right)
Every root is consonant-final

This will allow the attested forms VC and VVC and disallow the unattested forms V and VV.

In this section I have shown that the disallowed syllable types in Afar, medial onsetless syllables and verb roots ending in a vowel, can be accounted for with the use of the constraints: ONSET, ALIGN–L and FINAL-C. Additionally, I have shown that ALIGN–L must dominate ONSET.

The constraint hierarchy motivated thus far is shown in (88).

(88) Constraint Hierarchy

ALIGN-L >> ONSET; FINAL-C

In the following sections I discuss processes affecting syllable structure in Afar. I first discuss constraints needed to account for closed–syllable long vowel shortening. I then discuss the lack of long vowels in word–final position and the constraints governing this.

Closed-Syllable Long Vowel Reduction

There is evidence for a bimoraic syllable constraint in Afar in that vowels which are long in open syllables are short in closed syllables.[26] An example of this is shown below in (89). In both unsuffixed nouns and plurals the final vowel of the root is in a closed

[26]The VVC and CVVC examples illustrated above in (84) - (85) are discussed below.

syllable and is short. When postpositions are added to the nouns, causing the final syllable of the root to be open, the vowel is long.

(89) Vowel-shortening in Closed Syllables

Noun	Postpositional	Plural	Gloss	Source
lu.bāk	lu.bāa.k-at	lu.bak.-wā	*lion*	[B179]
di.rār	di.rāa.r-ak	di.rar.-wā	*supper*	[B179]
a.līl	a.līi.l-il	a.lil.-wā	*chest*	[B179]

This can be contrasted with the forms in (90) which have short vowels in the final syllable of the root whether that syllable is open or closed.

(90) Lack of Vowel-lengthening in Open Syllables

Noun	Postpositional	Plural	Gloss	Source
a.bāl	a.bā.l-at	a.bal-.wā	*game*	[B179]
a.līb	a.lī.b-ik	a.lib-.wā	*tendon*	[B179]
a.rāc	a.rā.c-al	a.rac-.wā	*place*	[B179]

If vowels are lengthened in open syllables, we would expect the penultimate syllables of the postpositional forms in (100) to be long. Since they are not, but all of the closed syllables in the nouns and plurals in (90) contain short vowels, I conclude that there is a constraint requiring that syllables be maximally bimoraic.[27]

[27]Bliese (1981:225) also notes that closed-syllable long vowel shortening occurs between words.

Input Output

This phenomenon is also seen in verbs, as shown by the data in (91). In (91 a & b) the root vowel occurs in an open syllable and is long. In (91 c & d) however, when affixation has closed the root syllable, the vowel is short.

(91) Vowel Shortening in Closed Syllables

	Open Syllable		Closed Syllable
a.	haa.d-e fly-perf *fly* [PH 118]	c.	had.-d-ē fly-3f,2-perf *she, you flew* [B226]
b.	duu.d-e able-perf *be able* [PH87]	d.	dud.-n-ā able-pl-impf *we are able* [B33]

Closed syllable long vowel shortening can be captured with a constraint limiting the weight of syllables. σ-WT is a constraint requiring that syllables be maximally bimoraic.

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a.	at**ū** **a**b-t-ē	-->	a.t**ā**b.te [B226]
	you do-you-perf		*You did*
b.	tamaar**ī** **u**r-t-ē	-->	ta.maa.r**ū**r.te [B224]
	student get well-she-perf		*The student got well*
c.	kimmir**ō** **u**r-t-ē	-->	kim.mi.r**ō**r.te [B224]
	bird get well-3m-perf		*The bird got well*
d.	**ā**n**u** **o**km-ē	-->	a.n**ō**k.me [B224]
	I eat-perf		*I ate*
e.	dar**ō** ecé	-->	darōoce
			I gave grain [B224]

(92) σ-WT: * [μ μ μ]σ (P&S 1993:210)

σ-WT combines with MAX (C), DEP (C), ONSET, and MAX (μ) to ensure the optimal output form. For example, when the root, *haad,* 'fly' is combined with the plural morpheme /n/ and the perfect aspect /ee/, we might expect one of the following output forms.[28]

(93) Possible Outputs from /haad + n + ee/

a. [haa.dne]
b. [ha.Cad.ne]
c. [ha.ad.ne]
d. [haad.ne]
e. [haa.ne]
f. [had.ne]

DEP (C), ONSET, σ-WT, MAX (C) and MAX (μ) correctly rule out the unattested forms as illustrated in (94). [ha.Cad.ne], (94a), is ruled out because it has an epenthetic consonant, thereby violating DEP (C). [ha.ad.ne], (94b), is non-optimal because it has a fatal ONSET violation. [haad.ne], (94c), is ruled out because violates σ-WT as the initial syllable is trimoraic. [haa.ne], (94d), has only two moras if /d/ is deleted so it

[28]The final vowel [ee] shortens in these forms due to a constraint which requires vowels to be short in word-final position in Afar. This is discussed in the next section.

does not violate σ–WT. It does, however, violate MAX (C). [had.ne], (94e), violates only MAX (μ) and is the optimal form.

(94) Closed-Syllable Long Vowel Reduction

	haad + n + ee	DEP (C)	ONSET	σ-WT	MAX (C)	MAX (μ)
a.	ha.Cad.ne	*!				*
b.	ha.ad.ne		*!			*
c.	haad.ne			*!		*
d.	haa.ne				*!	* *
☞ e.	had.ne					* *

The optimal form does, however, have two violations of a constraint, MAX (μ), indicating that MAX (μ) must be ranked lower than DEP (C) (94a), ONSET (94b) and σ-WT (94c). Notice also that this provides no evidence for the ranking of DEP (C), ONSET, σ-WT and MAX (C) with respect to each other: it is only required that the former three are ranked above MAX (μ). The resulting constraint hierarchy is shown in (95).

(95) Constraint Hierarchy

{DEP (C), σ-WT, ONSET} >> MAX (μ); MAX (C)

In the next section I discuss a phenomenon which restricts syllable structure only when a syllable occupies a specific place in a word.

Word Final Long Vowel Reduction

It has already been shown that long vowels shorten in closed syllables. Long vowels also shorten in word-final position.[29] This can be seen, for example, in the perfect forms. The perfect is formed by suffixing /ee/ to a verb stem. With suffixation of the plural (*n*) followed by the focus marker (*i*) (both the plural and the focus marker are discussed in Chapter 3), the perfect appears in a non-final open syllable and is long, as illustrated in (96a-c). If no further suffixation occurs and the aspect marker is word-final, the perfect is short (96d-f).

(96) Perfect Aspect

a. ab-t-ee-n-ī
do-3f-perf-pl-focus
They did [B110]

b. nak-t-ee-n-ī
drink milk-3f-perf-pl-focus
They drank milk [B125]

c. t-okm-ee-n-ī
3f-eat-perf-pl-focus
They ate [B110]

d. ab-t-ē
do-3f-perf
She did [B110]

e. nak-t-ē
drink milk-3f-perf
She drank milk [B125]

f. t-okm-ē
3f-eat-perf
She ate [B110]

---

[9]Exceptions to this are discussed later in this chapter.

A similar phenomenon is seen in nouns. The final vowel on feminine nouns is similar to the vowel of the perfect in that it is long when in an open non-final position (97a–c) and short in word-final position (97d–f).

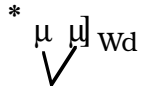
(97) Feminine Plurals

	Plural		Singular
a.	amoo-mā *heads* [B177]	d.	amō *head* [B177]
b.	gilee-lā *knives* [B177]	e.	gilē *knife* [B177]
c.	diyii-yā *charcoal* [B177]	f.	diyī *charcoal* [B177]

One possible analysis of this phenomenon is that short vowels lengthen in penultimate position. As shown previously with unsuffixed nouns versus nouns with postpositions, this cannot be the case (Exs. 89 and 90). I conclude that there is a constraint requiring that word-final vowels be short, rather than a constraint requiring vowels to be long in penultimate position. This constraint and its interaction with other constraints is discussed next.

A constraint prohibiting the occurrence of long vowels in final position, as in (98), can be used to account for word-final long vowel reduction.

(98) Final Short Vowel (FSV)
A word-final vowel must be short.



FSV states that a geminate may not occur at the end of a word. The tableau in (99) shows how this works with the input /ab+ee/.

(99) Word Final Vowel Shortening
/ab + ee/ [abē] (do-perf, *I did*) [B110]

	/ab + ee/	FSV	ONSET	DEP (C)	MAX (μ)
a.	μ μ a.be	*!	*		
b.	μ μ a.be.e		**!		
c.	μ μ a.be.C.e		*	*!	
☞ d.	μ μ a.be		*		*

(99a) is a non-optimal output as it violates FSV, having a long vowel in the final syllable. FSV must be ranked above MAX (μ) (99a vs. d). (99b) is non-optimal, not because it violates FSV, as the last syllable doesn't contain a long vowel, but because it has two ONSET violations, one more than any of the other candidates. ONSET must be ranked above MAX (μ) (99b) vs (99d). (99c) is nonoptimal because it violates DEP (C).[30] This shows that DEP (C) must be ranked above MAX (μ) (110c vs. d). Note that the optimal output, (99d), does violate a constraint in that the final mora must be deleted in order to avoid a violation of FSV. The rankings discussed above provide the following hierarchy.

(100) Constraint Hierarchy

{ FSV, DEP (C), ONSET } >> MAX (μ)

In the next section I discuss lexical exceptions to both closed-syllable shortening and final-vowel shortening and suggest a way they might be handled in OT.

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[30]This might also be accomplished with a constraint which enforces geminate integrity, disallowing insertion of a segment into a geminate. The exact characterization of this phenomenon isn't crucial to any of the points being made here.

Exceptions

In the next two sections I discuss exceptions to Closed-Syllable Vowel Shortening and Final Short Vowel.

Superheavy Syllables

There are also cases where it appears as if there are superheavy syllables, (C)VVC, which violate σ-WT and serve as exceptions to closed-syllable long vowel shortening. Examples of these are shown in (101). In (101a-c), the forms in (i) can be contrasted with the forms in (ii) in each case. In the (i) forms, the vowel appears long in an open syllable, but short in a closed syllable as required by σ-WT. In the (ii) forms, however, although the relevant vowel appears long in an open syllable, it also appears long in a closed syllable. The latter forms are exceptions to σ-WT in that they contain a trimoraic syllable.[31]

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[31] For (112)bi, Parker & Hayward (1986:142) give the following citation "ko (koo)", indicating that it optionally may contain either a short or long vowel. If *ko* is a possible form it may serve as an exception to the minimal word constraint proposed later in this chapter. Since closed class words are commonly exceptions to minimal word constraints, I do not address this.

(101) Exceptions to Closed-syllable Long Vowel Shortening

		Open Syllable	Closed Syllable
a.	i.	haa.d-e fly-perf *fly* [PH118]	had.-d-ē fly-3f,2-perf *She, you flew* [B226]
	ii.	maa.d-ē reach-perf *You reached* [PH157]	maad.-d-ē arrive-3f-perf *You, she arrived* [B226]
b.	i.	koo *you* [B13]	kō-t you-by *by you* [B226]
	ii.	kaa *him* [PH140]	kāa-t *him-by* *by him* [B226]
c.	i.	duu.d-e able-perf *be able* [B87]	dud.-n-ā able-pl-impf *We are able* [B33]
	ii.	sii.b-ē uproot-perf *I uprooted* [PH191]	siib.-n-ā uproot-pl-impf *We uproot* [B226]

The question arises as to how to handle these exceptions within OT. I first introduce a general way to handle exceptions in OT, proposed by Tranel (1994), then show it can be used to handle exceptions in Afar syllable structure.

Tranel (1994) discusses French elision and liaison and how to handle h-aspiré forms which serves as exceptions to these processes.

"Succinctly put, liaison refers to the pronunciation of otherwise silent word-final consonants before vowel-initial words, while elision refers to the phonetic absence of otherwise pronounced final vowels before consonant-initial words" (Tranel 1994:1). The basic French liaison facts are as shown in (102) - (103) (Tranel 1994:4; Figs. 4-7). For example, the final consonant of *peti(t)* surfaces when that word precedes a vowel-initial word (102b) but does not appear when followed by a consonant-initial word (102c).[32] (103) shows that there are some words for which the final consonant or vowel is invariant: it occurs in both contexts.

		'Underlying Representations'	'Phonetic Representations' (abbé 'abbot', curé 'priest')		
		(a)	(b) --- V	(c) ---C	(d) ---//
Liaison	(102)	peti(t) 'small'	petit abbé	peti curé	peti
	(103)	honnet 'honest'	honnet abbé	honnet curé	honnet

Tranel's basic analysis is as follows. Linking consonants are floating segments which lack higher structure such as a root node and are only present in the output when required by the constraint hierarchy. (Others have proposed that floating segments lack root nodes. For example, see Zoll 1994).

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[32]Tranel uses parentheses to indicate that the consonant is silent unless in liaison or that the vowel is pronounced except when elided.

Tranel uses the constraints in (104) (Tranel 1994:4; Fig. 8).

(104) Main Relevant Constraints and Informal Definitions:

MAX: Avoid deleting segments
DEP: Avoid inserting segments
AIF: Avoid integrating floaters
ONSET: Syllables must have an onset

AIF requires that floaters not be integrated into the prosodic structure of the output. Therefore, if a floater is present in the output, there is an AIF violation. Tranel's analysis proceeds as follows. If AIF is ranked below MAX, DEP and ONSET, the correct result obtains as shown in (105) (Tranel 1994:6; Fig. 12).

(105) Input: /peti(t) abbé/ *petit abbe* (small abbot)

	Candidates	{MAX	DEP}	ONSET	AIF
☞ a.	peti.tabbé				*
b.	pati.abbé			*!	
c.	petit.abbé			*!	*
d.	peti.qabbé		*!		
e.	pe.t<i>abbé	*!			
f.	peti.<a>bbé	*!			

The interesting part of the analysis for present purposes is his treatment of h-aspiré words. H-aspiré words are interesting because they exhibit the exact opposite output expected with respect to liaison.

When a consonant-final word is followed by an h-aspiré word, such as *ibu*, the floater is not integrated: i.e., there is no liaison (Tranel 1994:9; Fig. 23-24).

(106) /peti ibu/ *petit hibou* (small owl)

(a) 'UR'	(b) 'PR'	(c) Summary
peti(t)	peti ibu (*petitibu)	no liaison

To account for these forms, Tranel introduces a new constraint, ALIGN-LEFT. ALIGN-LEFT requires that the left edge of a word align with the left edge of a syllable (Tranel 1994:9; Fig. 27).

(107) ALIGN-LEFT: ALIGN (W, L, σ, L)

Following Tranel, in (108) "|" is used to mark the edge of a word and "." to mark syllable boundaries (Tranel 1994:10; Fig, 30). ALIGN-LEFT prevents the floating consonant from appearing to avoid an ONSET violation because the left edge of the word *ibu* would not be aligned with the left edge of a syllable.

(108) /peti ibu/ *petit hibou* (small owl)

	CANDIDATES	{MAX	DEP}	ALIGN-LEFT	ONSET	AIF
a.	peti.t|ibu			*!		*
☞ b.	peti.|ibu				*	

Referring back to the typical liaison case, we see that the difference between the typical cases and the h-aspiré cases is that for the h-aspiré cases, ALIGN-LEFT must dominate ONSET, while for the typical cases, ONSET dominates ALIGN-LEFT.

This provides the following hierarchies (Tranel 1994:11; Fig. 32).

(109) Relevant Constraint Hierarchies

(a) ALIGN-LEFT >> ONSET (for h-aspiré)
(b) ONSET >> ALIGN-LEFT (otherwise)

In French, Tranel argues that h-aspiré words are exceptions to liaison (and elision) because they trigger a different constraint hierarchy than the non-exceptional forms. In the following section I show that this approach can be used to account for (C)VVC syllables in Afar as well.[33]

I now turn to two possible analyses of (C)VVC syllables. First, I show that an analysis which posits that Afar actually does allow superheavy syllables in some instances is the preferred analysis.

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[33]Tranel's triggering of a different constraint hierarchy is a powerful way to handle exceptions. At this point it is not clear that the exceptions in Afar require that power and nothing in my analysis hinges on the use of his system to handle exceptions. It is also possible to account for exceptions as in Hammond (1995). All that is necessary here is that there is some way of handling exceptions in Afar.

Second, I show that an analysis which posits that these sequences actually consist of more than one syllable has significant problems.

The analysis adopted here is that there are some (C)VVC syllables in Afar despite the σ-WT constraint that requires that vowels be short in closed syllables. These words, as in the analysis of French elision and liaison above, trigger a rearrangement of part of the constraint hierarchy. Recall that the following constraint hierarchy was necessary to allow for closed-syllable long vowel shortening.

(110) Constraint Hierarchy for Closed-Syllable Vowel Shortening

{DEP (C) , σ-WT, ONSET} >> MAX (μ); MAX(C)

But this will produce the incorrect result in instances where a long vowel does not shorten in a closed syllable, as shown below. (I use ✖ to indicate that the constraint hierarchy produces the wrong form as optimal).

(111) σ-WT and Long Vowels that don't Shorten

/maad-t-ee/ [maad.de]
arrive-you, she-perf
You, she arrived [B226]

		maad + t + ee	DEP (C)	ONSET	σ-WT	MAX (C)	MAX (μ)
	a.	ma.Cad.de	*!				*
	b.	ma.ad.de		*!			*
☞	c.	maad.de			*!		*
	d.	maa.de				*!	**
✖	e.	mad.de					**

Instead of MAX (μ) being ranked below DEP (C), ONSET and σ-WT, it is σ-WT that must be lowest ranked to produce the correct result.

(112) Constraint Hierarchy for Exceptions

{DEP (C), ONSET, MAX (C), MAX (μ)} >> σ-WT

This is shown by the tableau in (113). As the optimal form (113e) violates σ-wt but none of the other outputs (113a-d) violate this constraint, it must be the lowest-ranked constraint.

(113) σ-WT and Long Vowels that do not Shorten In Closed Syllables

		maad + t + ee	MAX (μ)	DEP (C)	ONSET	σ–WT
	a.	mad.ne	**!			
	b.	ma.Cad.de	*	*!		
	c.	maa.ne	**!			
	d.	ma.ad.ne	*		*!	
☞	e.	maad.ne	*			*

I conclude, then, that exceptional syllables with a long vowel in a closed syllable can be accounted for within the rubric of OT.

Parker and Hayward, however, propose an analysis different from that presented above. They suggest that what appear to be superheavy syllables are in fact not a single syllable but rather two syllables with a syllable division between the vowels (PH 1986:215). They argue that this analysis is necessary "[i]n order to account for accent and tonal association... and also to define accurately the operation of the Double Vowel Reduction Rule <LF: closed-syllable long vowel shortening>" (Parker & Hayward 1986:215). I address each of these in turn.

Parker & Hayward discuss cases where geminate vowels exhibit different tonal patterns and suggest this is an argument for a syllable division between vowels in words where a long vowel does not shorten in a closed syllable. Specifically, they assert that some geminate vowels are pronounced with a falling pitch whereas others are pronounced with a slightly rising pitch. Parker & Hayward analyze these as a high tone being associated with the first and second vowel respectively.

(114) Tone and Geminate Vowels (Parker & Hayward 1986:216)

lā.a	*cattle*	le.ē	*water*
kā.a	*him*	tu.ūt	*cotton*
bō.ol	*hundred*	bo.ōn	*blacksmith*

This distinction is not found in words of more than one syllable. And, from the examples given by Parker & Hayward, it seems irrelevant to the discussion at hand as it does not seem to apply to verbs. I do not discuss it further here.

Parker & Hayward's argument that these syllables must be CV.VC in underlying representation in order not to trigger closed-syllable vowel shortening must be defined in terms of the output in Correspondence Theory. In Correspondence Theory, then, the issue would be how to get CV.VC as an output, avoiding shortening of the vowel by closed syllable shortening. The OT analysis which has CV.VC as the optimal output is similar to the one proposed for a CVVC output: these forms trigger a different constraint hierarchy.

The necessary constraint hierarchy is shown in (115).

(115) Constraint Hierarchy for Exceptional Forms

{σ WT, MAX (C)} >> ONSET; MAX (μ)

This is shown in the tableau in (116).

(116) CV.VC Syllables

	maad + n + ee	MAX (μ)	MAX (C)	σ –WT	ONSET
a.	mad.ne	**!			
b.	maa.ne	**!	*		
c.	maad.ne	*		*!	
☞ d.	ma.ad.ne	*			*

(116a) is ruled out because it is the only output with more than one MAX (μ) violation. (116b) is ruled out because it violates MAX (C). (116c) is non-optimal because it violates σ-WT. The optimal form is then (116d) which violates only the lower ranked ONSET. The corresponding constraint hierarchy is in (117).

(117) Constraint Hierarchy

{MAX (C), σ-WT} >> ONSET; MAX (μ)

In other words, within OT both the CVVC and the CV.VC analysis require basically the same machinery: a change in the ranking of constraints in the hierarchy.

The analysis adopted here, however, has two advantages over an analysis which posits that a CVVC sequence is actually two syllables: CV.VC. First, this analysis predicts there should be no forms of the shape (C)VV.VC because onsetless medial syllables are disallowed. No

such forms are attested. The model which analyses CVVC as CV.VC predicts there should be such sequences, as both medial VC and initial CVV syllables are permitted. Second, these analyses make different predictions about the pronunciation of the relevant words. This analysis posits that in the cases under discussion, the difference between the two types of (C)VVC syllables is that they trigger different hierarchies: therefore native speakers would consider (*haa.dē*vs *ma.adē* as having the same number of syllables. The Parker & Hayward analysis, on the other hand, predicts that native speakers would interpret *haa.dē* as having two syllables and *ma.a.dē* as having three. According to Parker & Hayward (1986:215), there is no difference in pronunciation between the two types of words. Therefore, the analysis of CVVC sequences where there is no syllable division between the vowels is the preferred one.

In this section I have shown that there are exceptions to the σ–WT constraint in that there are CVVC syllables in the output. I have also shown that these exceptions are best analyzed as CVVC syllables, not a sequence of two syllables. One way to account for these is through Tranel's theory of constraint reranking.

Long Vowels in Word-Final Position

There are also instances where word-final vowels do not shorten in spite of Final Short Vowel. There are three cases where vowels do not shorten in word-final position: when the word is monosyllabic, when a final long vowel is required by the prosody and when derived long vowels occur as a result of the root final /y/ deleting between vowels. I address each in turn.

The Minimal Word

In this section I show that a bimoraic minimal word constraint dominating FSV allows monosyllabic words to end in a geminate vowel. There is evidence elsewhere in the language for a bimoraic minimal word. There are no words of the form (C)V in Afar: in other words, there are no monomoraic nouns or verbs (Hayward 1976:69). There are, however, bimoraic nouns and verbs ending in a final long vowel (118).

(118) Monosyllabic Words in Afar

	Nouns		Verbs
a.	lēe *water* [B227]	d.	b-ēe (bey) *I have* [B226]
b.	lāa *cattle* [PH152, 216]	e.	w-ēe (wey) *I, he lacked* [B259]

c.	doo *ascent* [PH85]	f.	g-eē (gey) *I found* [B226]

This is accounted for through the use of two constraints. First, monosyllabic words are stressed, indicating that a PRWD must be a foot, as in (119).

(119) PRWD = FOOT
A prosodic word must contain a foot.

Feet in Afar are bimoraic as evidenced by the fact that there are no monomoraic words in Afar.

(120) FOOT = μμ
Feet are bimoraic.

Since these are two separate constraints, it should be possible for another constraint to occur between them. In this analysis, however, there is no need for any constraints to occur between them, and I abbreviate them as the single constraint shown in (121), the Bimoraic Minimal Word constraint.

(121) Bimoraic Minimal Word (MINWD)
PRWD = μμ

If MINWD is ranked above FSV, monosyllabic roots with an underlying long vowel will not shorten. If a mora in the input is deleted in order to satisfy FSV, the result will be monomoraic, violating the higher ranked MINWD (122a). This is seen below in (122) where the optimal form, (122b), violates FSV, but not the higher ranked MINWD.

(122) MINWD and FSV

lāa
m. *cattle, cows* [PH153]

	Candidates	MINWD	FSV
a.	la	*!	
☞ b.	laa		*

This ordering of constraints also achieves the correct result for disyllabic and longer words as shown in (123). In (123) neither the form with the final mora deleted (123a) nor the form with the final mora present (123b) violates MINWD as both are at least bimoraic. The latter, however, violates FSV.

(123) MINWD and FSV

ab-ē /ab + ee/
do-perf
Did [PH28]

	ab + ee	MINWD	FSV
☞ a.	a.be		
b.	a.bee		*!

MINWD cannot account for the other two cases where long vowels surface however, in that both of these cases may involve disyllabic words: words with a contour tone and words where the final vowel becomes long due to a consonant that is deleted.

Prosodic Vowels

Some of the cases where a long vowel surfaces in word-final position are due to the fact that the prosody marking questions requires a long vowel in word-final position. I first discuss the consultative.

As discussed in Chapter 1, the consultative is marked by a suffixed long [òò] with a high to falling tone (124). It is a subset of the larger phenomenon of yes/no questions.

(124) The Consultative

a. ab-òò	b. sol-n-òò	c. n-abbax-òò
do-consul	*stand-pl-consul*	*pl-hold-consul*
Shall I do (it)?	Shall we stand?	Shall we hold?
[B146]	[B146]	[B146]

Different sentence types are marked on the final word of the clause. As Afar is a verb final language, these prosodies typically occur on the verb. In what follows I discuss the prosodies of "WH" questions and yes/no questions.

In WH questions, the final verbs have "a vocalic extension which carries a gradually rising pitch throughout its length" (Parker & Hayward 1985:223). If the verb ends in a vowel, the vowel is lengthened; if it ends in a consonant, a long vowel is suffixed. In this case, the quality of the vowel is predictable: it is [a] after [a], [u] after [o], and [i] after [e].[34] In this case, however, the vowel is long.

(125) "WH" Question Prosody

a. ānke gex-x-áá?
where go-you-impf/WH Q
where are you going? [PH223]

b. mā waqadi gex-x-aa-n-áá?
what time go-you-impf-pl-WH Q
when are you (pl) going? [PH223]

The other type of question sentence prosody is found in yes/no sentences. Like WH sentences, a final vowel is lengthened or a durationally long vowel is suffixed to consonant–final verbs. The difference here is in the pitch. Whereas the final vowel of verbs in WH sentences have a rising pitch, in yes/no questions the final vowel of the verb carries a steep "high to low fall" (Parker & Hayward

[34]Parker & Hayward (1986:223) state that they don't mark stress or length in these in the examples because it is predictable so I have added stress and length to the data based on their description.

1986:224). According to Parker and Hayward, in yes/no questions a final vowel is lengthened or a durationally long vowel is suffixed to consonant–final verbs (PH 1986:224). Additionally, "[f]inal verbs in 'yes/no question' sentences are marked by a vocalic extension which carries a steep high to low fall" (Parker & Hayward 1986:223).

(126) Yes/No Question Prosody

a. gex-ee-n-ìì
go-perf-pl-Y/N Q
did he go? [PH224]

b. t-aamitt-àà
3f-work-impf-Y/N Q
does she work? [PH224]

To summarize, questions are marked with a final long vowel at the end of the last word in the sentence, despite the FSV constraint.

(127) Question Prosodies

a. WH Question: gex-x-aa-n-áá
b. Y/N Question: gex-ee-n-ìì

In what follows I show how this can be analyzed within an OT framework.

There are three constraints which are important in an analysis of Y/N and WH questions.[35] These are discussed below.

TONE specifies the attachment properties of tone: a tone must attach to a single vocalic mora.

(128) TONE: A tone must attach to a single vocalic mora.

The Y/N question constraint, Y/N Q, requires that a HL sequence of tones be attached to the final syllable of the sentence.

(129) Y/N Q
Align a high tone with the leftmost mora of the final syllable of the sentence and a low tone with the rightmost mora of the final syllable of the sentence.

The WH question constraint, WH Q, aligns a LH sequence with the final syllable of the sentence.

(130) WH Q
Align a low tone with the leftmost mora of the final syllable of the sentence and a high tone with the rightmost mora of the final syllable of the sentence.

---

[35] It is certainly possible to arrive at a more general analysis of tone assignment in Afar than the detailed constraints proposed here. The point of this section is not to analyze tone in Afar, but rather, to account for why the long vowels occur word finally in yes/no and WH questions in spite of Final Short Vowel.

I now show how this works for Y/N questions. If no vowel is epenthesized and the tone sequence is added to the final syllable of the word, two tones will be attached to a single mora, violating tone (131a). TONE must be ranked above DEP (μ), as seen by comparing (131a) and (131c). If a vowel is epenthesized into the final syllable of the word, TONE will be satisfied because each tone will be attached to a single vocalic mora, but σ-WT will be violated (131b). Because (131b) has only one violation of DEP (μ) whereas (131c) has two violations, σ -WT must be ranked above DEP (μ).

(131) TONE >> DEP (μ); σ-WT >> DEP (μ)

	gex + t + aa + n	TONE	σ-WT	DEP (μ)	MAX (μ)
a.	gex-.x-à`-n	*!			*
b.	gex-.x-àà-n		*!		
☞ c.	gex-.x-aa-.n-àà			* *	

If the tones are attached to both vowels in the word, Y/N Q is violated as the tones are aligned with more than one syllable.

(132) Y/N Q >> DEP (μ)

	gex + t + aa + n	Y/N Q	DEP (μ)
a.	gèx-.x-à-n	*!	
☞ b.	gex-.x-aa-.n-àà		* *

Finally, MAX (C) must be ranked above DEP (μ) so that the final consonant is not deleted in order to satisfy Y/N Q.

(133) MAX (C) >> DEP (μ)

	gex + t + aa + n	Y/N Q	MAX (C)	DEP (μ)
a.	gèx-.x-àà		*!	
☞ b.	gex-.x-aa-.n-àà			* *

The optimal output, then, is one in which two vowels are epenthesized to the end of the word, with a high low sequence of tones aligned with these moras.

A similar situation exists with WH questions. The only difference between Y/N questions and WH questions is that Y/N questions have a falling tone whereas WH questions have a rising tone. The reader may verify this for herself/himself.

Another constraint that interacts with both WH Q and Y/N Q is FSV as the former two constraints both require that the final vowel of the word be long. This indicates that FSV must be ranked below these, as shown, for example, in (1314).

(134) Y/N Q >> FSV

	gex + t + aa + n	Y/N Q	FSV	DEP (μ)
a.	gèx -x-à-n	*!		
☞ b.	gex-x-aa-n-àà		*	* *

The prosody of Y/N questions explains why the final vowel of the consultative is long: it is a Y/N question.

(135) The Consultative

		sool + n + oo	Y/N Q	TONE	FSV	MAX (μ)
	a.	sol.nó´		*!		*
☞	b.	sol.nóó			*	

In this section I have shown that an apparent violation of FSV is due to the need to satisfy a higher-ranked prosodic constraint.

There is one other case where a long vowel occurs in word-final position. This is discussed below.

The Deletion of /y/

The final case of exceptions are optional variants of the expected output. The facts are as shown below. In (116) are inputs and outputs for some verbs: in the left column are the inputs and in the right column are the outputs. The inputs consist of a [y]–final verb root followed by the perfect. The outputs are what we expect from the discussion thus far. The only change between the input and the output is that the final vowel is short as required by FSV.

(136) Outputs Consistent with the Current Constraint Hierarchy.

	Input	Outputs
a.	/uqunxuy + ee/ small-perf	[uqunxuye] *become small, become humble* [PH201]
b.	/agooriy + ee/ regard-perf	[agooriye] *regard, consider* [PH36]
c.	/alay + ee/ ripe-perf	[alaye] *become ripe, cook* [PH37]
d.	/eedey + ee/ dwell-perf	[eedeye] *dwell, rest, stay, stop* [PH94]
e.	/unuwwuy + ee/ refresh-perf	[unuwwuye] *be refreshed, be revived* [PH205]

If this were the only data there would be nothing more to say. In (137) however, are alternative outputs which are in free variation with the outputs introduced above. Bliese describes this phenomenon as follows. "A single *y* deletes when preceded by an unstressed *e* and followed by *e* or *i*. The preceding vowel deletes when the following vowel is long" (Bliese 1981:217). From the examples Parker and Hayward give, however, this does not seem to be the correct generalization as it also seems to happen when the /y/ is preceded by /u/ or /a/ (137a, c, e) (and it is unclear what happens when the examples are preceded by /o/). Although the exact generalization is unclear at this point, what is clear is that in some cases, if a /y/ is

preceded by a vowel and followed by /ee/, the [y] and a vowel in the input do not surface and the word ends in [ee], in violation of Final Short Vowel, as shown in (137).

(137) Outputs Inconsistent with the Constraint Hierarchy

	Input	Output
a.	/uqunxuy + ee/ small-perf	[uqunxee] *become small, become humble* [PH201]
b.	/agooriy + ee/ regard-perf	[agooree] *regard, consider* [PH36]
c.	/alay + ee/ ripe-perf	[alee] *become ripe, cook* [PH37]
d.	/eedey + ee/ dwell-perf	[eedee] *dwell, rest, stay, stop* [PH94]
e.	/unuwuy + ee/ refresh-perf	[unuwwee] *be refreshed, be revived* [PH205]

The hierarchy established thus far, as shown in (138), will produce the forms in (136) but not the forms in (137).

(138) Constraint Hierarchy

{FSV, DEP (C), MAX (C)} >> MAX (μ)

An additional constraint is needed which disallows the occurrence of [y] between vowels.

(139) *Vye

A [y] cannot be preceded by a vowel and followed by [e(e)]

Like the previous exceptions, these can be handled by triggering a reranking of the constraint hierarchy. First I present a tableau for the forms which do not delete the root final *-Vy* but do shorten the perfect marker. For these, FSV must dominate *Vye as shown by (140a-b) as compared with (140d). As (140d) has a *Vye violation but (140a-b) do not, FSV must be ranked above *Vye. MAX (C) must also be ranked above *Vye (140c) vs. (140d).

(140) FSV >> *Vye; MAX (C) >> MAX (μ)

	alay + ee	FSV	MAX (C)	*Vye	MAX (μ)
a.	a.la.yee	*!		*	
b.	a.lee	*!	*		*
c.	a.le		*!		* *
☞ d.	a.la.ye			*	*

For the variant forms, however, a different hierarchy is required as shown in (141). *Vye will rule out any forms in which the [y] surfaces. The remaining two forms illustrate the need for *CMP (V_1V_2)

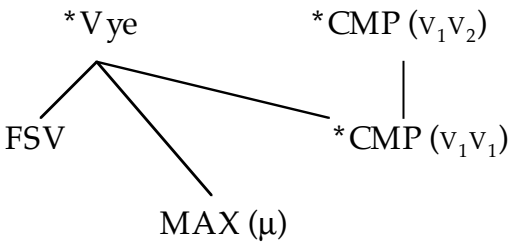
and *CMP (V_1V_1). [36] *Vye must be ranked above MAX (μ) (141a vs. 141c & d). *CMP (V_1V_2) must be ranked above *CMP (V_1V_1) so that the optimal output will have a geminate vowel instead of a diphthong. This shows that *Vye must be ranked above *CMP (V_1V_1) (141a & b vs. 141d). Finally, *Vye must be ranked above FSV or (141b) would be the optimal form.

(141) *CMP (V1V2) >> *CMP (V1V1); *Vye >> MAX (μ); *Vye >> FSV

		alay + ee	*Vye	MAX (C)	MAX (μ)	*CMP(V_1V_2)	*CMP(V_1V_1)	FSV
	a.	a.la.yee	*!					*
	b.	a.la.ye	*!		*			
	c.	a.lae		*	* *	*		*
☞	d.	a.lee		*	* *		*	*

The necessary hierarchy for these forms is shown in (142).

(142) Constraint Hierarchy for Exceptions



[36] Something also needs to be said about the quality of the resulting vowel. I do not discuss this here, however.

In this section I have discussed exceptions to syllable structure constraints, specifically exceptions to Closed-Syllable Long Vowel Shortening and Final Short Vowel. In the next section I discuss another phonological phenomenon, the non-occurrence of [y] following consonants.

The Absence of [y]

In this section I discuss the distribution of [y] in both phonological and morphological environments. I show that [y] does not occur after consonants and propose a constraint to account for this. This constraint also accounts for the non-occurrence of one of the dual–position affixes on consonant–initial verbs.

Phonological Distribution

In this section I discuss the distribution of [y] in phonological environments. For comparison, I contrast [y] with the other glide, [w], to show that this distribution is a property of [y], not glides in general. [w] and [y] share similar distributions except for one situation: when the [y] follows a non-identical consonant. As shown in (143d), [w] can occur after a non-identical consonant whereas [y] never does.[37]

---

[37]Hayward (1976:60) states that neither [y] nor [w] can follow a consonant.

(143) Distribution of [y] and[w]

a. Before a vowel

yV	wV
y-okm-ē	wōkkel
3m-eat	*there* [B11]
he ate [B110]	

b. Between vowels

VyV	VwV
acāy-u	awīita
give-subj	*eagle* (acc) [B126]
that I give [B217]	

c. As part of a geminate (underlying)

VyyV	VwwV
duyyē	qawween-ē
things [B11]	forget-perf
	I, he forgot [B154]

d. After a consonant

VCy	Vcw
*	marub-wā
	sheep-pl
	sheep (pl) [B210]

e. Before a consonant

VyC	VwC
t-eys-eemen-ē	awkī
2-caus-believe-perf	*child* [B7]
you caused to believe [B219]	

f. After a vowel

...Vy	...Vw
hay	bāxaw
Put (imper) [B226]	*Son* (vocative) [B183]

Morphological Alternations

There are also morphological environments where a [y] is expected to occur after a consonant but does not. The first concerns a suffix which attaches to nouns and means "a particular X", and the second is the masculine third person marker. I discuss the Particular here and delay discussion of the third person marker until Chapter 3.

The Particular suffix has several different forms: *-yta/ta, -yto/to, -ytu/tu*. The vowel alternation (a~o~u) is not relevant to our purposes and will not be discussed here (See Bliese 1981). Rather, the focus is the alternation between the presence and absence of [y]. The [y] form occurs after vowel-final nouns (144a-d) and the [y]-less forms occur after consonant-final nouns (144e-h).

(144) The Particular

	Noun	Particular Noun	Gloss
a.	wakalī	wakalī-yta	*(particular) companion* [B175]
	baarrā	baarra-ytō	*(particular) woman* [B175]
b.	tooboko	tookobō-yta	*brother* [PH228]
		tookobo-ytā	*sister* [PH228]
c.	qayso	qayso-yta	*a tuft of grass* [PH228]
d.	dummu	dummū-yta	*male cat* [PH228]
		dummu-ytā	*female cat* [PH228]
e.	cutūk	cutūk-ta	*(particular) star* [B175]
	qaskār	qaskār -tu	*(particular) servant* [B175]

f.	āqan	aqán-tu	*a/the frog* [PH228]
g.	bāsal	basāl-tu	*onions* [PH229]
h.	īgix	igīx-xa (from igix-ta)	*scorpions* [PH229]

With the Particular suffix, then, we see that [y] appears at the beginning of the affix when it follows a vowel, but that it does not appear when the Particular follows a consonant.

In this section I have shown that [y] has an unusual distribution in Afar: it does not occur following consonants unless it is part of a geminate. I have shown that this is the case with both phonological and morphological evidence. In the Particular suffix a [y] appears when the affix follows a vowel but it does not appear when the affix follows a consonant.

Insertion or Deletion

The question addressed in this section concerns how the phenomenon discussed above, the presence and absence of [y] in certain phonological and morphological environments, is to be analyzed. This phenomenon could be accounted for by a constraint which causes [y] to be inserted in certain environments or by a constraint which requires that [y] not surface in certain environments.

The combination of the phonological distribution of [y] and its distribution in the Particular shows that this constraint must be one of

"Y-Deletion" rather than "Y-Insertion". Recall that the Particular is the of the form *-tV/-ytV*. It is suffixed to nouns and the /y/ surfaces when it attaches to vowel-final stems but not when it attaches to consonant-final stems.

The previously suggested general constraint disallowing the occurrence of [y] after a consonant will account for the presence of [y] in the Particular: the [y] surfaces just in case it follows a vowel, it does not surface if it follows a consonant. An insertion analysis is also available, however: a [y] must occur following a vowel and preceding a CV suffix.[38]

The phonological distribution of [y] indicates that the deletion analysis is the correct one. Remember that unlike other consonants, [y] occurs in all environments except following a consonant. A constraint which disallows [y] after consonants accounts for this. A constraint which inserts [y] before a CV suffix does not.

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[38] Citing the Particular and the third person masculine morpheme which is discussed in Chapter 3, Bliese (1980:216-217) suggests that there is a rule of Y deletion. Another argument that might be made would be if there were other suffixes of the form CV that occurred after vowel-final and consonant-final forms to show that it is not the case that a [y] is inserted after final vowels when followed by a consonant-initial affix. I have not been able to find any affixes of this kind in Afar. The only consonant-initial affixes in Afar which occur after vowel-final stems are single consonants which mark the genitive on monosyllabic consonant-final nouns and on consonant-final weekday names (See Bliese 1980:167-169). No consonant could appear between these and the final vowel without violating syllabification constraints.

As discussed above, the absence of /y/ following consonants can be accounted for with a constraint which disallows [y] following a consonant.

(145) *Cy: A [y] cannot follow a consonant

In Chapter 3, I show how this accounts for one of the variable-position affixes, a /y/ which surfaces as an onset on vowel-initial verbs but does not surface on verbs where it would follow a consonant. I show how this constraint works with the Particular below. (146) shows that *Cy will require a form with [y] following a consonant to be less optimal than one where there is no [y] following a consonant (146a vs. 146b).

(146) The Particular and *Cy

cutuk-ta
star-particular
A particular star [B175]

	cutuk + yta	*Cy	MAX (C)
a.	cutuk–yta	*!	
☞ b.	cutuk-ta		*

*Cy will not, however, choose between two forms where one deletes the consonant preceding [y], and one deletes the [y] (147a vs. 147b).

(147) The Particular and *Cy

	cutuk + yta	*Cy	MAX (C)
a.	cutu–yta		*
☞ b.	cutuk–ta		*

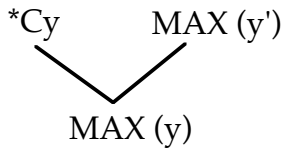
Deciding between these requires the division of MAX (C) into more than one constraint. For simplicity, I will represent these using two constraints: MAX (y) and MAX (y'). MAX (y) prohibits the non-parsing of [y]. MAX (y') is a cover for the rest of the constraints prohibiting deletion of all consonants except /y/: MAX (t), MAX (g), MAX (q), etc. If MAX (y') is ranked above MAX (y), the correct result is obtained, as shown in (148).

(148) The Particular and *Cy

	cutuk + yta	*Cy	MAX (y')	MAX (y)
a.	cutuk–yta	*!		
b.	cutu–yta		*!	
☞ c.	cutuk–ta			*

Both *Cy and MAX (y') must be ranked above MAX (y) as can be seen by comparing (148a & b) with (148c). The resulting constraint hierarchy is shown below.

(149) Constraints Needed for the Non-appearance of [y]



In this section I have shown that /y/ is different from other consonants in that it never follows consonants (except as part of a geminate) even though it precedes consonants and it can precede or follow vowels. This distribution is also exhibited when [y] is the initial element of a morpheme such as the Particular, where it appears after vowels but does not occur following consonants. I have proposed a constraint of the form *Cy, which disallows [y]s from occurring following consonants. Additionally, I showed that the MAX constraints must be divided into two constraints to capture the fact that when [y] follows the consonant in the input, it is the [y] that deletes to satisfy *Cy rather than the preceding consonant. In Chapter 3, I discuss a verbal case where a /y/ does not surface, the third person masculine marker on consonant-initial verbs.

Summary

In this Chapter I have analyzed phonological phenomena which play a role in the analysis of the variable-position affixes. Specifically, I have discussed the structure of syllables, closed syllable long-vowel

shortening, final-vowel shortening and the absence of [y] following a consonant. In analyzing these phenomena, the constraints in (150) are motivated.

(150) Constraints motivated in this chapter

a. ONSET
b. ALIGN-L
c. FINAL-C
d. σ-WT
e. dep (c)
f. FSV
g. DEP (μ)
h. MAX (μ)
i. TONE
j. Y/N Q
k. WH Q
l. *Cy
m. MAX (y)
n. MAX (y')

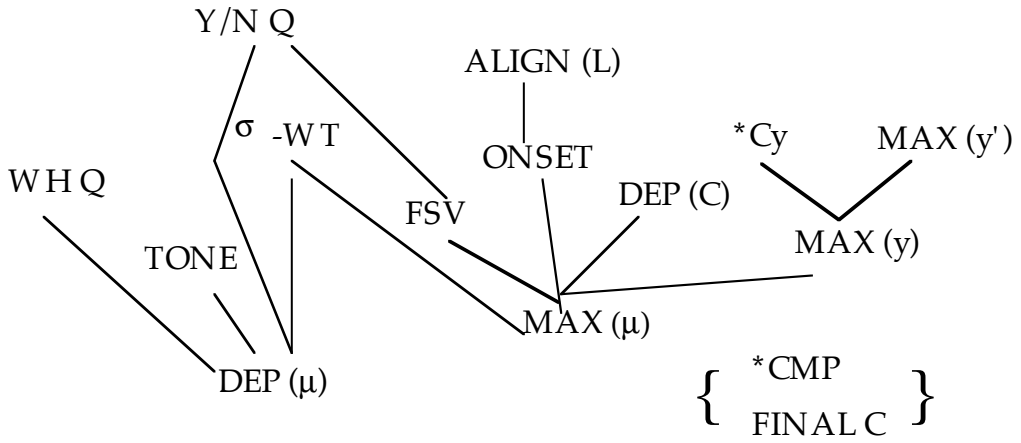
In addition, the rankings in (151) were established for the non-exceptional cases. (Also listed are the phenomena which motivated each ranking).

(151) Rankings Motivated by Phonological Phenomena

Rankings	Word-Final Short Vowels	Initial vs. Medial Onsets	Short Vowels in Closed Syllables	Absence of [y] following consonants	Prosody
ALIGN L >> ONSET		✔			
FSV >> MAX (μ)	✔				
DEP (C) >> MAX (μ)	✔		✔		
ONS >> MAX (μ)	✔		✔		
σ-WT >> MAX (μ)			✔		
σ-WT >> DEP (μ)					✔
Y/N Q >> DEP (μ)					✔
WH Q >> DEP (μ)					✔
TONE >> DEP (μ)					✔
MAX (C) >> MAX (μ)			✔		
Y/N Q >> FSV					✔
*Cy >> MAX (y)				✔	
MAX (y′) >> MAX (y)				✔	

The corresponding constraint hierarchy is seen in (152). A line between two constraints indicates a dominance relation.

(152) Phonological Constraint Hierarchy



In the Chapter 3 I introduce the variable-position affixes in Afar and offer an analysis in Optimality Theory.

3. A MULTIPLANAR MODEL

In this chapter I present the person and number markers in Afar and discuss the generalizations that should be accounted for in an analysis of this data. I show that in an OT analysis of the Afar data either an extension of the representations used or serialism in deriving outputs from inputs must be allowed.[39] First I introduce the person and plural markers, discussing generalizations about this data. Second I show that the Afar data create a paradox in an OT account. An extension of OT to include morphological planes which accounts for the Afar data is then introduced. Finally, I discuss the input form for the plural, how /a/-initial forms fit into the analysis proposed here and exceptional vowel-initial verbs.

The Data: The Person and Plural Markers

In this section I introduce the variable-position affixes including their input and surface representations and generalizations about their distribution. In the data discussed below, the [e(e)] suffix marks perfect aspect for both classes of regular verbs. First person forms for the

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[39] Previous work on the variable-position affixes in Afar was done in a generative pre-OT framework (Fulmer 1990, 1991). This derivational analysis, which attempts to account for both inflectional and derivational variable-position affixes argues that the alternating locations of the variable-position affixes are due to rules of copy and deletion. This type of derivational analysis is not possible in OT. Additionally,

consonant-initial class are illustrated in (153). The only overt morphemes are the verb root and the aspect marker.[40]

(153) First Person for Consonant-Initial Verbs

	Verb	*Gloss*	Source
a.	ab-ē	*do*	[B110]
b.	array-ē	*water stock at a different watering place*	[PH45]
c.	arkaak-ē	*flee in the face of some danger*	[PH45]
d.	robaaq-ē	*bounce something*	[PH182]
e.	gex-ē	*go*	[B23]
f.	kal-ē	*stop/prevent*	[B13]
g.	nak-ē	*drink milk*	[B125]
h.	cot-ē	*plow*	[B48]
i.	kaqlis-ē	*wash*	[B45]

The first person vowel-initial forms are shown in (154). Like the consonant-initial forms, they consist of only two morphemes: the root and the perfective.

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previous work on Afar did not address the problem in the ordering of the plural and aspect markers.

[40]It may be the case that there is a person marker that is not overt, or a zero morpheme. Whether the first person is marked or not is not relevant to any of the issues discussed here. I will refer to the first person as not being marked, meaning that there is no overt marker.

(154) First Person Singular for Vowel-Initial Verbs

	Verb	*Gloss*	Source
a.	ewc-ē	*go out*	[B132]
b.	eeqet-ē	*step on*	[B131]
c.	ekk-ē	*become*	[B125]
d.	ixiggil-ē	*milk*	[B132]
e.	isissik-ē	*hurry*	[B132]
f.	ittikiiy-ē	*dress*	[B132]
g.	okm-ē	*eat*	[B110]
i.	ookom-ē	*win*	[B123]
k.	uduur-ē	*return*	[B132]
l.	ucussul-ē	*measure*	[B132]

There are no person markers in the first person singular so there are no variable-position affixes. I have included first person only to illustrate the complete paradigm.

Second person is marked with a [t] in both verb classes.[41] In the consonant-initial class it occurs following the root but preceding the aspect marker, [e(e)] (155).

(155) Second Person Consonant-Initial Verbs

	Verb	*Gloss*	Source
a.	ab-**t**-ē	*do*	[B110]
b.	sar-it-**t**-ē	*wear (benef)*	[B95]
c.	bah-**t**-ē	*bring*	[B101]
d.	bar-it-**t**-ē	*learn*	[B198]

[41]Though in some cases it may assimilate to a preceding consonant. This is discussed further in Chapter 4.

e.	nak-**t**-ē	*drink milk*	[B125]
f.	hay-**t**-ē	*put*	[B147]
g.	sug-**t**-ē	*had*	[B200]
h.	kal-**t**-ē	*prevent*	[B105]
i.	alif-**t**-ē	*close*	[FM7]

The shape of the second person marker is the same for vowel-initial roots, [t], but the location of the affix is different. Instead of occurring between the root and aspect marker, it appears to the left of the root, as a prefix.

(156) Second Person Vowel-Initial Roots

	Verb	*Gloss*	Source
a.	**t**-emmex-ē	*finish*	[B126]
b.	**t**-ekk-ē	*become*	[B125]
c.	**t**-erd-ē	*run*	[B132]
d.	**t**-ec-ē	*give*	[B29]
e.	**t**-ibbix-ē	*seize*	[B6]
f.	**t**-imlik-ē	*rule*	[B132]
g.	**t**-ookom-ē	*win*	[B123]
h.	**t**-okm-ē	*eat*	[B110]
i.	**t**-usuul-ē	*laugh*	[B5]
j.	**t**-ubl-ē	*see*	[B13]

Gender (masculine and feminine) is only distinguished in third person singular verbs. Third person feminine has the same form and

distribution as second person. The form is a [t] which is suffixed to the root in consonant-initial verbs (157).

(157) Third Feminine Singular Consonant-Initial Verbs

	Verb	*Gloss*	Source
a.	ab-**t**-ē	*do*	[B110]
b.	wag-it-**t**-ē	*look (benef)*	[B98]
c.	biyaakit-**t**-ē	*hurt*	[B16]
d.	bey-**t**-ē	*take*	[B88]
e.	digir-**t**-ē	*play*	[B24]
f.	hay-**t**-ē	*put*	[B11]
g.	cawal-**t**-ē	*tire*	[B215]
h.	kal-**t**-ē	*stop/prevent*	[B14]
i.	kud-**d**-ē	*flee*	[B126]
j.	nak-**t**-ē	*drink milk*	[B125]

Third person feminine is prefixed in vowel-initial verbs (158).[42]

(158) Third Feminine Singular Vowel-Initial Verbs

	Verb	*Gloss*	Source
a.	**t**-emeet-ē	*come*	[B126]
b.	**t**-emmex-ē	*finish*	[B126]
c.	**t**-ec-ē	*give*	[B11]
d.	**t**-eed-ē	*stay*	[B131]

[42]The third person feminine forms are identical to the second person forms so each example of one should also be an example of the other. Since many of the forms I have cited have come from a sentential context, they had only one meaning cited and therefore only appear in the data as a second person or a third person feminine. In other words, the verbal forms for second person and third person feminine are formally ambiguous but only one meaning may be indicated in any particular sentence.

e.	**t**-ibbix-ē	*held/seize*	[B6]
f.	**t**-ookom-ē	*win*	[B123], [B125]
g.	**t**-oom-ē	*spoil*	[B131]
h.	**t**-oobb-ē	*hear*	[B14]
i.	**t**-okm-ē	*eat*	[B110]
j.	**t**-usuul-ē	*laugh*	[B5]

There appears to be no marking for third person masculine in the consonant-initial class as shown in (159).[43]

(159) Third Masculine Singular Consonant-Initial Verbs

	Verb	*Gloss*	Source
a.	ab-ē	*do*	[B110]
b.	be-ē	*take*	[B21]
c.	digb-ē	*marry*	[B16]
d.	guf-ē	*arrive*	[B48]
e.	he-ē	*permit*	[B14]
f.	xaam-ē	*buy*	[B202], [B6]
g.	nak-ē	*drink milk*	[B125]
h.	kallac-ē	*beg*	[B10]
i.	daff-ē	*sit*	[B92]
j.	we-ē	*lack*	[B36]

[43]These forms are identical to the first person consonant-initial forms but again, depending on the context in which they occurred they may have been glossed as only first person or only third person or both first and third person.

Third person masculine vowel–initial verbs are different from third masculine consonant–initial verbs in that here third person masculine is marked by a [y] prefix.

(160) Third Masculine Singular Vowel-Initial Forms

	Verb	*Gloss*	Source
a.	**y**-erd-ē	*run*	[B16]
b.	**y**-emeet-ē	*come*	[B10]
c.	**y**-ec-ē	*give*	[B21]
d.	**y**-illiil-ē	*dare*	[B35]
e.	**y**-icdir-ē	*spend the night*	[B131]
f.	**y**-oobb-ē	*hear*	[B14]
g.	**y**-oogoq-ē	*bury*	[B131]
h.	**y**-okm-ē	*eat*	[B110]
i.	**y**-usuul-ē	*laugh*	[B5]
j.	**y**-ubl-ē	*see*	[B11]

In sum, the paradigm for person appears in (161). As was noted above, there is no marking for first person. Second person and third feminine appear as a [t] which is a suffix on consonant-initial verbs and a prefix on vowel-initial verbs.[44] When it is a suffix, it occurs to the left of the aspect marker, [e(e)]. Third person masculine is not marked on consonant-initial verbs, but it occurs as a [y] prefix on vowel-initial verbs.

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[44] The compound and stative classes discussed in Chapter 1 do not exhibit the variable-position phenomenon because there are no vowel-initial compounds and only four vowel-initial statives.

(161) The Paradigm for Person

	Vowel-Initial Verbs	Consonant-Initial Verbs	
	okom (*eat*)	nak (*drink milk*)	ab (*do*)
a. 1	okm-ē	nak-ē	ab-ē
b. 2	**t**-okm-ē	nak-**t**-ē	ab-**t**-ē
c. 3 fem	**t-**okm-ē	nak-**t**-ē	ab-**t**-ē
d. 3 masc	**y**-okm-ē	nak-ē	ab-ē

The plural marker surfaces as either *-n-* or *-nV*, where the quality of the vowel varies depending on the quality of the preceding vowel. In this section I show that, like the person affixes, the plural marker is a variable-position affix: it can occur either prefixed or suffixed to the verb root. It is different from the person markers, however, in that, when it is a suffix, it may either precede or follow the aspect marker.

The first person plural has a different distribution from the second and third person plurals. In first person plural consonant-initial verbs, the plural appears following the root, but preceding the aspect marker.

(162) First Person Consonant-Initial Plurals

	Verb	*Gloss*	Source
a.	ab-**n**-ē	*do*	[B110]
b.	dud-**n-**ā	*able*	[B33]
c.	giin-**n-**ā	*pull*	[B114]
d.	fan-**n-**ā	*want*	[B17]

In the vowel-initial first person plurals, however, the plural not only precedes the aspect marker, it precedes the root.

(163) First Person Vowel-Initial Plurals

	Verb	*Gloss*	Source
a.	**n**-ubl-ē	*see*	[B113]
b.	**n**-ookom-ē	*win*	[B131]
c.	**n**-okm-ē	*eat*	[B110]
d.	**n**-ekk-ē	*become*	[B125]
e.	**n**-uqbud-ē	*worship*	[B131]

In the second person plural consonant-initial verbs, the plural again occurs as a suffix, but unlike first person, this time it follows aspect. Recall that [t] marks second person.

(164) Second Person Consonant-Initial Plurals

	Verb	*Gloss*	Source
a.	ab-t-ee-**n**-ī	*do*	[B110]
b.	mak-t-ee-**n**-ī	*turn*	[B112]
c.	nak-t-ee-**n**-ī	*drink milk*	[B125]
d.	sol-t-e-**n**	*stand*	[B123]
e.	way-t-ee-**n**-ī	*lack*	[B36]
f.	ab-t-aa-**n**-ā	*do*	[B114]
g.	sol-t-ee-**n**-ī	*stand*	[B123]

The vowel-initial second person plural verbs are similar to their consonant-initial counterparts in that the plural marker appears as a

suffix following the aspect marker. The second person marker, as shown previously, surfaces as a prefix on these forms.

(165) Second Person Vowel-Initial Plurals

	Verb	*Gloss*	Source
a.	t-ekk-ee-**n**-ī	*become*	[B125]
b.	t-okm-ee-**n**-ī	*eat*	[B110]
c.	t-ookom-ee-**n**-ī	*win*	[B123]
d.	t-ootok-ee-**n**-ī	*hit*	[B131]
e.	t-ifrid-ee-**n**-ī	*judge*	[B131]

In both the third person consonant-initial and vowel-initial verbs, the location of the plural marker is the same as in second person: it occurs as a suffix following the aspect marker (166 & 167). Recall that there appears to be no third person marker on the consonant-initial verbs.

(166) Third Person Consonant-Initial Plurals

	Verb	*Gloss*	Source
a.	gex-aa-**n**-ā	*go*	[B13]
b.	kal-aa-**n**-ā	*stop/prevent*	[B40]
c.	nak-ee-**n**-ī	*drink milk*	[B125]
d.	rab-aa-**n**-ā	*die*	[B114]
e.	sool-ee-**n**-ī	*stand*	[B112]
f.	wa-a-**n**-ā	*lack*	[B36]
g.	xin-ee-**n**-ī	*refuse*	[B38]
h.	ab-aa-**n**-ā	*They did*	[B123]
i.	kaql-a-**n**	*They wash.*	[B123]

(167) Third Person Vowel-Initial Plurals

	Verb	*Gloss*	Source
a.	y-eexeg-ee-**n**-ī	*know*	[B34]
b.	y-eemen-ee-**n**-ī	*believe*	[B113]
c.	y-affar-ee-**n**-ī	*fail*	[B35]
d.	y-ekk-ee-**n**-ī	*become*	[B125]
e.	y-ibbix-ee-**n**-ī	*held/seize*	[B131]
f.	y-okm-ee-**n**-ī	*eat*	[B110]
g.	y-ookom-ee-**n**-ī	*win*	[B123]
h.	y-usuul-ee-**n**-ī	*laugh*	[B5]
i.	y-uktub-e-**n**	*write*	[B123]

The plural affixes are repeated in (168) below. In first person, plural occurs as a prefix on vowel-initial verbs but as a suffix on consonant-initial verbs (168a). The plural in both second and third person occurs as a suffix on both vowel-initial and consonant-initial verbs, but here it occurs following aspect, as opposed to the first person consonant-initial forms where plural was a suffix which preceded aspect.

(168) The Plural Paradigm

	Vowel-initial	Consonant-initial	
	okom (*eat*)	nak (*drink milk*)	ab (*do*)
a. 1pl	**n**-okm-ē	nak-**n**-ē	ab-**n**-ē
b. 2pl	**t**-okm-ee-**n**-ī	nak-**t**-ee-**n**-ī	ab-**t**-ee-**n**-ī
c.	**t**-okm-e-**n**	nak-**t**-ee-**n**	ab-**t**-ee-**n**
d. 3pl	**y**-okm-ee-**n**-ī	nak-ee-**n**-ī	ab-ee-**n**-ī
e.	**y**-okm-e-**n**	nak-ee-**n**	ab-ee-**n**

There are three generalizations about the distribution of person and plural that should be accounted for in any analysis of the Afar variable-position affixes. First, the second and third feminine person markers and the plural in first person both appear as prefixes on vowel-initial roots but as suffixes on consonant-initial roots.

(169) Prefix vs. Suffix in Consonant- and Vowel-initial Verbs

	Vowel-initial	Consonant-initial
a. 2nd/3rd fem	**t**-okm-ē	nak-**t**-ē
b. 1pl	**n**-okm-ē	nak-**n**-ē

A similar comparison can be made between the plural in first person and the plural in second and third person in the vowel-initial class. In first person the plural is a prefix, but in second and third it is a suffix.

(170) Prefix vs. Suffix

		Vowel-initial
a.	1pl	**n**-okm-ē
b.	2pl	t-okm-e-**n**
c.	3pl	y-okm-e-**n**

Second, the first person plural can be contrasted with the second and third person plural in another way as well. The first person plural precedes aspect whether it is a prefix on vowel-initial verbs or a suffix on consonant-initial verbs (171a). But in second and third person,

plural follows aspect (171b). Note, in fact, that the first and third person consonant-initial forms are identical except for the order of the plural and aspect morphemes.

(171) Plural Precedes and Follows Aspect

		Vowel-initial	Consonant-initial
a.	1pl	**n**-okm-ē	nak-**n**-ē
b.	2pl	t-okm-e-**n**	nak-t-e-**n**
c.	3pl	y-okm-e-**n**	nak-e-**n**

Finally, [y] appears as a prefix on third person masculine singulars and third person plurals in the vowel-initial verbs but there appears to be no corresponding marker on the third person consonant-initial verbs in either singular or plural. As mentioned above, first and third person consonant-initial forms are identical except for the order of the plural and aspect morphemes.

(172) Prefix vs. Null

		Vowel-initial	Consonant-initial
a.	3rd masc	**y**-okm-ē	nak-ē
b.	3pl	**y**-okm-e-n	nak-e-n

In sum, there are three sets of facts that need to be accounted for: 1. why these affixes sometimes occur as prefixes but other times as suffixes, 2. why the plural marker sometimes precedes aspect and at

other times follows aspect, and 3. why some affixes occur as prefixes on vowel-initial verbs but do not appear at all on consonant-initial verbs.

There are two additional issues that should be addressed in the analysis of this data. Both concern inputs. First, I have referred to the "suffixing" class of verbs as consonant-initial verbs even though some of the roots begin with [a]. As I will argue that on verbs beginning with [e(e)], [i], [o(o)], and [u], person and number affixes are prefixed in order to avoid an onsetless syllable, it is necessary to show why the same does not happen with [a]-initial verbs. I discuss this after I present the model proposed here.

Second, the plural has appeared as either [n], [n-a], [n-u] or [n-i] in the examples. I discuss how these different outputs result from a single input. In the following section I discuss the input for the plural.

The Plural

The vowel following the plural varies with the context it occurs in. It is [a] after [a], [i] after [e], and [u] after [o].[45]

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[45]The plural never occurs after [u] or [i].

(173) Variable Quality of the Plural Vowel

a.	b.	c.
kacl-**aa**-n-**ā**	y-uktub-**ee**-n-**ī**	kinn-**oo**-n-**ū**
wash-impf-pl-V	he-write-perf-pl-V	is-they-pl-V
They wash	*They wrote*	*They are*
[B123]	[B123]	[B112]

Second, the plural can occur in final position without the vowel.[46]

(174) The Plural Without a Final Vowel

a.	b.
y-uktub-e-n	sol-t-e-n
they-wrote-perf-pl	stand-you-perf-pl
They wrote [B123]	*You stood* [B123]

Bliese suggests that the first person plural marker is /n/ and that the second and third person plural marker is /nV/, where V is an unspecified vowel. His analysis posits that "[t]he final vowel <of the plural> is optionally deleted if no following conjunctive occurs on the verb, especially when another verb precedes in the same sentence" (Bliese 1981:123). Parker & Hayward (1986), on the other hand, propose a different analysis. They posit that the first, second and third person plural have the same phonological form, /n/.[47] When a vowel follows

[46]Bliese doesn't mark stress on these, but similar words from Parker & Hayward, seen later in this section, exhibit stress on the final syllable.

[47]But unlike the analysis here, they consider first person to be different from second and third person because of affix order. Later in this chapter I show that the order is independently derived and that therefore there is a single plural affix.

the plural it is epenthetic, a result of the sentential context the verb occurs in (Parker and Hayward 1986:222-224). To see this, I first discuss sentence prosodies suggesting, following Parker & Hayward, that it is these prosodies that condition the presence/absence of the vowel following the plural.

As shown in Chapter 2, the vowel following the plural may be epenthetic in WH and yes/no questions as required by the WH Q and Y/N Q constraints. Examples of these are repeated in (175).

(175) Question Prosody

a.	WH Question:	gex-x-aa-n- áá
b.	Y/N Question:	gex-ee-n- ìì

In sentences where the verb is focused or the sentence has a neutral focus, and the sentence is affirmative, indicative or declarative, then the final word of the verb phrase (i.e., the final word of the sentence) has an *-h* suffixed (which I gloss as 'emph' for 'emphasis'), and the vowel preceding the *-h* has a high tone.[48] Bolding in the glosses of the examples in (176) and (177) indicate that an element is focused. The glosses in (176) are not conjoined sentences but, rather,

---

[48] (Bliese (1981:248) refers to this [h] as aspiration and does not indicate it in his examples. I have not altered his examples to include the [h]. The lack of this [h] in his examples has no effect on the points of the analysis proposed here.

indicate that the sentences may have either a neutral (no bolding) or verbal (verb bolded) focus.

(176) Neutral or Verb Focus

a. ūsuk gex–ē–h
he go–perf–emph
he went or he **went** [PH222]

b. ōson gex-ee-n-ī-h
they go–perf–pl–V-emph
they went or they **went** [PH223]

c. duyyē liyō-h
money have–emph
*I have money or I **have** money* [PH223]

On plurals, as shown in (176b), an epenthetic vowel separates the *-n-* of the plural from the *-h* marking the verb phrase or neutral focus.

This prosody can be contrasted with an affirmative declarative sentence in which an NP or PP constituent is focused. In these sentences, the verb is uttered on a low pitch which may undergo further gradual lowering throughout its duration (Parker & Hayward 1986:223). The *-h* of the verb phrase or neutral focus prosody cannot occur on these sentences and neither does the vowel following the plural, as shown in (177c).

(177) NP or PP Focus

a. Macāmmad gex-ē * Macāmmad gex-ē-h
Mohammed do-perf
Mohammed *went.* [PH223]

b. yoō t-ubl-ē * yoō t-ubl-ē-h
Me she–see–perf
She *saw me.* [PH223]

c. kīmal gex-ē-n * kīmal gex-ēn-(i)-h
yesterday go-perf-pl
They *went yesterday.* [PH223]

To summarize, in three of four contexts, there is a vowel added to a consonant-final verb, as shown in (178). In the other context, the vowel following the plural is impossible. The vowel that occurs on plurals, then, is epenthetic as required by the prosody and the input form is /n/. The prosodies discussed above are shown in (178)

(178) Sentence Prosodies

a. WH Question: gex-x-aa-n- áá
b. Y/N Question: gex-ee-n- ìì
c. VP or neutral focus: ōson gex-ee-n-ī-h
d. NP or PP Focus: kímal gex-ē-n

As seen in the above discussion, then, the plural can be analyzed as having an input form of /n/. There are three cases where the plural is followed by a vowel, all of which involve epenthetic vowels. In

sentences where the verb is focused or the focus is neutral, a vowel is epenthesized between the [n] of the plural and the [h] of the focus to satisfy syllabification constraints. The other two cases where the plural is followed by a vowel are cases involving questions: in both cases a final long vowel is epenthesized in order to satisfy the question constraints requiring that a sequence of tones occur on the last syllable of the word. There is a context where no focus marker is required, on sentences with noun phrase or postpositional phrase focus, and there is no vowel following the verb. From this point on I refer to the input of the plural as /n/.

An OT Account

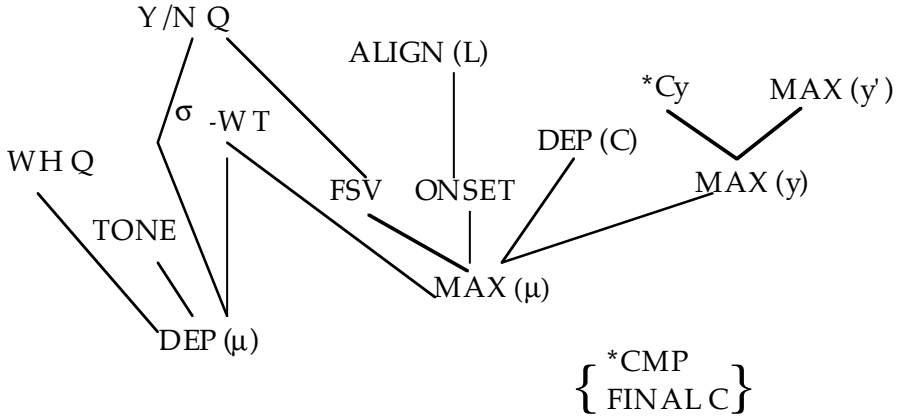
In this section I discuss the constraints needed in any OT account of the data. I then show the problems encountered in an OT account requiring parallelism.

Necessary Constraints

In Chapter 2 I introduced the constraints in (191) and motivated their use in the syllabification system of Afar. I also introduced *Cy which accounts for the absence of /y/ following a consonant anywhere in the language.

The resulting hierarchy is shown in (179).

(179) Phonological Constraint Hierarchy



Here I introduce the morphological constraints needed to account for person, aspect and plural in Afar. Specifically, I show that the Afar affixes can be characterized as suffixes through the use of ALIGN constraints. Each constraint specifies that the relevant affix (aspect or plural) is a suffix as the right edge of the affix is aligned with the right edge of a prosodic word. The necessary constraints are listed in (180). The constraint in (180a) specifies that aspect is a suffix and the constraint in (180b) specifies that plural is a suffix. At this point there is no need for an alignment constraint for person as will be seen below.

(180) Morphological ALIGN Constraints

a. ASPECT (R): ALIGN (ASPECT, R, PRWD, R)
Align the right edge of aspect with the right edge of a prosodic word.

b. PLURAL (R): ALIGN (PLURAL, R, PRWD, R)
Align the right edge of plural with the right edge of a prosodic word.

Evidence for analyzing aspect as a suffix can be seen in (181). As shown below, aspect (or more precisely, perfect aspect) only ever occurs following the verb root on both vowel–initial and consonant–initial verbs. There is no reason to believe it is anything but a suffix.

(181) Perfect Aspect as a Suffix

	Vowel–Initial		Consonant–Initial
a.	y-eemen-**ee**-n-ī hey-believe-perf-pl-V *They believed* [B113]	d.	kalbis-**ee**-n-ī long-perf-pl-V *They long* [B35]
b.	iggif-**ē** kill-perf *I killed* [B113]	e.	ab-t-**ē** do-2,3f-perf *You (she) did* [B110]
c.	y-uktub-**e**-n they-wrote-perf-pl *They wrote* [B123]	f.	sol-t-**e-**n stand-you-perf-pl *You stood* [B123]

The plural marker also appears to be a suffix. As seen in (182), plural occurs as a suffix in the majority of cases. In first person, plural occurs as a prefix on vowel-initial verbs. But on all consonant–initial

verbs and on vowel-initial second and third person verbs, it occurs as a suffix.

(182) The Plural Paradigm

	Vowel Initial	Consonant Initial	
	okom (*eat*)	nak (*drink milk*)	ab (*do*)
a. 1pl	n-okm-ē	nak-n-ē	ab-n-ē
b. 2pl	t-okm-ee-n-ī	nak-t-ee-n-ī	ab-t-ee-n-ī
c.	t-okm-e-n	nak-t-ee-n	ab-t-ee-n
d. 3pl	y-okm-ee-n-ī	nak-ee-n-ī	ab-ee-n-ī
e.	y-okm-e-n	nak-e-n	ab-e-n

This suggests that plural is a suffix and that some constraint, argued here to be ONSET, forces it to be a prefix in the first person vowel–initial forms. If plural is analyzed as being a prefix, it is not clear what would motivate it to appear as a suffix in consonant-initial verbs and second and third person vowel-initial verbs. In the following discussion I show how the morphological constraints are ranked with respect to the phonological constraints to achieve the optimal outputs. Any OT account of Afar will need these constraints ranked high enough in the constraint hierarchy to play a role in the location of the variable-position person and plural affixes. I first discuss inputs in Correspondence Theory.

Inputs in Optimality Theory and Correspondence Theory

McCarthy (1995:33) argues that the notion "richness of the base" is a crucial tenet of Optimality Theory. By this he means that given any input, the optimal output should be attainable. This view of inputs works for the model proposed here as well. This is illustrated below. In (195), ASPECT (R) requires that aspect be the rightmost morpheme. Everything else being equal, any form in which it is a prefix will be less optimal than a form in which it is a suffix (183a vs. 183b).[49] Following McCarthy & Prince, I mark ALIGN violations in terms of the segments separating the aligned element from the relevant edge. Whether the input is *rab* + *ee* or *ee* + *rab*, the same output tableau will be obtained.

(183) Tableau for *rabē* ('I die')

			ASPECT (R)	MAX (μ)
	a.	[ee].[rab]	r!ab	
☞	b.	[ra.b][e]		*

If there is more than one affix in a word, the ranking of the constraints specifies the order of affixes. To see how this works, consider the tableau in (184). If ASPECT (R) >> PLURAL (R), then the

[49]In this and following tableau, I typically identify morphemes by enclosing them in brackets ([ ]). These brackets are not meant to have any theoretical significance and are used for purposes of clarity alone.

optimal output will be the one in which aspect is the rightmost morpheme. Again, this is irrespective of the order of morphemes in the input.

(184) Tableau for *raben* ('They die')

	{rab, ee, n}	ASPECT (R)	PLURAL (R)
a.	[ra.b][e][n]	n!	
☞ b.	[rab].[n][e]		e

Throughout this thesis, when discussing the Multiplanar Model, I represent inputs as an unordered set of root and affixes.

In the following section I show how morphological and phonological constraints in a parallel OT model of Afar create a paradox.

A Paradox for OT

In this section I use the previously motivated constraints to analyze the Afar data. I show that no ranking of the constraints in a monoplanar parallel model can account for the order of the affixes without resulting in a paradox. I first show the monoplanar parallel model has some explanatory value as it accounts for a subset of the data. I then proceed to data in which trouble arises. The analysis of second person plural vowel-initial verbs poses a paradox with respect

to the analysis of the consonant-initial first person plurals: it requires the opposite ordering of the ASPECT (R) and PLURAL (R).

First person consonant–initial plurals require that ASPECT (R) dominates PLURAL (R) to select [rab–n–ē] instead of *[rab–e–n], but second person plural vowel–initial forms require that PLURAL (R) dominates ASPECT (R) to get the correct [t–okm–e–n] instead of the incorrect *[t–okom–n–e].[50]

In this and following analyses, I argue that syllabification constraints play a role in the location of variable-position affixes. I briefly show how this works. Imagine an input consisting of four morphemes: the root (*rab*), second person (*t*), plural (*n*) and aspect (*ee*). GEN will produce outputs with all possible orders of these morphemes. Some of these orders will require that a vowel be epenthesized or a consonant deleted in order to syllabify the string without violating *CMP.

[50] As mentioned in Chapter 1, there is a second vowel syncope constraint that does not allow the second vowel to surface in a sequence of three light syllables. I delete these vowels in the tableaux as required to be true to the data. This has no effect on the analysis proposed here.

(185) Possible Outputs that Violate Syllabification Constraints

	Outputs			Violation
a.	[n][rab][t][e] pl-die-2-asp *You (pl) die*	b.	[t][rab][e][n]	*CMP
b.	[n]V[rab][t][ee] pl-V-die-2-asp	d.	[t]V[rab][e][n]	DEP (μ)
c.	[rab][t][ee] die-2-asp	f.	[rab][e][n]	MAX (C)

This means that constraints which determine allowable syllable structure, irrespective of the lower ranked morphological constraints, will require that all three of these affixes occur on the same side of the root on consonant-initial verbs.

Syllabification constraints also play a role in ordering the affixes even when they are all on the same side of the root. Person and plural cannot occur together on either side of aspect without requiring epenthesis or deletion.

(186) Syllabification Constraints and the Order of Morphemes

a. *[rab][t][n][ee]
b. *[rab][ee][t][n]

In other words, higher ranked syllabification constraints limit the candidates to be decided between by the lower ranked

morphological constraints to the four outputs shown in (199). The morphological alignment constraints decide between these possibilities.

(187) Outputs Decide Among by Morphological Constraints

a. [t][e][n][rab]
b. [n][e][t][rab]
c. [rab][n][e][t]
d. [rab][t][e][n]

I now show how this analysis translates into OT.

Syllabification constraints prevent aspect and plural from occurring on opposite sides of the root as shown in the tableaux in (188) - (190). If plural occurs to the left of the consonant–initial root but aspect to the right, a complex onset would result as in (188a).

(188) *CMP

	{rab, n, ee}	*CMP	MAX (μ)
a.	[n][ra.b][e]	*!	*
☞ b.	[rab][.n][e]		*

Another nonoptimal possibility would be that an epenthetic vowel is inserted between the consonants (189a).

(189) DEP (μ)

	{rab, n, ee}	DEP (μ)	MAX (μ)
a.	[n]𝕍.[ra.b][e]	*!	*
☞ b.	[rab][.n][e]		*

Another nonoptimal output would be that one of the consonants is deleted as in (190a).

(190) MAX (μ)

	{rab, n, ee}	MAX (C)	MAX (μ)
a.	[ra.b][e]	*!	*
☞ b.	[rab][.n][e]		*

This leaves the optimal form as one where aspect is rightmost and plural and aspect are on the same side of the root as in (190b). There is no evidence for any ordering of these constraints as all of the outputs have one MAX (μ) violation: the optimal form has no additional relevant constraint violations. The other possible outputs are the ones where plural and aspect both occur on the same side of the root.

Some of these possibilities are shown in (191). ONSET or ASPECT (R) will rule out forms where aspect is prefixed (191a, b). Notice that ASPECT (R) must be ranked above MAX (μ) as (191b) has no MAX (μ) violations, but the optimal form does.

(191) ASPECT (R) >> MAX (μ); ONSET

	{rab, n, ee}	ONSET	ASPECT (R)	MAX (μ)
a.	[e][n].[rab]	*!	nrab	*
b.	[n][ee].[rab]		r!ab	
☞ c.	[rab].[n][e]			*

Of the other forms, the ones with both plural and aspect as suffixes, the optimal form is the one where aspect is rightmost (192b), as it has the least ASPECT (R) violations.

(192) ASPECT (R)

	{rab, n, ee}	ASPECT (R)	MAX (μ)
a.	[ra.b][e][n]	n!	*
☞ b.	[rab].[n][e]		*

In the vowel-initial forms, if plural is not leftmost, a fatal ONSET violation will occur.

(193) ONSET

	{okom, n, ee}	ONSET	MAX (μ)
a.	[ok.m][e][n]	*!	* *
☞ b.	[n][ok.m][e]		* *

Of the remaining possible outputs, (194) is the most optimal because it has the least violations of ASPECT (R).

(194) ASPECT (R)

	{okom, n, ee}	ASPECT (R)	MAX (μ)
a.	[n][e][o.kom]	o!kom	*
☞ b.	[n][ok.m][e]		* *

ONSET must dominate PLURAL (R) so that plural will occur in onset position rather than to the right of the root as required by PLURAL (R). Additionally, ASPECT (R) must dominate MAX (μ) as the optimal form has more MAX (μ) violations than the nonoptimal form.

The second person plural input consists of four morphemes: plural, person, aspect and a root as shown in (195-197). Person and plural cannot occur on the same side of the root without aspect between them, or a syllabification violation will result as shown in (195)-(197).

(195) *CMP

	{rab, t, ee, n}	*CMP	MAX (μ)
a.	[rab].[t][n][e]	* !	*
☞ b.	[rab].[t][e][n]		*

(196) DEP (μ)

	{rab, t, ee, n}	DEP (μ)	MAX (μ)
a.	[ra.b]𝕍.[n][e]	* !	*
☞ b.	[rab].[t][e][n]		*

(197) MAX (C)

	{rab, t, ee, n}	MAX (C)	MAX (μ)
a.	[rab].[n][e]	*!	*
☞ b.	[rab].[t][e][n]		*

This leaves only the candidates where person and plural occur on the same side of the root with aspect between them. The morphological constraints then determine the optimal form. Forms with aspect to the left of the root will incur fatal ASPECT (R) violations.

(198) ASPECT (R)

	{rab, t, ee, n}	ASPECT (R)	MAX (μ)
a.	[t][e][n][rab]	nr!ab	*
b.	[n][e][t][rab]	tr!ab	*
☞ c.	[rab][t][e][n]	n	*

The remaining candidates (199a & b) both have a single ASPECT (R) violation so PLURAL (R) decides between them.

(199) PLURAL (R)

	{rab, t, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[rab][n][e][t]	t	e!t	*
☞ b.	[rab][t][e][n]	n		*

There is no additional evidence for constraint ranking in these forms.

Similar to the consonant-initial plural forms, the position of the vowel-initial second person and plural markers are limited by syllabification constraints (200-202). These forms provide evidence for additional constraint rankings. *CMP must dominate ASPECT (R) as shown by (200a vs. 200b).

(200) *CMP >> ASPECT (R)

	{okom, t, ee, n}	*CMP	ASPECT (R)	MAX (μ)
a.	[o.kom].[t][n][e]	*!		*
☞ b.	[t][ok.m][e][n]		n	* *

DEP (μ) must also dominate ASPECT (R) (201a vs. b).

(201) DEP (μ) >> ASPECT (R)

	{okom, t, ee, n}	DEP (μ)	ASPECT (R)	MAX (μ)
a.	[o.kom].[t]𝕍.[n][e]	*!		*
☞ b.	[t][ok.m][e][n]		n	* *

Either ONSET or MAX (C) must dominate ASPECT (R) (202a vs. 202b)

(202) MAX (C) or ONSET >> ASPECT (R)

	{okom, t, ee, n}	MAX(C)	ONSET	ASPECT (R)	MAX(μ)
a.	[okom][t][e]	*!	*		*
☞ b.	[t][okm][e][n]			n	* *

The remaining nonoptimal candidates are ruled out by the morphological constraints. If ASPECT (R) is the highest ranking morphological constraint, it will rule out candidates in which aspect is not the rightmost morpheme (203a & b). PLURAL (R) will decide between the remaining candidates with the optimal output being the one with the least PLURAL (R) violations (203d). There is a problem with this however. This hierarchy chooses the wrong output as optimal.

(203) ASPECT (R) >> PLURAL (R)

		{okom, t, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
	a.	[n][ok.m][e][t]	t!	okmet	* *
☞	b.	[t][ok.m][e][n]	n!		* *
	c.	[n][o.kom].[t][e]		ok!omte	*
✖	d.	[t][o.kom].[n][e]		e	*

To choose the correct optimal output, PLURAL (R) must dominate ASPECT (R).

(204) PLURAL (R) >> ASPECT (R)

		{okom, t, ee, n}	PLURAL(R)	ASPECT(R)	MAX (μ)
	a.	[t][o.kom].[n][e]	e!		*
☞	b.	[t][ok.m][e][n]		n	* *

It is now necessary to return to the first person consonant–initial plurals to see how ranking PLURAL (R) above ASPECT (R) affects these forms.

Recall that the plural and aspect markers cannot occur on opposite sides of the root on consonant-initial forms without violating *CMP, DEP (μ) or MAX (C). Also, forms with aspect to the right of the root will be more optimal than forms with aspect on the left side. This leaves us with the two candidate outputs shown in (205) for first person consonant-initial plurals. But if PLURAL (R) outranks ASPECT (R), as required by the vowel-initial second person forms, the wrong candidate will be designated as optimal.

(205) PLURAL (R) >> ASPECT (R)

		{rab, n, ee}	PLURAL (R)	ASPECT (R)	MAX (μ)
☞	a.	[rab][.n][e]	e!		*
✖	b.	[ra.b][e][n]		n	*

To produce the correct form, first person plural requires a change in the dominance between ASPECT (R) and PLURAL (R). If ASPECT (R) outranks PLURAL (R), the correct result is obtained, as shown in (206). (206b) is optimal because (206a) violates the higher-ranked ASPECT (R).

(206) ASPECT (R) >> PLURAL (R)

	{rab, n, ee}	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[ra.b][e][n]	n!		*
☞ b.	[rab][.n][e]		e	*

The first person consonant–initial verbs require that ASPECT (R) dominate PLURAL (R). But the change in dominance between ASPECT (R) and PLURAL (R) creates a problem for the second person plural vowel–initial verbs. If ASPECT (R) outranks PLURAL (R) the incorrect result is obtained for the second person vowel–initial plurals as repeated in (207). If ASPECT (R) dominates PLURAL (R) then the optimal form will be the incorrect (207b) as it is the only form without an ASPECT (R) violation.

(207) ASPECT (R) >> PLURAL (R)

	{okom, t, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
☞ a.	[t][ok.m][e][n]	n!		* *
✖ b.	[t][o.kom.][n][e]		e	*

It seems, then, that the Afar data create a paradox for OT. First person consonant–initial plurals require that ASPECT (R) dominate PLURAL (R) because aspect occurs to the right of plural ([rab–n–ē] instead of *[rab–e–n]) but second person plural vowel–initial forms

require that PLURAL (R) dominate ASPECT (R) because plural occurs to the right of aspect ([t–okm–e–n] instead of the incorrect *[t–okom–n–e]). I conclude that a monoplanar parallel model cannot account for the Afar data. In the next section I show it is possible to avoid this paradox through the use of morphological planes in the output representations.

Morphemic Tiers and OT

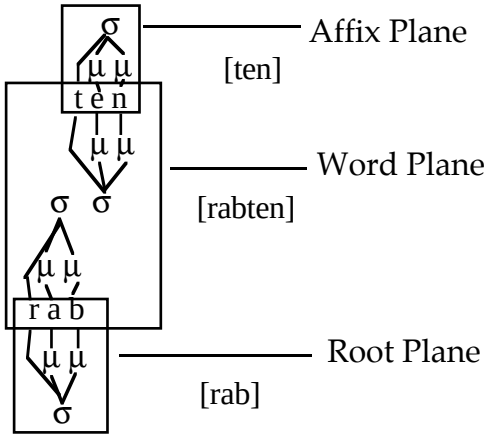
In this section I show that the use of morphemic tiers, or planes, similar to those proposed by McCarthy (1979, 1981) or Halle & Vergnaud (1987) can be used to account for the PLURAL (R) >> ASPECT (R) versus ASPECT (R) >> PLURAL (R) paradox. Specifically, I propose that affixes occupy a plane separate from roots.[51] These planes are syllabified together to form a third plane, the word plane. Constraints apply simultaneously to each of these planes.

A given input, then, produces multi-tiered outputs. For example, (208) illustrates one possible output for an input consisting of a root, *rab*, the second person morpheme -*t*-, the perfect aspect marker,

[51]In this thesis I examine only those affixes which might be termed "inflectional" affixes. Whether the "derivational" affixes of Afar occur on the same plane as the inflectional affixes or whether they occupy some other plane is not addressed here.

-e(e), and the plural marker *-n-*. On the affix plane, the top box, the three affixes, *-t-*, *-e* and *-n* are syllabified together. In the bottom plane, the root is syllabified. Finally, these two planes are syllabified together onto the word plane, shown in the middle box.

(208) One Representation for {rab, t, ee, n}



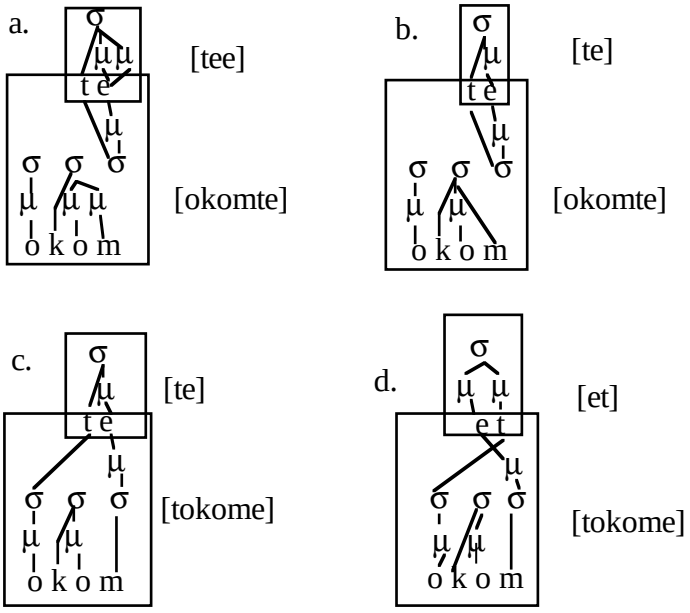
In the following section I show that an analysis that posits multiple planes and has constraints applying simultaneously to each can account for the distribution of the dual–position affixes in Afar. First, I further illustrate the formalism proposed here.

In (209) I show some of the possible outputs given the input {okom, t, ee}.[52] In (209a), the [t] and [ee] are syllabified on the affix plane

[52] Throughout the rest of this thesis, I do not discuss the root plane unless it is required as part of an argument.

with the result being [tee]. These are simultaneously syllabified to the right of the root but with the final vowel linked to a single mora [okomte]. In (209b), the affix plane is syllabified differently in that the perfect is linked to only one mora, but the word plane is the same. In (209c), the aspect vowel is only linked to a single mora on each plane, and the [t] is syllabified as an onset on each plane. In (209d), the [t] is syllabified as a coda of the affix plane. On the word plane, the [t] is syllabified as an onset to the root and the aspect marker is syllabified as a suffix on the root. I assume that the first three representations (209a-c) are possible outputs but that the fourth, (209d), is not as it violates the No Crossing Constraint (Goldsmith, 1976; Pulleyblank, 1983; Hammond, 1988, etc.) contained in GEN.

(209) Possible Outputs From {okom, t, ee}



In the rest of this section outputs such as those in (209a, b and c) will be represented in a tableau as follows. (209a, b, and c) correspond to (210a, b and c) in the tableau in (210) respectively. If these were the only possible outputs, (210c) would be the optimal form. This is so because an ONSET violation on the word plane would rule out (210a) and a FSV violation of the affix plane would rule out (210b). Violations on each plane are summed as shown in (210c) where a MAX (μ) violation on each plane equals two total MAX (μ) violations. In the rest of this chapter I use tableaux such as that in (210) to stand for representations such as those in (209).

(210) Multiplanar Representations in Tableaux

	{okom, t, ee}	ONSET	FSV	MAX (μ)
a.	[t][e] [okom][t][e]	*! 		* *
b.	[t][ee] [t][okm][e]		*! 	 * *
☞ c.	[t][e] [t][okm][e]			* * *

One of the questions that arises in this model concerns which part of the output representation is pronounced. In both Halle & Vergnaud's and McCarthy's serial planar models, discussed in Chapter 1, only the final plane, the word plane, is pronounced. The situation here is similar. Although this analysis is not serial, there is still only

one plane that is pronounced. This is the most complete plane, the one in which the root and affix planes are syllabified together: the word plane.

I now show that the multiplanar analysis provides the correct result for both the person and plural paradigms. First I show this proposal resolves the paradox discussed previously. I show that both the division into three domains, root, word and affix, and the non–linearity of these domains, is required to account for this data. Finally, I show this proposal provides the correct result for all of the relevant data.

Recall that the paradox involves the ordering of the PLURAL (R) and ASPECT (R) constraints. The first person plural consonant–initial form requires that ASPECT (R) dominates PLURAL (R) (*rab-n-e* vs. **rab-e-n*. The second person plural vowel–initial forms, however, require the opposite order, with PLURAL (R) dominating ASPECT (R) (*t-okm-e-n* vs. **t-okom-n-e*).

The Multiplanar Model resolves this paradox. The ranking of constraints in the multiplanar analysis has PLURAL (R) ranked above ASPECT (R), as required by the second person plural vowel–initial verbs discussed above. In other words, if only morphological constraints determined the location of the dual–position affixes, plural would occur to the right of aspect. The paradox with respect to the second person plural (where plural occurs to the left of aspect) is resolved through the addition of a plane containing only affixes, and the ONSET constraint being ranked higher than the morphological constraints.

This is shown in (211). Although plural is required to be the rightmost morpheme and it is in (211a), the higher ranked ONSET is then violated on the affix plane. A form which has plural leftmost on the affix plane to avoid an ONSET violation, but rightmost on the word plane to satisfy PLURAL (R) is a disallowed representation as it violates the No Crossing Constraint (i.e., [n][e]; [rab][e][n]) is an illegal output. The optimal form, (211b) has two PLURAL (R) violations, but no violations of the higher-ranked ONSET as neither plane has a syllable lacking an onset. ONSET must be ranked above PLURAL (R) as the optimal output has two plural violations while the non-optimal output has none.

(211) First Person Consonant–initial Plurals

	{rab, ee, n}	ONSET	PLURAL (R)	ASPECT (R)
a.	[e][n] [ra.b][e][n]	*!		* *
☞ b.	[n][e] [rab].[n][e]		*! *	

The segregation of affixes on their own plane, along with ranking ONSET above PLURAL (R) and PLURAL (R) above ASPECT (R) achieves the correct result for the second person vowel-initial forms as well. Person must be leftmost on both planes or a fatal ONSET violation will occur.

(212) Second Person Vowel-initial Plurals

	{okom, n, ee, t}	ONSET	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[t][e][n]			n	*
	[o.kom].[t][e][n]	*!		n	*
☞ b.	[t][e][n]			n	*
	[t][ok.m][e][n]			n	*

Furthermore, plural cannot be used to fill the onset position on either plane because if plural is not rightmost, fatal PLURAL (R) violations are incurred (213a). The optimal form has no PLURAL violations (213b).

(213) PLURAL (R)

	{okom, n, ee, t}	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[n][e][t]	e!y	t	*
	[n][okm][e][t]	okmet	t	* *
☞ b.	[t][e][n]		n	*
	[t][okm][e][n]		n	* *

For the same reason, the entire set of affixes cannot be prefixed to the root when [n], plural, is a prefix, as there will be a fatal plural violation. This leaves (213b) as the optimal form, where plural is the rightmost morpheme on both planes to satisfy PLURAL (R) and person is leftmost to satisfy ONSET on both planes.

Thus far, I have shown that the paradox in the ordering of the PLURAL (R) and ASPECT (R) constraints is resolved by the Multiplanar

Model, and that this model can account for the paradoxical forms. For completeness, I now show that this works for the rest of the paradigm.

The tableau for the first person singular consonant-initial forms is shown in (214). Recall that the input for this consists of the root and aspect. If aspect is prefixed, the ONSET violations will be fatal as there will be two violations: one each on the affix and word planes (214a).

(214) Consonant-Initial First Person Singular

	{rab, ee}	ONSET	ASPECT (R)	MAX (μ)
a.	[e] [ee].[rab]	* * !	rab	*
☞ b.	[e] [ra.b][e]	*		* *

This contrasts with the other outputs (215a & b) which each have only one ONSET violation, on the affix plane. If the final vowel on either plane is long, it violates FSV as shown in (215a). This leaves (215b) as the optimal form, where aspect is short on both planes and suffixed to the root.

(215) Consonant-Initial First Person Singular

	{rab, ee}	ONSET	FSV	MAX (μ)
a.	[ee] [ra.b][e]	*	* !	 *
☞ b.	[e] [ra.b][e]	*		* *

For the vowel-initial first person singular forms, if aspect is not short on both planes, fatal violations of FSV will result (216a & b). If aspect is not rightmost, a fatal ASPECT (R) violation will result (216c). This leaves (216d), with aspect as the rightmost morpheme and the final vowels short on both planes, as the optimal form.

(216) Vowel-Initial First Person Singular

	{okom, ee}	ONSET	FSV	ASPECT (R)	MAX (μ)
a.	[ee] [ok.m][e]	* *	*!		* *
b.	[e] [ok.m][ee]	* *	*!		* *
c.	[e] [e][o.kom]	* *		o!kom	* *
☞ d.	[e] [ok.m][e]	* *			* *

From this point on I assume that FSV is ranked high enough that a violation will always be fatal, and do not include it in the rest of the tableaux unless it is germane to the point being made.

For second and third person feminine singular consonant-initial verbs the input consists of the root, person and aspect. Any ordering of the input in which the person marker does not occur leftmost on the affix plane will violate ONSET as in (217a).

(217) Consonant-Initial Second Person Singular

	{rab, t, ee}	ONSET	ASPECT (R)	MAX (μ)
a.	[e][t] [rab][e][t]	*!	t t	* *
☞ b.	[t][e] [rab][t][e]			* *

If aspect and person are separated, appearing on opposite sides of the root, a violation of a syllabic constraint will occur, as shown in (218)-(220). If no vowel is epenthesized, a *CMP violation will result on the word plane.

(218) Consonant-Initial Second Person Singular

	{rab, t, ee}	*CMP	MAX (μ)
a.	[t][e] [t][ra.b][e]	*!	* *
☞ b.	[t][e] [rab][t][e]		* *

If a vowel is epenthesized to break up an illegal consonant cluster, a DEP (μ) violation will result (219a).

(219) Consonant-Initial Second Person Singular

	{rab, t, ee}	DEP (μ)	MAX (μ)
a.	[t][e] [t] 𝕍 [.ra.b][e]	*!	* *
☞ b.	[t][e] [rab][t][e]		* *

The other option is to delete a consonant, violating MAX (y').

(220) Consonant-Initial Second Person Singular

		{rab, t, ee}	MAX (y')	MAX (y)	MAX (μ)
	a.	[t][e] [t][a.b][e]	*!		* *
☞	b.	[t][e] [rab][t][e]			* *

This leaves the optimal form as (220b), where aspect is the rightmost morpheme on both planes and is immediately preceded by person. There is no new evidence for the ranking of constraints. Forms which violate *CMP, and DEP (μ) are never optimal in the relevant data and I do not include these in future tableaux.

The second/third feminine person vowel–initial verbs are similar to the second person consonant-initial verbs. They differ in that the second person marker, [t], must be leftmost on both planes or the output will incur an ONSET violation (221a).

(221) Vowel-Initial Second/Third Singular

		{okom, t, ee}	ONSET	MAX (μ)
	a.	[t][e] [okom][t][e]	*!	* *
☞	b.	[t][e] [t][okm][e]		* **

Any output in which aspect is not rightmost on both planes will incur fatal ASPECT (R) violations (222a).

(222) Vowel-Initial Second/Third Feminine Singular

		{okom, t, ee}	ASPECT (R)	MAX (μ)
	a.	[t][e] [t][e][okom]	 o!kom	* *
☞	b.	[t][e] [t][okm][e]		* * *

This leaves (222b) as the optimal form, with person as the leftmost morpheme on both planes and aspect as the rightmost morpheme on both planes. It also shows that ASPECT (R) must be ranked higher than MAX (μ).

In the third person masculine singular consonant-initial forms, any form in which person does not precede aspect will have an ONSET violation on the affix plane (223a).

(223) Consonant-Initial Third Singular

		{rab, y, ee}	ONSET	ASPECT (R)	MAX (y)	MAX (μ)
	a.	[e][y] [rab][e][y]	* !	y y		* *
☞	b.	[y][e] [rab][e]			*	* *

Any form in which aspect is not rightmost on either plane will incur a fatal violation of ASPECT (R) (224a). Additionally, ASPECT (R) must be ranked above MAX (y).

(224) Consonant-Initial Third Singular

	{rab, y, ee}	ASPECT (R)	MAX (y)	MAX (μ)
a.	[y][e] [y][ee][rab]	r!ab		*
☞ b.	[y][e] [rab][e]		*	* *

If the third person masculine singular /y/ is not deleted on the word plane, a *Cy violation will occur (225a).

(225) Consonant-Initial Third Singular

	{rab, y, ee}	*Cy	MAX (y')	MAX (y)	MAX (μ)
a.	[y][e] [rab][y][e]	* !			* *
☞ b.	[y][e] [rab][e]			*	* *

MAX (y') must be ranked above MAX (y) because it is the /y/ that cannot surface (225a vs. 225b). This leaves the optimal form as one where the person marker does not surface, with aspect being the rightmost morpheme on both planes (226b).

(226) Consonant-Initial Third Singular

	{rab, y, ee}	*Cy	MAX (y')	MAX (y)	MAX (μ)
a.	[y][e] [ra][y][e]		*! 		* *
☞ b.	[y][e] [rab][e]			* 	* *

For the vowel-initial third person singular, if person is not leftmost on both planes, a fatal ONSET violation will result (227a).

(227) Vowel-Initial Third Singular

	{okom, y, ee}	ONSET	*Cy	MAX (y')	MAX (y)	MAX (μ)
a.	[y][e] [okom][y][e]	*!	*			* *
☞ b.	[y][e] [y][okm][e]					* * *

If aspect is prefixed, it will violate ASPECT (R) (228a). In the optimal form, then, aspect is rightmost on both planes to satisfy ASPECT (R) and the person marker is leftmost on both planes to satisfy ONSET (228b).

(228) Vowel-Initial Third Singular

	{okom, y, ee}	ONSET	ASPECT (R)	MAX (μ)
a.	[y][e] [y][e][o.kom]		o!kom	* *
☞ b.	[y][e] [y][ok.m][e]			* * *

The consonant-initial first person plural was discussed previously. In the vowel-initial first person plural, any output which does not have plural leftmost on both planes will violate the high-ranked ONSET (229a). The remaining outputs differ in whether aspect is prefixed or suffixed to the root. When aspect is prefixed to the root, the result is a greater number of plural and aspect violations than that found in the optimal output.

(229) Vowel-Initial First Person Plural

	{okom, ee, n}	ONSET	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[e][n] [ok.m][e][n]	* *		n n	* * *
b.	[n][e] [n][ee][.kom]		e eekom!	 kom	* *
☞ c.	[n][e] [n][ok.m][e]		e okme		* * *

As discussed previously, in the second person consonant-initial plural, to avoid fatal syllable structure violations, person, plural and aspect must occur on the same side of the root. Further, aspect must occur between person and plural. Considering this, the relevant possible outputs are in the tableau in (230). Any form in which plural is not rightmost will be nonoptimal (230a, b vs. 230c)

(230) Consonant-initial Second Person Plural

	{rab, n, ee, t}	ONSET	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[t][e][n] [t][e][n][rab]		 r!ab	n nrab	* *
b.	[n][e][t] [rab][n][e][t]		e!t et	t t	* *
☞ c.	[t][e][n] [rab][t][e][n]			n n	* *

The vowel-initial second person plurals were discussed previously.

In the third person consonant-initial plurals, any form in which plural is not rightmost on both tiers will be nonoptimal (231a, b). If plural is rightmost and is preceded by aspect, the only place for the third person marker, [y], to go is following the root (231c). This, however, yields a fatal *Cy violation. The optimal form, then, has plural rightmost, preceded by aspect and the third person marker does not surface on the word plane (231d).

(231) Consonant-initial Third Person Plural

	{rab, n, ee, y}	PLURAL (R)	ASPECT (R)	*Cy	MAX (y)	MAX (μ)
a.	[n][e][y] [n][e][y][rab]	e!y eyrab	y yrab			* *
b.	[n][e][y] [rab][n][e][y]	e!y ey	y y			* *
c.	[y][e][n] [rab][y][e][n]		n n	 *!		* *
☞ d.	[y][e][n] [rab][e][n]		n n		*	* *

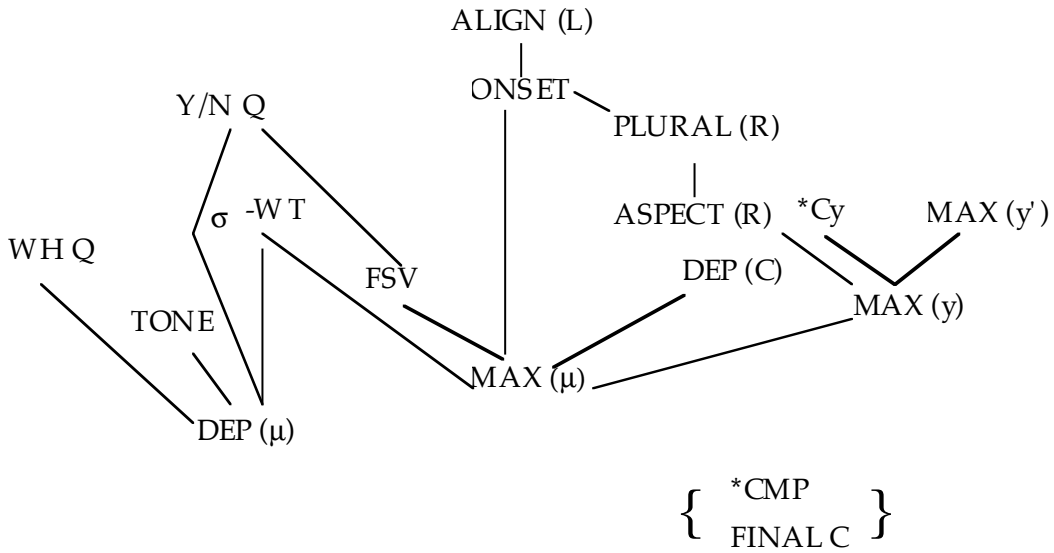
For the third person vowel-initial plurals, if neither person nor plural is leftmost on both planes, ONSET is violated (232a). If plural is not the rightmost morpheme on both planes, PLURAL (R) is violated (232b & c). The optimal form, then, has person leftmost on both planes and plural rightmost on both planes.

(232) Vowel-initial Third Person Plural

	{okom, n, ee, y}	ONSET	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[y][e][n] [okom][y][e][n]	*!		n n	* *
b.	[y][e][n] [y][e][n][kom]		k!om	n nkom	* * *
c.	[n][e][y] [n][okm][e][y]		e!y okmey	y y	* * *
☞ d.	[y][e][n] [y][okm][e][n]			n n	* * *

In this section I have shown that the ordering paradox PLURAL (R) >> ASPECT (R) versus ASPECT (R) >> PLURAL (R) is resolved in an analysis which posits different planes for words and affixes (and eventually roots). In this type of analysis, if ONSET dominates the morphological constraints, PLURAL (R) and ASPECT (R), then affixes will sometimes appear leftmost on both planes to satisfy ONSET. The constraint hierarchy required by the data is shown in (233).

(233) Constraint Hierarchy



In the next chapter I discuss alternative analyses within OT. First, I discuss [a]-initial forms.

[a]-Initial Verbs

One question that arises is why the verbs are divided into these two classes: with one class consisting of the majority of verbs beginning with [e(e)], [i], [o(o)], and [u] and the other class consisting of all other verbs: all consonant-initial verbs, all [a]-initial verbs, and a small number of [e(e)], [i], [o(o)], and [u]-initial verbs. In other words, what do members of each class have in common with each other that they do not share with members of the other class?

/a/ patterning with consonants in word-initial position is not unique to Afar. Hamilton (1995) discusses four Australian languages

which do not allow vowels word initially unless the vowel is /a/: Mbabaram, Anindilyabwa, Marra and Tiwi. For example, Mbabaram has six vowels all of which exhibit length contrasts as shown in (261).

(234) Only [a] occurs in Word-initial Position

i, ii	ɨ, ɨɨ	u, uu
ɛ, ɛɛ	a, aa	ɔ, ɔɔ

The only one which can occur word-initially is [a].

The question arises as to what can account for [a(a)] patterning with consonants in various languages such as Afar and Mbabaram. I discuss this below.

Some authors have suggested that limited underspecification is required in OT (i.e., Inkelas 1994). I propose that /a/-initial roots are in a class with consonant-initial roots because /a/'s in roots are completely unspecified. There is additional evidence for /a(a)/ as an unspecified vowel: vowel co-occurrence restrictions. I address these first. I then turn to the issue of /a(a)/-initial forms acting as if they are consonant initial.

Vowel co-occurrence restrictions were introduced in Chapter 1. The facts are as follows. Within a verbal or nominal root, all vowels

may be of the same quality. Roots with more than one vowel quality are much rarer. These roots may have two vowel qualities, one of which must be /a/. This can be explained if /a/ within roots is not specified for any features and if the OCP holds of vowel features. All vowels will be required to be identical, or one vowel quality may occur with [a] without violating the OCP. If /a/ is not specified for features, its grouping with consonants can be explained as well.

Recall that the person and plural markers surface as prefixes on [-lo] vowel-initial verbs but as suffixes on [a] and consonant-initial verbs. The fact that [-lo] vowel-initial words require onsets whereas [a]-initial verbs do not can be accounted for through the use of two ONSET constraints in Afar: one that requires that vowels with features have onsets and the other that requires that all syllables have onsets. Recall that variable-position affixes occur as prefixes on vowel-initial roots because ONSET is ranked above the morphological align constraint which specifies that plural is a suffix. If, however, the ONSET constraint specifying that only vowels with features must have onsets is ranked above PLURAL (R), while the more general ONSET constraint is ranked below PLURAL (R), then vowels with features will require the variable-position affixes to serve as onsets while [a] will not.

The necessary constraints are shown in (235).

(235) ONSET Constraints

a. ONSET ([+F]):
Syllables where the vowel has features must have an onset.

$*_{\sigma}[V_{[+F]}$

b. ONSET: Syllables must have onsets.

$*_{\sigma}[V$

Examples of how this works for [-lo] vowel-initial and /a/-initial verbs are shown in (236) and (237). With [-lo] vowel-initial verbs, ONSET [+F] will rule out any form in which there is no onset on either the affix or the word plane. The forms in (236a) and (236b) are therefore nonoptimal, leaving (236c), where plural serves as the onset, as the optimal output.

(236) ONSET [+F] and [-lo] Vowel-initial Verbs

	{okom, n, ee}	ONSET [+F]	PLURAL (R)	ASPECT (R)	ONSET
a.	[n][e] [o.kom].[n][e]	 *!	e e		 *
b.	[e][n] [ok.m][e][n]	* *!		n n	* *
☞ c.	[n][e] [n][ok.m][e]		e okme		

The relevant constraints have a different effect on the /a/-initial roots. These roots do not violate ONSET [+F] as [a] is completely unspecified. The only ONSET [+F] violations then, are when aspect, [e], occurs leftmost on the affix plane as in (237a). PLURAL (R) decides

between the two other possibilities as on the word plane, plural is farther to the left in (237b) than in (237c), thereby incurring more violations of PLURAL (R).

(237) ONSET and [a]-initial Roots

	{ab, n, ee}	ONSET [+F]	PLURAL (R)	ASPECT (R)	ONSET
a.	[e][n] [ab][e][n]	*!		n n	* *
b.	[n][e] [n][ab][e]		e ab!e		
☞ c.	[n][e] [ab][n][e]		e e		*

This analysis provides the correct results for this data, but there are two additional cases that need to be considered. Both of these concern [a(a)]s that are derived as a result of a morphological process: one on the affix plane and the other involving roots. Both of these can be seen with the imperfect. The imperfect was discussed in Chapter 1. I briefly reintroduce it here.

In consonant-initial verbs the imperfect is marked with an [a(a)] suffix which is short in word-final position and in closed syllables.

(238) Consonant-initial Verbs: IMPERFECT

a. rab-aa-n-ā
die-impf-pl-emph
You die [B114]

b. digr-ā
play-impf
I play [B114]

c. kaql-a-n
wash-impf-pl
They wash [B123]

d. mool-ā
shave-impf
I shave [FM9]

Vowel-initial imperfects have an [e(e)] suffixed to the root, the first root vowel is [a(a)] and any mid vowels in the root are raised.

(239) Vowel-initial Verbs: IMPERFECT

a. y-abl-ee-n-ī (ubul)
3m-impf/see-impf-pl-emph
They see [B114]

b. y-aamin-ē (eemen)
3m-impf/believe-impf
He believes [B114]

c. t-aduur-ee-n-i-h (uduur)
2-impf/return-impf-pl-V-focus
You are returning [PH259]

d. aalim-ē (eelem)
impf/remember-impf
I remember [FM10]

In both of these cases, it is the [a(a)] that is relevant for my purposes and the other aspects of the imperfect are ignored here. The [a(a)]s create problems for the analysis presented above. This can be seen with the first person consonant-initial forms. The relevant constraints are shown in the tableau in (241). The following ranking has been previously established for these constraints.

(240) ONSET [+F] >> PLURAL (R) >> ASPECT (R) >> ONSET

The first relevant constraint is PLURAL (R). This will rule out both (241a) and (241c) as both have PLURAL (R) violations but (241b) does not. But (241b) is not the surface form, (241c) is.

(241) ONSET and Morphologically-derived [a(a)]s

		{ab, n, aa}	ONSET [+F]	PLURAL (R)	ASPECT (R)	ONSET
	a.	[n][a] [n][ab][a]		a! aba		
✖	b.	[a][n] [ab][a][n]			n n	* *
☞	c.	[n][a] [ab][n][a]		a! a		 *

A similar problem exists with respect to the vowel-initial imperfect as shown in (242). If the [e(e)] suffix is leftmost on the affix plane, a fatal ONSET [+F] violation will result (242b). (242c) has the most PLURAL (R) violations, leaving (242a) as the optimal output. Again, however, (242a) is not the optimal form, (242c) is.

(242) ONSET and Morphologically-derived [a(a)]s

		{ubul, n, ee, [+lo]}	ONSET [+F]	PLURAL (R)	ASPECT(R)	ONSET
✖	a.	[n][e] [abl][n][e]		e e		 *
	b.	[e][n] [abl][e][n]	*!		n n	* *
☞	c.	[n][e] [n][abl][e]		e! able		

It is possible to explain both of these cases with the ONSET constraints already motivated. They account for the three way distinction in onset requirements for vowel-initial words: [-lo] vowels require onsets, words beginning with /a/-initial roots do not require onsets and words or affix sequences beginning with derived [a(a)]s do require onsets. As mentioned previously, I propose that the /a/ in roots is completely unspecified. [-lo] vowels are specified (minimally) as [-lo] and morphologically-derived [a(a)]s are specified (minimally) for the feature [+lo]. This analysis requires the two previously discussed ONSET constraints repeated in (243).

(243) ONSET Constraints

a. ONSET ([+F]):
Syllables where the vowel has features must have an onset.
$*_{\sigma}[V_{[+F]}$

b. ONSET: Syllables must have onsets.
$*_{\sigma}[V$

As before, ONSET [+F] must be ranked above PLURAL (R) and ONSET must be ranked below PLURAL (R).

ONSET [+F] is relevant to the imperfect suffix because it is a morphologically-derived [a(a)] and therefore specified as [+lo]. This

means that if the imperfect [a(a)] is leftmost on the affix plane it will incur a fatal ONSET [+F] violation as in (244a). Since the initial [a] in *ab* is not morphologically derived and therefore not specified for [+lo], it does not incur a violation of ONSET [+F]. PLURAL (R) decides between the other two possibilities. Although both have one PLURAL (R) violation in the affix plane, (244b) has additional violations on the word plane, leaving (244c) as the correct optimal form.

(244) ONSET and Morphologically-derived [a(a)]s

	{ab, n, aa}	ONSET [+F]	PLURAL (R)	ASPECT (R)	ONSET
a.	[a][n] [ab][a][n]	*!		n n	* *
b.	[n][a] [n][ab][a]		a ab!a		
☞ c.	[n][a] [ab][n][a]		a a		*

This analysis also works for the [-lo]-vowel-initial imperfect cases where the first vowel of the root surfaces as a derived [a(a)]. (245a) violates ONSET [+F] if the [e] affix is initial on the affix plane, making it a non-optimal candidate. (245b) also violates ONSET [+F] because the initial vowel of the root is derived and therefore specified for the feature [+lo]. This leaves (245c) as the correct optimal form, with the plural [n] serving as onset on both the affix and word planes.

(245) ONSET and Morphologically-derived [a(a)]s

	{ubul, n, ee, [+lo]}	ONSET [+F]	PLURAL (R)	ASPECT (R)	ONSET
a.	[e][n] [abl][e][n]	*! *		n n	* *
b.	[n][e] [abl][n][e]	*!	e e		*
☞ c.	[n][e] [n][abl][e]		e able		

Given richness of the base, the idea that the constraint hierarchy must choose the optimal output whatever the input happens to be, it is necessary to account for one more possibility. The analysis of [a]-initial roots requires that [a] not be specified for any features. But something is needed to achieve the same result if a fully-specified [a(a)] is input as the initial segment of an [a]-initial verb. The necessary constraints are shown in (246) and (247).

First, a constraint is needed which disallows a specified [a(a)] in a root.

(246) $*_{root}$[a(a)]
|
[+F]

An [a(a)], specified for feature(s), cannot occur in a root.

For cases of derived [a(a)]s which occur at the beginning of /-lo/ vowel-initial roots, such as in the imperfect, the constraints requiring that these vowels be [a(a)] must be ranked above $*_{root}$[a(a).

The second constraint required is MAX (Feature) which requires that features of an input segment must be present in the corresponding segment in the output.

(247) MAX (Feature)
Every feature of S_1 has a correspondent in S_2.

In other words, a feature present in the input must be present in the output.

I now show how these constraints combine to yield the optimal output. An [a(a)] cannot occur in root-initial position without fatally violating $*_{root}$[a(a)] (248a). The optimal output, then, is one where the mora remains and only the feature(s) have been deleted (248b).

(248) A Specified [a(a)] in the Input

abaar-e
place a curse on-perf
place a curse on [PH28]

	{abaar, ee}	$*_{root}$[a(a)	MAX (μ)	MAX (Feature)
a.	[a]baar-e	*!	*	
☞ b.	Vbaar-e		*	*

The Exceptions

The final cases to be accounted for are exceptional cases: [-lo] vowel-initial roots on which the variable-position affixes occur as suffixes, rather than the expected prefixes. A paradigm for one of these verbs is shown in (249). The variable-position affixes show the same distribution as on consonant-initial verbs, even with the nonappearance of /y/ in the third masculine singular and third plural verbs.

(249) Vowel-initial Exceptions

ob *descend* [RJH261]

	Singular	Plural
1	oob-e	ob-**n**-e
2	ob-**t**-e	ob-**t**-e-**n**
3m	oob-e	oob-e-**n**
3f	ob-**t**-e	

The appearance of the variable-position affixes as suffixes on some vowel-initial verbs, rather than the expected prefixes, can be accounted for by a reranking of the constraint hierarchy, as was the case with the phonological exceptions. First, the ONSET constraints must be ranked below the morphological constraints. If the ONSET constraints

are ranked below the morphological constraints, then the variable-position affixes will appear as suffixes, as they are positioned by ALIGN constraints which align the right edge of the affix with the right edge of a prosodic word. Second, ASPECT (R) must be the highest ranked morphological constraint, as demonstrated below. Finally, an additional constraint is needed which aligns the person markers with the right edge of the word.

(250) PERSON (R): (PERSON, R, PRWD, R)
Align person with the right edge of the prosodic word.

I now demonstrate how these changes in the constraint hierarchy account for exceptional vowel-initial roots which have the variable-position affixes as suffixes. I discuss three forms from the paradigm which exhibit the range of cases to be accounted for.

For the second/third feminine, as shown in (251a & b), any output in which aspect is not the rightmost morpheme will be nonoptimal. The other two outputs are decided between by ASPECT (R): (251d) is optimal because it has fewer ASPECT (R) violations. Notice that ASPECT (R) must be ranked above PLURAL (R), or (251b) would be chosen by the constraint hierarchy as the incorrect optimal form. Also, ONSET

[+F] must be ranked below PERSON (R), or (252c) would be incorrectly chosen as optimal.

(251) Second/Third Feminine Exceptional Verbs

	{ob, t, ee}	ASPECT (R)	PERSON (R)	ONSET [+F]	MAX (μ)
a.	[e][t]	t!		*	*
	[e][t][ob]	tob	ob	*	*
b.	[e][t]	t!		*	*
	[ob][e][t]	t		*	*
c.	[t][e]		e		*
	[t][ob][e]		ob!e		*
☞ d.	[t][e]		e		*
	[ob][t][e]		e	*	*

A similar situation exists in the first person plurals. Any form in which aspect is not rightmost will be nonoptimal (252a & b), as ASPECT (R) is the highest-ranked relevant constraint. Of the remaining forms, PLURAL (R) must be a suffix, or there will be fatal PLURAL (R) violations (252c vs. d). This data show that PLURAL (R) must be ranked below ASPECT (R) (252b vs. d) and ONSET [+F] must be ranked below PLURAL (R) (252c vs. d).

(252) First Plural Exceptional Verbs

	{ob, n, ee}	ASPECT (R)	PLURAL (R)	ONSET [+F]	MAX (μ)
a.	[e][n]	n!		*	*
	[e][n][ob]	nob	ob	*	*
b.	[e][n]	n!		*	*
	[ob][e][n]	t		*	*
c.	[n][e]		e		*
	[n][ob][e]		obe!		*
☞ d.	[n][e]		e		*
	[ob][n][e]		e	*	*

The final cases to account for are the second person plurals, where both the person and plural markers surface. As shown in (253), forms which have more than two ASPECT (R) violations will be nonoptimal (253a). Forms without plural rightmost will also be nonoptimal (2534b &c). This leaves the optimal form as shown in (253d). Notice that PLURAL (R) must be ranked above PERSON (R) or (253c) would be incorrectly chosen as the optimal form.

(253) Second Plural Exceptional Verbs

	{ob, n, ee, t}	ASPECT(R)	PLURAL(R)	ONSET[+F]	MAX (μ)
a.	[t][e][n]	n			*
	[t][e][n][ob]	no!b			*
b.	[n][e][t]	t	e!t		*
	[ob][n][e][t]	t	et	*	*
c.	[n][e][t]	t	e!t		*
	[n][ob][e][t]	t	obet		*
☞ d.	[t][e][n]	n			*
	[ob][t][e][n]	n		*	*

A nice consequence of this analysis is the predictions it makes about exceptional consonant-initial verbs. Recall that person and plural surface on vowel-initial verbs because they must satisfy the high-ranked ONSET [+F]. The tableau for the second person plural is repeated in (254).

(254) Second Person Vowel-initial Plurals

	{okom, n, ee, t}	ONSET[+F]	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[t][e][n]			n	*
	[o.kom].[t][e][n]	*!		n	*
☞ b.	[t][e][n]			n	*
	[t][ok.m][e][n]			n	*

Vowel-initial exceptional forms, which take the variable-position affixes as suffixes, were handled by a reranking of the constraint hierarchy, with both ONSET constraints ranked below the morphological constraints as repeated in (255).

(255) Second Plural Exceptional Verbs

	{ob, n, ee, t}	ASPECT(R)	PLURAL(R)	ONSET[+F]	MAX (μ)
a.	[t][e][n]	n			*
	[t][e][n][ob]	no!b			*
b.	[n][e][t]	t	e!t		*
	[ob][n][e][t]	t	et	*	*
c.	[n][e][t]	t	e!t		*
	[n][ob][e][t]	t	obet		*
☞ d.	[t][e][n]	n			*
	[ob][t][e][n]	n		*	*

Now recall that the ONSET constraints played no role in determining whether the variable-position affixes are prefixes or suffixes on consonant-initial verbs, as shown in (256).

(256) Consonant-initial Second Person Plural

	{rab, n, ee, t}	ONSET	PLURAL (R)	ASPECT (R)	MAX (μ)
a.	[t][e][n]			n	*
	[t][e][n][rab]		r!ab	nrab	*
b.	[n][e][t]		e!t	t	*
	[rab][n][e][t]		et	t	*
☞ c.	[t][e][n]			n	*
	[rab][t][e][n]			n	*

No reranking of the constraint hierarchy will cause the suffixes to become prefixes on consonant-initial roots as consonant-initial roots already have onsets and no reranking of the constraint hierarchy can change this.[53] There are therefore no consonant-initial exceptional forms.

Summary

In this chapter I introduced the variable-position affixes of Afar. The person markers are suffixes on [a] and consonant-initial verbs but prefixes on vowel-initial verbs. The plural is a prefix on vowel-initial

[53] This analysis predicts, however that there should be exceptional [a]-initial forms and there are none.

roots when there is no person marker, and otherwise it occurs as a suffix. The distribution of the plural shows an additional twist: as a suffix it sometimes precedes the aspect marker and other times follows it. Finally, the third person masculine marker occurs as a prefix on vowel-initial verbs but does not appear on consonant-initial verbs.

I then showed that a parallel model in Optimality Theory reaches a paradox: it is unable to account for the different order of affixes in forms such as *rab-n-e* versus *rab-e-n*. The Multiplanar Model was then introduced. It accounts for the problem data by positing that the output representations consist not only of a word plane, but of an affix plane as well. In particular, the Multiplanar Model accounts for the data proposed above. The representations for the two forms are: [y-e-n], [rab-e-n] and [n-e], [rab-n-e]. In the first case, plural is specified as the rightmost morpheme by morphological constraints. /y/, even though it cannot surface on the word plane, satisfies ONSET on the affix plane. This contrasts with the second case, where because ONSET is ranked higher than PLURAL (R), plural occurs to the left of aspect.

In the next chapter I examine alternative OT analyses of this data. I show that a serial monoplanar analysis can also account for this data. I then compare the serial and Multiplanar Models, arguing that phonological evidence supports the Multiplanar Model.

4. Alternative Accounts in OT

In this section I discuss another possible OT analysis of the affixes in Afar to show that the best possible analysis in OT is the Multiplanar Model. Here, I introduce the use of levels, as McCarthy & Prince (1993a) use levels to account for various phenomena in Axininca Campa. McCarthy & Prince propose that the phonology of Axininca Campa is split across three different morphologically–defined levels. The motivation for this comes from the fact that although the morphological properties of prefixation and suffixation overlap, they have distinct phonologies. McCarthy & Prince therefore propose the levels in (263). In each level there is a distinct constraint hierarchy, with the output of one level serving as the input to the next level.

(263) Levels in Axininca Campa

The optimal output for each level is fully specified (filling in empty structure, etc.) and then passed on as input to the next level.

McCarthy and Prince cite as evidence for the different levels the variant rankings of PARSE and FILL. At the prefix level, V+V and C+C

sequences occurring as the result of morphology are resolved by deleting prefixed material, in other words, with FILL dominating PARSE (DEP >> MAX). In the suffix level, however, syllabic violations induced by the morphology are resolved by epenthesis therefore invoking the opposite constraint hierarchy: PARSE dominates FILL (MAX >> DEP). At the final level, the word-level, stress and related phonology occur. The idea here is that different morphology may constitute different levels, where, for each level, there is a separate and distinct mini–phonology, or constraint hierarchy.

A Linear Planes Analysis

A question that could be asked is whether division into nonlinear planes is necessary, or if all that is needed are distinct linear planes. For example, an analysis could be imagined where there are two linear planes: roots and suffixes. This is shown in (265) for the first person plural. If the constraints apply to each plane (where here "[ ]" sets off planes and "–" separates morphemes within a plane), the same results might be achieved for this data as were achieved with nonlinear planes. (265a) is non–optimal because it lacks an onset in the affix plane ([e-n]). This leaves (265b) where both planes have onsets, as the optimal form.

(265) First Person Plural Consonant–Initial Verbs

			ONSET	PLURAL (R)	ASPECT (R)
	a.	[rab][e-n]	*!		n
☞	b.	[rab][n-e]		e	

Data such as the third person plural consonant forms, however, show the solution cannot be a linear one. What is of importance here is the relationship between the person marker and the order of the plural and aspect markers. Recall that both the multiplanar and linear plane analyses assert that morphological constraints require plural to be rightmost morpheme. This is consistent with the surface order of the second and third person consonant and vowel–initial forms.

(266)	Second	Third Fem.	Third Masc.
Consonant-Initial	rab-t-e-n	rab-t-e-n	rab-e-n
Vowel-Initial	t-okom-e-n	t-okom-e-n	y-okom-e-n

It is not consistent with the surface order of the first person plural, where in neither case is the plural rightmost.

(267) First Plural

a.	Consonant-Initial	b.	Vowel-Initial
	rab-n-e		n-okom-e
	root-pl-perf		pl-root-perf

In the Multiplanar Model, plural was argued to occur to the left of aspect in the first person plural because otherwise there would be an ONSET violation on the affix plane.

(268) Explanation in the Multiplanar Model

*[e-n]	vs.	[n-e]
[rab-e-n]		[rab-n-e]

It was then pointed out that this same analysis could be done with linear planes. If there were a root plane and an affix (or suffix) plane, it could still be the case that plural occurs to the left of aspect only in order to avoid an onset violation in the affix plane.

(269) Explanation in the Linear Planes Model

*[rab][e-n] vs [rab][n-e]

But this does not work the same for the third person plural as shown below. If the third person marker, /y/, immediately follows the root but does not surface, as required by *Cy, then a fatal ONSET violation in the affix plane will result (270a), choosing the incorrect form as optimal.

(270) A Problem with Linear Planes

		{rab, y, ee, n}	ONSET	ASPECT(R)	*Cy	MAX (y)
☞	a.	[rab][e-n]	*!	n		*
✖	b.	[rab][y-e-n]		n	*!	

Notice that ranking *Cy higher (above PLURAL) to rule out (271d) is of no help. If *Cy is ranked above PLURAL (R), the correct optimal form will still be ruled out by ONSET.

(271) A Problem with Linear Planes

		{rab, y, ee, n}	*Cy	ONSET	ASPECT(R)	PLURAL(R)	MAX (y)
☞	a.	[rab][e-n]		*!	n		*
	b.	[rab][y-e-n]	*!		n		
	c.	[rab][n-e-y]			y!	ey	
✖	d.	[rab][n-e]				e	*

The first and third person plurals combine to show that a planar analysis must be nonlinear in order to account for the Afar data.

In the next section I discuss the possibility of using a Levels Model to account for Afar.

Avoiding the Paradox with Levels

One attempt to resolve the paradox found in a linear parallel analysis may be to posit that there is more than one level in Afar, as discussed above for Axininca Campa. For example, some morphology

may be added to the root and the outputs from this submitted to the constraint hierarchy. The optimal output of this would then be submitted to a new constraint hierarchy in a second level. In this section I examine that possibility. To gauge the potential and problems a level-ordered approach might have, it is necessary only to look at the first, second and third person plural forms as the singular forms exhibit a subset of the phenomena found in the plurals.

Recall that in the plurals an ordering problem exists with respect to the plural and aspect markers. If aspect is designated to occur to the right of the plural, then the first person forms, where plural precedes aspect, are predicted (rab-n-ē; n-okom-ē) but the second and third person forms, where aspect precedes plural, are not (e.g., t-okom-e-n; rab-t-e-n). If, however, plural is required to occur to the right of aspect, then the second and third person forms are predicted to occur, but not the first person plural. The problem is that in the first person, plural precedes aspect, but in second and third person, aspect precedes plural.

One way to get around this problem might be to posit that at least two levels exist in Afar. I first describe how this would work, then I formalize the analysis in OT, suggesting that at least two levels are required. In the first level the affixes are all suffixes and neither ONSET nor *Cy play a prominent role. Imagine for the moment that

the morphological constraints align the affixes to the root as suffixes, in the order shown in (278), person–plural–aspect.

(272) Ordering of Root and Affixes

a. <u>First Person</u>	b. <u>Second Person</u>	c. <u>Third Person</u>
rab-**n-e**	rab-**t-n-e**	rab-**y-n-e**
root-pl-asp	root-2-pl-asp	root-3-pl-asp
We drank milk	*You drank milk*	*They drank milk*
okom-**n-e**	okom-**t-n-e**	okom-**y-n-e**
root-pl-asp	root-2-pl-asp	root-3-pl-asp
We ate	*You ate*	*They ate*

This could be done with the use of two constraints used in the previous analysis: ASPECT (R) and PLURAL (R). A third constraint is required which also aligns the person affix to the right of the root, PERSON (R).

(273) PERSON (R): ALIGN (PERSON, R, WORD, R)

Align the right edge of person with the right edge of a prosodic word.

These would have the ranking shown in (274), in order to generate the forms in (272).

(274) ASPECT (R) >> PLURAL (R) >> PERSON (R)

This would guarantee that aspect is the rightmost morpheme, plural the second rightmost, and person is to the left of plural.

Now notice that the entire string for first person is syllabifiable with the affixes ordered this way (275).

(275) First Person

Consonant-Initial	Vowel-Initial
rab.ne	o.kom.ne

Note that this is not the case with the second and third person. With person and plural immediately following consonant-final roots, an illicit triconsonantal sequence results (276).

(276) An Unsyllabifiable Sequence

Second Person	Third Person
rabyne	okomyne
rabtne	okomtne

There are three possible ways to syllabify these strings. First, one of the consonants could be deleted (277).

(277) Consonant Deletion

Second Person	Third Person
rab.ne	rab.ne
o.kom.ne	o.kom.ne

Second, a vowel could be epenthesized as in (278).

(278) Vowel Epenthesis

Second Person	Third Person
ra.b𝕍t.ne	ra.b𝕍y.ne
o.ko.m𝕍t.ne	o.ko.m𝕍y.ne

Third, one of the morphemes could be "moved" into a position where it could syllabify. Notice that plural in the forms in (279) could be "moved" to the right here so that it could syllabify.

(279) Altering the Order of the Morphemes

Second Person	Third Person
rab.ten	rab.yen
o.kom.ten	o.kom.yen

No such movement would be required in the first person as it can already syllabify in these forms. The idea here is that some syllabification constraints would hold of Level 1, overriding the morphological constraints when necessary for syllabification. In the second level, other syllabification constraints would apply. On the first, second and third person vowel-initial plurals either the plural or person marker would move to prefix position in order to avoid an ONSET violation.

(280) First, Second, and Third Person Vowel-Initial Verbs

okom n ee	okom t ee n	okom y ee n
[n-o.ko.m-e]	[t-o.ko.m-e-n]	[y-o.ko.m-e-n]

In the third person consonant-initial forms, where the /y/ follows a consonant, *Cy would have the effect of deleting the /y/.

(281) Third Person Consonant-initial Roots and *Cy

[ra.ben]

It is crucial that ONSET and *Cy are relevant in the second but not the first level. If *Cy (or ONSET for vowel-initial verbs) were to apply at Level 1, then the plural marker would not be forced rightward in order to syllabify: it could syllabify to the left of aspect, generating the incorrect output as optimal.

(282) *Cy Cannot Apply in Level 1

*rab.ne

This analysis has a serial flavor to it. First, the affixes are ordered by the morphological and some phonological constraints. Then ONSET and *Cy apply. If the claim of parallelism is to be maintained, a possibility for "ordering" these constraints so that ONSET and *Cy apply "after" the order of plural and aspect has been fixed would be to have PLURAL (R) and ASPECT (R) ranked with respect to each other at one level, while having ONSET and *Cy play an active role in the following level. I show how this would work in OT and discuss the problems with this type of analysis.

The tableau for first person plural consonant-initial verbs in Level 1 is shown in Figure (283).[54] In the first person plural consonant-initial forms, ASPECT (R) must be ranked above PLURAL (R) to derive the optimal form (283a vs. 283b). Recall that plural and aspect must occur on the same side of the root or the plural will be unable to syllabify.

(283). First Person Plural in Consonant-Initial Verbs

			ASPECT (R)	PLURAL (R)	ONSET	MAX (μ)
	a.	[ra.b][e][n]	n!			*
☞	b.	[rab][.n][e]		e		*

The resulting hierarchy is shown below.

(284) Constraint Hierarchy

ASPECT
|
PLURAL (R)

{MAX (μ), ONSET}

The vowel-initial first person plural forms are similar to the consonant–initial first person forms. ASPECT (R) will rule out any form in which aspect is not the rightmost morpheme (285a). As both (285b &

[54]I assume that *CMP is ranked high enough that it is unviolated and I do not generate any outputs in the tableaux in this section which would violate it. FSV and σ–WT are irrelevant to the issues discussed here and forms which would violate these are not

c) have aspect in the rightmost position, PLURAL (R) will select between them, choosing the form in which plural is farther to the right (285c).

(285). First Person Plural Vowel-Initial (Desired Output: okom-n-e)

	{okom, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[ok.m][e][n]	n!		* *
b.	[n][ok.m][e]		ok!me	* *
☞ c.	[o.kom][.n][e]		e	*

There is no new evidence for the ordering of constraints and the constraint hierarchy is the same as for the consonant-initial first person plurals.

Second person plural differs from first person plural in that the order of affixes is determined in part by phonological constraints. The person marker, *-t-*, and the plural marker, *-n-*, cannot occur next to each other without violating DEP (μ) as in (286a) or MAX (C) as in (286b).

(286) Second Person Plural Consonant-Initial

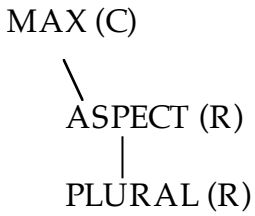
	{ran, t, ee, n}	DEP (μ)	MAX (C)	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[ra.b][ee][.t]𝕍[n]	*!		tVn		
b.	[rab].[n][e]		*!		e	*
☞ c.	[rab][.t][e][n]			n		*

---

generated either.

The second person establishes new rankings in the hierarchy. MAX (C) >> ASPECT (R) as seen by comparing (286b vs. c). ASPECT (R) must dominate MAX (μ) ((286a vs. c). The resulting constraint hierarchy is shown below.

(288) Constraint Hierarchy



{MAX (C), MAX (μ), DEP (μ)}

Of the three remaining outputs shown in the tableau in (287), the ones with the aspect marker farthest away from the right edge of the root are non-optimal as they incur more ASPECT (R) violations (287a). Each has one ASPECT (R) violation, so PLURAL (R) decides between them (287b vs. 287c), with the optimal form being the one in which plural is rightmost.

(287) Second Person Consonant-initial Plurals

	{rab, t, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[t][e][n][rab]	nr!ab	rab	*
b.	[rab][.n][e][t]	t	et!	*
☞ c.	[rab][.t][e][n]	n		*

There are no new arguments for constraint ranking from this table.

In the second-person vowel–initial forms, DEP (μ) and MAX (C) prevent the person and plural markers from occurring next to each other (289a & 289b) when they would not be able to syllabify.

(289) Second Person Vowel-Initial Plurals

		{okom, t, ee, n}	DEP (μ)	MAX (C)	ASPECT(R)	PLURAL(R)
	a.	[ok.m][ee][.n]𝕍 [t]	*!		nVt	Vt
	b.	[o.kom][.n][ee]		*!		ee
☞	c.	[o.kom.][t][e][n]			en	

The outputs in (290a and 290c) each have one ASPECT (R) violation so the optimal output appears to be (290b) which has no ASPECT (R) violations. Unfortunately, this is an incorrect output. Notice that although ultimately the person marker will appear as an onset to the word, if it appears as an onset in this level, the order of aspect and plural will be incorrect, i.e., plural will precede aspect instead of follow it.

(290). Second Person Vowel-Initial Plurals

		{okom, t, ee, n}	ASPECT (R)	PLURAL (R)
	a.	[o.kom.][n][e][t]	t!	et
✖	b.	[t][o.ko.m][n][e]		e
☞	c.	[o.kom.][t][e][n]	n!	

An additional constraint is needed to make (290c) the optimal output over (290b). ALIGN-ROOT aligns the left edge of the root and the left edge of a prosodic word (291).[55]

(291) ALIGN-ROOT

Align the left edge of a root with the left edge of a prosodic word.

$$[_{PrWd} = [_{root}$$

This constraint, in effect, requires that all affixes be suffixes because it requires that a root be aligned with the left edge of a prosodic word. (292) shows the addition of this constraint provides the correct result. Any form in which the root is not leftmost will be ruled out by ALIGN–ROOT (292a).

(292). Second Person Vowel-Initial Plurals

	{okom, t, ee, n}	ALIGN-ROOT	ASPECT(R)	PLURAL(R)	MAX (μ)
a.	[t][o.ko.m][n][e]	*!		e	*
☞ b.	[o.kom.][t][e][n]		n		*

ALIGN-ROOT must be ranked above ASPECT (R) as the optimal form (292b) has an ASPECT (R) violation whereas (292a) does not.

---

[55]This analysis doesn't necessarily need ALIGN-ROOT. Any constraint that requires that all affixes at this level must be suffixes will suffice. McCarthy and Prince (1993a: 114) also use this constraint for Mangarayi, although they refer to it as ROOT-ALIGN.

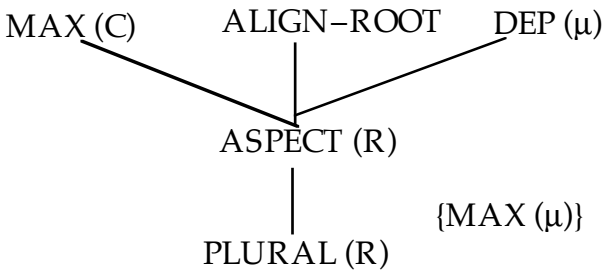
This leaves only outputs in which the root is the leftmost morpheme and person and plural are separated by aspect. The only issue to be decided is whether plural or person should be the rightmost morpheme. (293a) vs. (293b) shows that the optimal form is one where plural is rightmost.

(293). Second Person Plural Vowel-Initial

	{okom, t, ee, n}	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[o.kom.][n][e][t]	t	e!t	*
☞ b.	[o.kom.][t][e][n]	n		*

The resulting constraint hierarchy is shown in (294).

(294) Level 1 Constraint Hierarchy



Third person plural is similar to second person plural, with the exception that the person marker here is /y/ instead of /t/. As *Cy does not play an active role at this level, the analysis for the third person plural is exactly the same as it was for the second person plural. Any

form in which any of the affixes are prefixes will be ruled out by ALIGN-ROOT (295a).

(295) Third Person Consonant-Initial Plurals

	{rab, y, ee, n}	ALIGN-ROOT	ASPECT (R)	PLURAL (R)
a.	[y][ee][n][.rab]	*!	nrab	rab
☞ b.	[rab][.y][ee][n]		n	

Person and number cannot be adjacent or there will be a violation of DEP (μ) (296a) or MAX (C) (296b).

(296) Third Person Consonant-Initial Plurals

	{rab, y, ee, n}	DEP (μ)	MAX (C)	ASPECT (R)	PLURAL (R)
a.	[rab][.y]𝕍.[n][ee]	*!			ee
b.	[rab][.n][ee]		*!		ee
☞ c.	[rab][.y][ee][n]			n	

The forms in (297a and b) each have an ASPECT (R) violation so they are decided between by PLURAL (R).

(297) Third Person Consonant-Initial Plurals

	{rab, y, ee, n}	ASPECT (R)	PLURAL (R)
a.	[rab][.n][ee][y]	y	e!ey
☞ b.	[rab][.y][ee][n]	n	

The same situation obtains if the root is vowel–initial, as shown by the tableau in (298). Once again, the root must be leftmost or it will violate ALIGN–ROOT (298a). Person and plural must not be adjacent or a syllabic fix will be needed, such as the deletion of a consonant which fatally violates MAX (C) (298b). The optimal form requires that the root be the leftmost morpheme and that person and plural be separated by aspect. Additionally, the optimal form must have plural as the rightmost morpheme to avoid a fatal violation of PLURAL (R) (298c vs. 298d).

(298). Third Person Vowel-Initial Plurals

	{okom, y, ee, n}	ALIGN-ROOT	MAX (C)	ASPECT(R)	PLURAL(R)
a.	[y][o.kom.][n][ee]	*!			ee
b.	[o.kom][.n][ee]		*!		ee
c.	[o.kom][.n][ee][y]			y	e!ey
☞ d.	[o.kom.][y][ee][n]			n	

The third person provides no new evidence for the ordering of constraints.

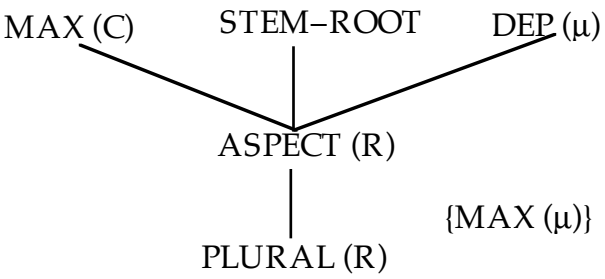
The output from Level 1 provides the correct ordering of the plural and aspect markers with respect to each other as repeated in (299). In first person, plural precedes aspect whereas in second and third person, plural follows aspect.

(299) Outputs of Level 1

First Person	Second Person	Third Person
rab.**nee**	rab.t**een**	rab.y**een**
o.kom.**nee**	o.kom.t**een**	o.kom.y**een**

The final constraint hierarchy for Level 1 is repeated in (300).

(300) Level 1 Constraint Hierarchy



If ONSET is ranked high enough in Level 2, this will have the effect of moving the plural /n/ in first person, the second person /t/, and the third masculine /y/ to onset position in the vowel-initial verbs. Additionally, *Cy will require that the [y] in the third person masculine is deleted when it follows a consonant. This is discussed below.

Level 2 is similar to Level 1 except that in Level 2 the constraints *Cy and ONSET are ranked high enough in the hierarchy to have an effect on the output forms. Also, ALIGN-ROOT must be low enough in the hierarchy so its violations are not fatal as some of the affixes are

prefixes. Additionally, the input to Level 2 is not an unordered set of morphemes but a linear string of concatenated morphemes. As McCarthy & Prince suggest for Axininca Campa, the input to a level is the output of the immediately preceding level if there is one. Since the input to Level 2 is an ordered string, it is subject to LINEARITY as discussed below.

LINEARITY is a constraint requiring that if elements are ordered in the input, that order must be preserved in the output. McCarthy (1995:4) defines LINEARITY as follows:

(301) LINEARITY
S_1 is consistent with the precedence structure of S_2 and vice versa.

Let $x, y \in S_1$ and $x', y' \in S_2$
If $x \mathfrak{R} x'$ and $y \mathfrak{R} y'$ then
$x < y$ iff $\neg (y' < x')$.

Forms like that in (302a), where metathesis is observed, are less optimal than forms like that in (302b) where the order of output segments is the same as in the input, because they violate LINEARITY.

(302) LINEARITY

		CVC$_1$ C$_2$ VC	LINEARITY
	a.	CVC$_2$ C$_1$VC	*!
☞	b.	CVC$_1$ C$_2$ VC	

LINEARITY is not relevant to the variable-position affixes in the Multiplanar Model nor to Level 1 of the Levels Model as there is no linearity across roots and affixes in these inputs (the input is an unordered set of morphemes). In the Levels Model, however, LINEARITY is relevant to Level 2 as the input to this level, (the output of Level 1) is an ordered set of roots and affixes. LINEARITY will be necessary in this model in the second person vowel-initial forms and I delay further discussion of it until that point.

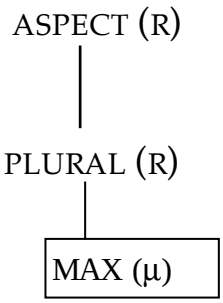
In the first person plural consonant-initial forms, ASPECT (R) will rule out any form in which aspect is not rightmost (303a & b vs. 303c). The optimal form is one in which aspect is rightmost, immediately preceded by plural (303c).

(303) First Person Consonant-Initial Plurals

	rab + n + ee	ASPECT (R)	PLURAL (R)	MAX (μ)
a.	[ra.b][e][n]	n!		*
b.	[n][ee.][rab]	r!ab	eerab	
☞ c.	[rab][.n][e]		e	*

ASPECT (R) must dominate PLURAL (R) as can be seen by comparing (303b) and (303c). ASPECT (R) and PLURAL (R) must also be ranked above MAX (μ) (303a & b vs. c). The constraint hierarchy is given below.

(304) Level 2 Constraint Hierarchy



{DEP (μ), ONSET, MAX (C), *Cy}

First person vowel-initial plurals are similar. Any form where aspect or the root is leftmost will be ruled out by ONSET (305a & b).

(305) First Person Vowel-Initial Plurals

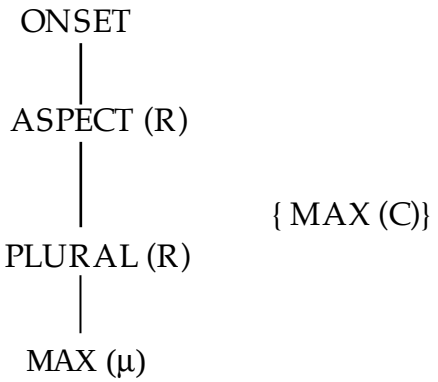
		okom + n + ee	ONSET	ASPECT (R)	PLURAL (R)	MAX (μ)
	a.	[ee][.n][o.kom]	*!	nokom	okom	
	b.	[o.ko.m][n][e]	*!		e	*
☞	c.	[n][ok.m][e]			okme	* *

This shows that ONSET must be ranked above ASPECT (R) (305b vs. c). This leaves (306a) and (306b) with the latter being optimal because it does not violate ASPECT (R).

(306) First Person Vowel-Initial Plurals

		okom + n + ee	ASPECT (R)	PLURAL (R)	MAX (μ)
	a.	[n][ee][.kom]	kom!	eekom	*
☞	b.	[n][ok.m][e]		okme	* *

(307) Level 2 Constraint Hierarchy



The second person plural consonant-initial forms are also straightforward. If plural and person occur next to each other, *CMP will force the output to violate DEP (μ) (308a) or MAX (C) (308b).

(308) Second Person Consonant-Initial Plurals

	rab + t + ee + n	DEP ($_{\mu}$)	MAX(C)	ASPECT(R)	PLURAL (R)	MAX($_{\mu}$)
a.	[rab][t]𝕍[n][e]	*!			e	*
b.	[rab][n][e]		*!		e	*
☞ c.	[rab][.t][e][n]			n		*

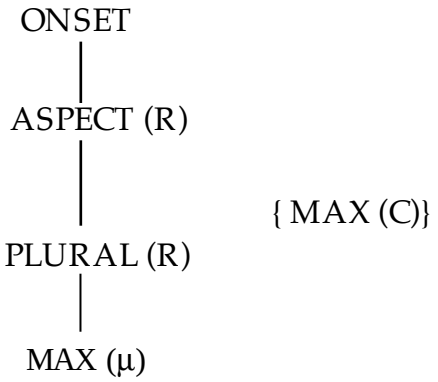
Any form in which aspect is more than one segment away from the right edge will be ruled out by ASPECT (R) (309a) as there are outputs with only one ASPECT (R) violation. Finally, plural must be the rightmost morpheme, or the form will be non–optimal: it will be ruled out by PLURAL (R) (309b vs. 309c).

(309) Second Person Consonant-Initial Plurals

	rab + t + ee + n	ASPECT (R)	PLURAL (R)	MAX ($_{\mu}$)
a.	[t][e][n].[rab]	nr!ab	rab	*
b.	[rab.][n][e][t]	t	e!t	*
☞ c.	[rab][.t][e][n]	n		*

The resulting constraint hierarchy is shown in (311).

(311) Level 2 Constraint Hierarchy



Second person plural vowel-initial verbs require an additional constraint, LINEARITY, introduced above. Recall that the input to any subsequent level is the output of the previous level. In Level 2, affixes must be allowed to occupy a different position in the string in the output than they occupied in the input, as the person and plural markers appear as suffixes in the inputs to Level 2, but they sometimes appear as prefixes in the output. It is important that affixes not have unlimited movement between the positions they occupy in Level 1

and the positions they occupy in Level 2, however. Therein lies the need for LINEARITY.

The problem is that if the morphemes are allowed to freely recombine, then the effect of having two levels is lost and the paradox re-emerges. What is needed, then, is some constraint which maintains the affix order from the output of Level 1, allowing only minimal violations.

LINEARITY prevents segments within a string from being re-ordered in the output. The Levels Model requires that this idea be extended to morphemes within a string.

In the vowel-initial second person plurals, any form in which the root is leftmost will be ruled out by ONSET (312a). But this ordering of the constraints predicts the incorrect (312b) as the optimal form because it has less violations of ASPECT (R) then does (312c).

(312) The Need for LINEARITY

		okom + t + ee + n	ONSET	ASPECT (R)	PLURAL (R)	MAX (μ)
	a.	[o.kom.][t][e][n]	*!	n		*
✖	b.	[t][okom][n][e]			e	*
☞	c.	[t][okm][e][n]		n!		* *

Herein lies the need for linearity. (312c) is more optimal than (312b) because it corresponds more closely to the input form. These forms are

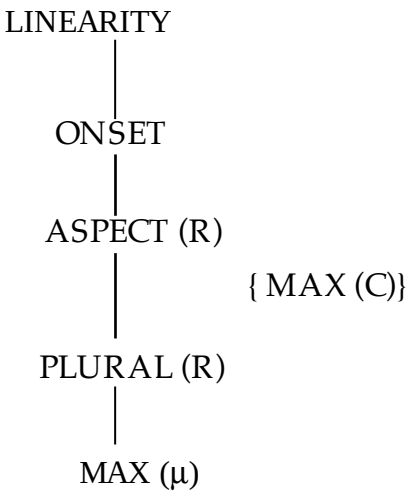
repeated in (313). In (313a), the plural has moved six segments away from its position in the input. In (313b) the person marker has moved only three segments away from its input position.

(313) LINEARITY

	okom + t + ee + n	LINEARITY	ASPECT(R)	PLURAL(R)	MAX (μ)
a.	[n][okom][t][e]	okom!te		okomte	*
☞ b.	[t][ok.m][e][n]	okm	n		* *

There is one addition to the previously motivated constraint hierarchy: (313a) versus (313b) shows that LINEARITY must dominate ASPECT (R).

(314)



Third person plural is similar to second person with a variation in the consonant–initial forms. With the third person plural

consonant–initial forms, MAX (C) must again be divided into two constraints: MAX (y') and MAX (y) as discussed in the Multiplanar Model. Any order of the morphemes that varies from the input will produce fatal LINEARITY violations. For example, in (315a) both the person and plural markers have moved one segment away from their original location.

(315) Third Person Consonant-Initial Plural

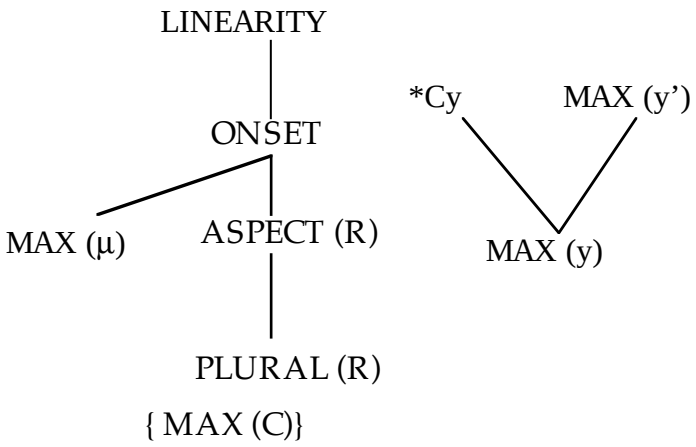
	rab + y + ee + n	LINEARITY	ASPECT(R)	PLURAL(R)	MAX (y)	MAX (μ)
a.	[rab][.n][e][y]	e!/e	y	ey		*
☞ b.	[ra.b][e][n]		n		*	*

If the third person marker, *-y-*, immediately follows the root, a *Cy violation results (319a). The choice is then between (319b) versus (319c). (319b) is less optimal because it violates the higher ranked MAX (y') rather than the lower ranked MAX (y) (319c).

(319) Third Person Consonant-Initial Plural

	rab+y+ee+n	ASPECT(R)	*Cy	MAX(y')	MAX (y)	MAX (μ)
a.	[rab].[y][e][n]	n	*!			*
b.	[ra][.y][e][n]	n		*!		*
☞ c.	[ra.b][e][n]	n			*	*

(320) Level 2 Constraint Hierarchy



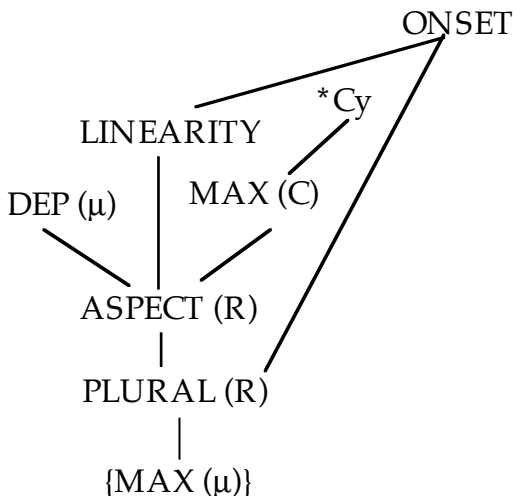
Third person vowel-initial plurals are exactly the same as second person vowel-initial plurals. If the root is the initial morpheme, a fatal ONSET violation results (317a). LINEARITY distinguishes between (317b) and (317c). In the optimal form, (317c), aspect and plural are in the same order as they were in the input (i.e., as the output of Level 1). In both forms (317b & c), [y] has violated linearity by becoming a prefix. (317b) is ruled out, however because the order of aspect and plural has been changed, thereby incurring a fatal LINEARITY violation.

(317) Third Person Vowel-Initial Plurals

	okom+y+ee+n	ONSET	LINEARITY	ASPECT(R)	PLURAL (R)	MAX (μ)
a.	[o.kom.][y][e][n]	*!		n		*
b.	[y][o.kom][.n][e]		okom/e!		e	*
☞ c.	[y][ok.m][e][n]		okm	n		* *

This data shows that ONSET must dominate LINEARITY (317b) vs. (317c). The new constraint hierarchy is shown in (318).

(318) Level 2 Constraint Hierarchy



In this section I have shown that an analysis which posits that Afar has two levels can account for the Afar data. In Level 1, the *Cy and ONSET constraints are ranked low enough to have no effect on the ordering of affixes. The constraints in this level are those required in the Multiplanar Model with one additional constraint, ALIGN–ROOT that requires that a root be aligned with the left edge of a prosodic word: i.e., that all affixes be suffixes. The output of Level 1, an ordered string of morphemes, serves as the input to Level 2. In this level, *Cy and ONSET are ranked high enough to play an active role in the ordering of affixes. Additionally, LINEARITY is required to ensure that, as much as

possible, the order of morphemes in the output of Level 2 is the same as the order of morphemes in the input.

In the next section I discuss problems with this model, showing that the Multiplanar Model is preferable.

Problems with a Level-ordered Approach

In this section I discuss three important differences between the Multiplanar and Levels Models. First, there are differences between the ways the planes and levels are organized. The planes are defined morphologically (root, affixes, word), whereas the levels are not. Compare the Levels Model necessary here with the Levels Model proposed by McCarthy and Prince for Axininca Campa. McCarthy and Prince suggest that Axinica Campa must be divided into at least two levels: prefixes are part of the input in Level 1, whereas suffixes occur in the input only in Level 2. These levels are therefore morphologically defined. Level 1 is the prefixal level and Level 2 is the suffixal level. This contrasts with the way levels must be defined for the Afar data. In Afar, all of the morphology is present in both levels. What differs between the levels is not the morphology, but the phonological constraints. Specifically, ONSET, LINEARITY and *Cy must play a prominent role in Level 2, but they crucially cannot play a role in Level 1. Additionally, ALIGN-ROOT is also required in Level 1.

Second, the analyses make different predictions about the effects of assimilation constraints on the variable-position affixes. In the Multiplanar Model, the person and plural markers never occur immediately following the root in the vowel–initial verbs. This can be seen for example, in the second person plural. The input is the unordered set of morphemes {okom, t, n, ee}; the output is the set of strings, [t-okom-e-n], [okom], and [t-e-n], corresponding to the word, root and affix planes respectively. As such, this model predicts that assimilation constraints targeting the final segment of the root and an immediately following coronal or nasal may target the second/third feminine person marker, [t], in the consonant–initial verbs where it appears immediately following the root, ([rab-t-e-n]) but not the person marker in the vowel–initial forms ([t-okom-e-n]) where the person marker occurs to the left of the root. This can be contrasted with the Levels Model where the output of the first level places the person marker immediately to the right of the root in both vowel and consonant–initial verbs: [okom-t-e-n] and [rab-t-e-n]. The Levels Model predicts that if assimilation constraints targeting the final segment of the root and an immediately following /t/ or /n/ apply at Level 1 they will apply to both the vowel–initial and consonant–initial forms. Only if this type of assimilation rule applies at Level 2 will it affect the affix

in consonant–initial but not vowel–initial forms because here the outputs are [t-okom-e-n] and [rab-t-e-n].

The final difference between the models also concerns constraints. In the Multiplanar Model affixes form a single plane, therefore it should be expected that some constraints should apply to them as a cluster. As the affixes are not grouped in the Levels Model, it is expected that no constraints would apply to them as a group. All of these differences between the two models point to the Multiplanar Model as the superior proposal. I discuss each below.

Ad Hoc Levels

The most significant argument against the Levels Model is that unconstrained and at odds with the use of levels previously proposed for OT. McCarthy and Prince motivate levels morphologically in Axininca Campa: there is a level with prefixes, a level with prefixes and suffixes, and a word level. But the levels in the Afar analysis are quite different. These levels are not defined morphologically and in principle, there are no limits on the number of possible levels. The first level differs from the second level by the active presence of ALIGN-ROOT and the low ranking of ONSET, LINEARITY and *Cy. There is nothing in this model which limits the number of levels there may be. There is no reason that there could not be, in addition to the levels

already needed, a level where FINAL SHORT VOWEL is not relevant and another level where MAX (C) is not high ranked, etc. In other words, a Levels Model of this sort is really a serial model with nothing prohibiting an unlimited number of levels.

Consonant Co-occurrence Restrictions

Another difference between the Multiplanar Model and the Levels Model concerns which constituents they group together into a unit. The Multiplanar Model considers roots to be a unit, but it treats affixes as a unit as well in that affixes combine to constitute a single plane. The Levels Model differs from the Multiplanar Model in that affixes do not constitute a group of any type. The two models, then, make different predictions about the affixes. The Multiplanar Model predicts that there should be constraints which affect the affixes as a group, whereas the Levels Model makes no such prediction. In this section I show that the morpheme structure constraints on consonant co-occurrence that hold of roots in Afar hold of the affix plane as well, but not the word plane. This, I suggest, provides support for the Multiplanar Model over the Levels Model.

As discussed previously, not all of the consonants in Afar can co-occur with each other within a single verb root. With each group of consonants in (319), only one consonant from each group may occur in

a root. In other words, if a root contains a /d/ it cannot contain a /t/ or a /x/. If it contains a /t/ it cannot contain a /d/ or a /x/. If it contains a /x/ it cannot contain a /d/ or a /t/. The same is true for each set of consonants in (319b, c & d).

(319) Consonant Co-occurrence Restrictions

a. d, t, x
b. l, r
c. k, g
d. c, q, h

The plural, second/third feminine and third masculine person markers have been discussed extensively above. Below, I briefly list the other verbal affixes containing consonants. Discussion of these can be found in Bliese (1981) and Parker & Hayward (1986).

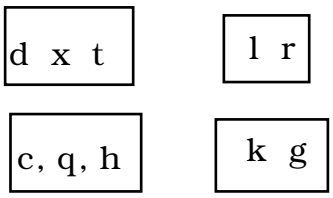
(320) Verbal affixes containing Consonants

a.	*-ah, -ih*	VH participle
d.	*-h*	Prosody, Participle Marking
c.	*-ay*	Jussive
d.	*-ay, -iy*	Y Imperative
e.	*-y-*	Third masculine
f.	*-k*	Participle
g.	*-t-*	Second/third feminine
h.	*-n-*	Plural
i.	*Vy-, Vys-, Vs-, -s, -siis*	Causative

j.	*-t, Vtt-*	Benefactive
k.	*-m-, -Ciim*	Passive

First I remind the reader of the full range of consonants that can occur in Afar, as introduced in Chapter 1. The boxes group together the consonants subject to co-occurrence restrictions in roots, discussed above, where any two consonants within a box cannot co-occur within a root. In the brackets are the consonants which are not subject to co-occurrence restrictions: they may co-occur with each other or with any of the consonants in the boxes.

(321) Consonants in Afar Roots

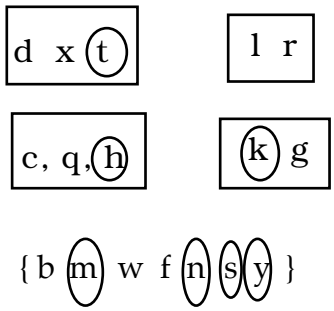


{ b m w f n s y }

There are seven consonants which occur in affixes: [n], [t], [y], [h], [k], [s], and [m].[56] This distribution is shown in (322), where each consonant that occurs as part of an affix is circled.

[56]These are the consonants occurring in both inflectional and derivational suffixes. If it were limited to just the inflectional affixes, [m] and [s] would not be included.

(322) Consonants in Afar Affixes



The interesting part of this is that no two consonants from a group constrained by the co-occurrence restrictions are found in the group of affixes. This means that no matter what combinations of affixes occur on the affix plane, they will not violate any of the consonant co-occurrence restrictions. In other words, consonant-occurrence restrictions hold not only of root plane, but affix plane as well. These restrictions do not, however, hold of the word plane, as shown by the data in (323). In (323) it is shown that within a word, [t] and [x], or [t] and [d] can co-occur, even though these combinations cannot be found in either roots or affixes alone.

(323) Consonant Co-occurrence Restrictions and the Word Plane

a. **x**al-**t**-ē
bore-3f-perf
She bore [B21]

b. **t**-ee**x**-ē
3f-suck milk-perf
She sucked milk [B131]

e. **d**igir-**t**-ē
play-3f-perf
She played [B24]

f. **d**affey-**t**-ā
sit-3f-impf
She sat [B10]

c. **t**-aa**x**ig-ē
3f-impf/know-impf
She knew [B17]

d. **t**-ibbi**x**-ē
3f-seize-perf
She seized [B6]

g. **t**-ee**d**-ē
3f-stay-perf
She stayed [B131]

h. **t**-er**d**-ē
3f-run-perf
She ran [B132]

This suggests that, like the root plane, the affix plane is subject to consonantal co-occurrence restrictions. In order to capture this generalization both affixes and roots need to be on their own planes.

Assimilation Constraints

Finally, there is a problem with a Levels Model or any analysis which has the plural and the second and third feminine marker to the right of the root on vowel-initial verbs at some stage in the derivation (e.g., Fulmer 1990). These analyses predict that assimilation constraints targeting both the final segment of the root and an immediately following segment could apply to both vowel and consonant–initial verbs, as the morphemes in the vowel–initial verbs at some point occur to the right of the root. There are four constraints in Afar which affect /t/'s and /n/'s at morpheme boundaries. For the points being made here, it is not necessary to formalize these constraints and I do not formalize them in the following sections. In each case the only variable-position affixes these constraints affect are the ones which

surface as suffixes. They crucially do not apply to the variable-position affixes which end up as prefixes on vowel-initial verbs. In this section I show that this application of constraints is expected in the Multiplanar Model, but not in the Levels Model. The problem with the Levels Model with respect to the assimilation constraints is that it is a complete accident in this analysis that the assimilation constraints never affect the vowel-initial verbs. There is no a priori reason that all four of the assimilation constraints would play a role only at Level 2 where on vowel-initial verbs, the segments that would be affected by the assimilation constraint are prefixes. In fact, this analysis predicts that some constraints would play a role at Level 1 while others would be important in Level 2. What is expected is that in some cases the variable-position affixes would show the effects of the assimilation constraints on the vowel-initial verbs (when the constraints are ranked high enough in Level 1), while in others they would not (when the constraints are ranked high in Level 2).

First I introduce IDENT (Feature), a constraint which interacts with the four assimilation constraints in Afar. Second I introduce the assimilation constraints. Finally I discuss the implications of these constraints for the Multiplanar Model and the Levels Model.

IDENT (Feature) is one of a family of faithfulness constraints which require correspondence between input and output. IDENT (Feature) requires that an input segment and its corresponding output segment be featurally identical as shown in (324).

(324) IDENT (Feature) (McCarthy 1995:4)
Correspondent segments have identical values for the feature F.
If x ℜ y and x is [ξF], then y is [ξF].

I briefly show how this interacts with assimilation constraints. Imagine a constraint which requires that an obstruent assimilate in voicing to an immediately preceding obstruent. In other words, an input like /rad-t-e/ would yield an optimal output of [rad-d-e]. This is shown in (325). (325a) is nonoptimal because it violates Voicing Assimilation as the [t] differs in the value for the feature [voice] from the preceding [d]. The optimal form does violate a constraint, IDENT (Feature), as the [d] is not featurally identical to the corresponding /t/ in the input.

(325) Voicing Assimilation >> IDENT (Feature)

	{rad, t, ee}	Voicing Assimilation	IDENT (Feature)
a.	rad-t-e	*!	
☞ b.	rad-d-e		*

Notice that if IDENT (Feature) is ranked above Voicing Assimilation the effects of Voicing Assimilation cannot be seen in the optimal output.

(32) IDENT (Feature) >> Voicing Assimilation

	{rad, t, ee}	IDENT (Feature)	Voicing Assimilation
a.	rad-d-e	*!	
☞ b.	rad-t-e		*

I now introduce the assimilation constraints in Afar.

In addition to the second person marker, there are two processes in Afar which suffix a /t/-initial morpheme to a root: the genitive and the Particular. This is important because there is a coronal assimilation constraint which targets /t/ when it follows an immediately preceding /d/, /x/ or /s/. The genitive, the Particular, and the second person/third feminine are all subject to this assimilation constraint affecting /t/ and I discuss these below. First I discuss the genitive, then the Particular, then the second/third feminine.

The genitive is formed in several different ways depending on whether the noun is masculine or feminine, vowel- or consonant-final. Vowel–final masculine nouns occur with a final stressed *–ī* instead of the final root vowel (327a). Consonant–final nouns exhibit no overt marking for the genitive (327b). The form of the genitive on vowel–final nouns depends on the initial segment of the following

word. If the word following the genitive begins with a vowel, the genitive is formed by suffixing *-h* (327c). If the following word begins with a consonant, the genitive has a copy of the first segment of the following noun (327d).

(327) Genitive Formation

	Genitive	Gloss	Nominative
a. Masc. Vowel-Final	awk-ī kitāaba	*a boy's book*	āwka [PH7]
b. Masc. Consonant-Final	danān amō	*donkey's head*	danān [PH80]
c. Fem. followed by Vowel-Initial Word	sagā-h ība	*a cow's foot*	sagā-h [PH185]
d. Fem. followed by Consonant-Initial Word	buxā-m māra	*village's people (villagers)*	buxā-m [PH74]

What is of interest here are the exceptions to the genitives as stated above: monosyllabic nouns and the consonant-final names of weekdays (Bliese 1981:165-166). It is these genitives that exhibit the phenomenon that plays a role in the following analysis. Most monosyllabic nouns do not form their genitives in any of the four ways discussed above. Instead, monosyllabic consonant-final nouns form their genitive by suffixing *-tī*.[57] This suffix is shown in (328).

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[57]According to Bliese, only monosyllabic nouns with short vowels in their input form their genitive with *-ti*. Parker and Hayward (1996: 220), however, cite *-ti* genitives where the vowel is long in the input, however, so it isn't completely clear what the

(328) The *-ti* Genitive on Monosyllabic Nouns

	Nominative	Genitive Phrase	Gloss
a.	bar [PH 69] night	bar-tī wāx night-gen cold	*night's cold* [B165]
b.	rob [PH182] rain	rob-tī cammurē rain-gen cloud	*rain cloud* [B165]
c.	xan [PH125] milk	xan-tī bīsu milk-gen color	*milk's color* [B165]

Consonant-final names of weekdays also take the *-tī* genitive.

(329) The *-ti* Genitive on Consonant-Final Names of Weekdays

	Nominative	Genitive Phrase	Gloss
a.	gumqat [PH117] Friday	gumqat-tī ayrō Friday-gen day	*Friday day* [B166]
b.	itlen [PH139] Monday	itlen-tī bār Monday-gen	*Monday night* [B166] night

There are cases of monosyllabic nouns and weekdays, however, where instead of the expected *-ti,* a monosyllabic noun or a weekday is followed by a [d] or an [s].[58]

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generalization is. For present purposes this isn't important. The following appears to be a counterexample to the claim that all monosyllabic nouns form their genitive by suffixing *-ti*: húm kitáaba *a man's book*.

[58]According to Bliese this happens with /x/ as well though I haven't found data to confirm or disprove this.

(330) Coronal Assimilation in the Genitive

[d]

a.	bad-dī sea-gen	bāgul belly	*sea's belly* [B166]
b.	(a)cad-dī Sunday-gen	māaca morning	*Sunday morning* [B166]

[s]

c.	kamis-sī Thursday-gen	cārra evening	*Thursday evening* [B166]

This suggests a constraint requiring coronal assimilation when a coronal stop or fricative is immediately followed by /t/.

As discussed in Chapter 2, the Particular adds the meaning "a particular X" to a noun.[59] It appears on vowel-final nouns as a suffixed *-yta/-yto/-ytu*, and on consonant-final nouns as a suffixed *-ta/-to/-tu*, due to *Cy.[60] This is illustrated in (331).

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[59]Parker and Hayward (1986: 228-229) refer to this process as the singulative.

[60]The quality of the vowel in the particular may occur as [a], [o], or [u]. I do not discuss this as it is not relevant to the issue at hand. For further information, see (Bliese 1981:175).

(331) The Particular

Vowel-Final Nouns

	Noun	Particular	Gloss
a.	gaqambō	gaqambo-ytā	*particular bread* [B175]
b.	qalē	qale-ytā	*particular mountain* [B175]
c.	qērqa	qerqā-yta	*a thread* [FM39]
d.	diyī	diyi-yta	*particular charcoal* [B175]
e.	dūmmu	dummū-yta	*particular tomcat* [B175][61]

Consonant-Final Nouns

	Noun	Particular	Gloss
f.	cutūk	cutūk-ta	*particular star* [B175]
g.	qaskār	qaskār-tu	*particular servant* [B175]
h.	idal	idāl-tu	*particular elder* [B175]
i.	maskin	maskin-tō	*a poor woman* [FM 39]

In some cases though, the /t/ of the Particular surfaces as [x] as shown in (332). This again suggests a rule of coronal assimilation where /t/ assimilates to a preceding coronal stop.[62]

(332) Coronal Assimilation in the Particular

a	ayxix-xu	*poor-particular*	*poor man* [B236]
b.	īgix-xa	*scorpions-particular*	*scorpion* [PH229]
c.	cībix-xo	*mollusk shell-particular*	*mollusk shell* [PH229]

[61]According to Mahaffey, (331e) is [dummú-ta].

[62]And possibly fricative as Bliese claims the same process occurs when the particular follows [x] or [s].

A similar phenomenon is found with the second/third feminine. As discussed earlier in this chapter, the second/third feminine marker is /t/. When following some coronals, however, the second/third feminine takes a different form: when following [x] it surfaces as [x], after [s] it is [s] and after [d] it is [d]. This is shown in (333).

(333) Coronal Assimilation in Person

a. [d]

rad-d-ē	*you, she fell* [B235]
haad-d-aa-n-ā	*you (pl) fly* [B235]
kud-d-ē	*flee* [B126]
ebbid–d-ē	*you (sg). sweated* [FM6]

b. [x]

gex-x-a	*you (sg). go* [FM6]
hax-x-ē	*you, she poured* [FM6]
gex-x-aa-n-ā	*you (pl) go* [B236]

c. [s]

mahas–s–ē	*how are you (morning)* [FM6]
baris-s-ē	*you, she taught* [B235]
facis-s-ee-n-ī	*you (pl) boiled* [B236]
xaam-sis-s-e-n	*you (pl) caused to buy* [FM13]

This constraint is important because although it affects the second person/third feminine marker when it occurs as a suffix on consonant-initial verbs as was shown in (334), it does not affect the

person affix when it occurs as a prefix on vowel-initial verbs, as shown in (334).

(334) Lack of Coronal Assimilation in Vowel-Initial Verbs

	Verb	Lacking	Gloss	Source
a. [d]	t-erd-ē	*d-erd-e	*run*	[B132]
	t-eed-ē	*d-eed-ē	*stay*	[B131]
	t-uqbud-ē	*d-uqbud-ē	*she worshipped*	[B251]
	t-ey-redd-ē	*d-ey-redd-ē	*you caused to run*	[B132]
b. [x]				
	t-emmex-ē	*x-emmex-ē	*finish*	[B126]
	t-eex-ē	*x-eex-ē	*suck milk*	[B131]
	t-ibbix-ē	*x-ibbix-ē	*held/seize*	[B6]
	t-aaxig-ē	*x-aaxig-ē	*knew*	[B17]
	t-ex-ē	*x-ex-ē	*gave*	[B11]
c. [s]				
	t-uhurus-ē	*s-uhurus-ē	*you, she plowed*	[FM22]
	t-ays-ē	*s-ays-ē	*she (it) is greater*	[B111, B148]
	t-esces-e-h	*s-esces-e-h	*you have shown*	[B120]
	t-innikis-ē	*s-innikis-ē	*you fell*	[B49]
	t-ikriy-siis-ē	*s-ikriy-siis-ē	*You caused to read* (Aussa dialect)	[B126]

The two models discussed here make different predictions about this constraint. The Multiplanar Model predicts that this constraint will apply to the second person /t/, but only in the consonant–initial verbs, for it is only in these verbs that the person marker follows the

root. In the vowel–initial verbs, the person marker precedes the root.

This differs from the Levels Model, where, in the output of Level 1, the person marker follows the root not only in consonant–initial forms, but in vowel–initial forms as well. The Levels Model predicts that if this constraint has an effect at Level 1 it should affect both vowel and consonant–initial verbs. If, on the other hand, it plays a role at Level 2, it will affect only the consonant–initial verbs. This is discussed below.

The Levels Model makes different predictions about constraints which affect an affix when it immediately follows the last segment of the root. To see this, examine the Level 1 outputs in (335) and (336). If the coronal assimilation constraint were to apply at Level 1, the output of that level would be that shown in (335b), not (335a).

(335) Coronal Assimilation at Level 1

	{rad, t, ee}	Coronal Assim.
a.	rad–t–e	*
☞ b.	rad–d–e	

The same is true of the vowel–initial roots as shown in (336). If coronal assimilation were to play a role at Level 1, then (336b) would be the optimal form because (336a) violates Coronal Assimilation.

(336) Coronal Assimilation at Level 1

	{ered, t, ee}	Coronal Assim.
a.	ered–t–e	*
☞ b.	ered–d–e	

As shown previously, Level 2 has no effect on the order of morphemes in the consonant–initial verbs and the output for the consonant-initial verb would be [rad-d-ē]. On the vowel–initial verbs, however, Level 2 ensures that the person marker is a prefix to avoid an ONSET violation. This results in the incorrect *[d–erd-ē] instead of the correct [t-erd-ē]. It cannot be then, that coronal assimilation holds at Level 1. It may, however, play a role in Level 2. If the coronal assimilation constraint holds of Level 2, then the correct [rad-d-ē] will be produced.

(337) Coronal Assimilation at Level 2 in Consonant-Initial Verbs

	{rad, t, ee}	Coronal Assim.
a.	rad–t–e	*
☞ b.	rad–d–e	

The correct result is also obtained for the vowel–initial verbs. If coronal assimilation applies in Level 2, where the optimal output for vowel–initial verbs has person prefixed to the root, the desired result is

obtained. Coronal assimilation will not apply to these forms as the person marker does not occur following the root. If the person marker does assimilate, it would constitute a violation of IDENT (Feature).

(338) Coronal Assimilation at Level 2 in Vowel–Initial Verbs

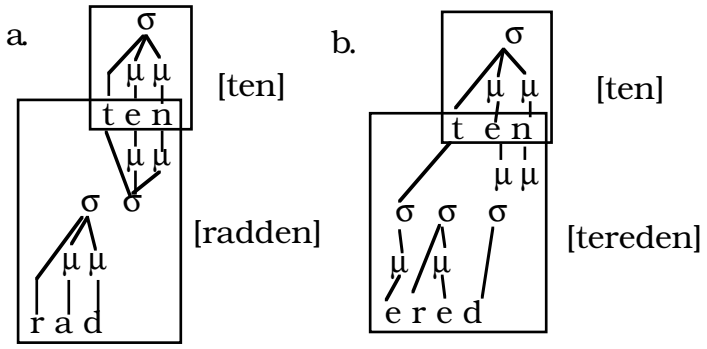
	{ered, t, ee}	Coronal Assim.	IDENT (Feature)
☞ b.	d–ered–e		*
a.	t–ered–e		

Coronal assimilation must therefore hold of Level 2 but not Level 1 in the Levels Model.

The Multiplanar Model predicts that if there are constraints which apply to the second/third feminine person marker (or the plural marker) when it is adjacent to the final segment of the root, these constraints will apply to the consonant-initial verbs but not the vowel-initial verbs. This is seen by looking at the representations in (339). In (339a), with a consonant-initial root, the person marker appears adjacent to the final segment of the root at the word level (the larger box). The coronal assimilation constraint requires that in the output this person marker appear as [d]. The second/third feminine marker on the vowel-initial verbs, however, is not adjacent to the final segment of the root on either the affix or the word tier and therefore

will not be subject to the coronal assimilation constraint (339b) producing the desired [t-ered-e-n] instead of the incorrect *[d-ered-e-n].

(339) Coronal Assimilation in the Multiplanar Model



In addition to the constraint which affects the /t/ of the second person/third feminine, there are also various constraints which affect an /n/ when it follows the final segment of a root. These include metathesis and two assimilation constraints. These are also relevant to the analyses presented here in that they apply to the plural /n/ on consonant–initial verbs but not on vowel–initial verbs, exactly the result predicted by the Multiplanar Model. I discuss each of these in turn and then discuss their analysis with respect to both the Multiplanar and Levels Models.

In one dialect of Afar, the Northern Coastal dialect, verbs ending in /x/ exhibit "metathesis of this *x* with the -*n* of the first person plural" (Bliese, 1981: 236). This is shown in (340). In (340), the first

person singular for the relevant verbs illustrates the underlying verb root as the first person singular consists of only the root and the aspect marker [e(e)] (or [a(a)] for the imperfect). The first person plural of these forms exhibits metathesis involving the final consonant of the root and the plural, /n/.

(340) Metathesis in Consonant-Initial Verbs

	First Sg.	First Pl.	Gloss
a.	xaax–ē [PH88]	xa-n-x-ē	*we almost did* [B236]
b.	cax-ē [PH124]	ca-n-x-ē	*we poured* [B236]
c.	gex-ā [PH112]	ge-n-x-ā	*we go* [B236, PH216]
d.	fax-ā [PH99]	fa-n-x-ā	*we want* [B236, PH216]

What is interesting is that this metathesis does not apply to the final consonant of the root in the vowel–initial verbs.

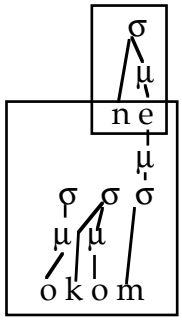
(341) Lack of Metathesis in Vowel-Initial Verbs

	First Sg.	First Pl.	Gloss
a.	n-ixcix-ē	*x-ixcin-ē	*We sewed* [B214]

As shown previously, both models make the same predictions regarding the consonant–initial roots: both predict that metathesis should apply to these forms. Where they differ is with respect to the vowel–initial forms. The Multiplanar Model predicts that there

should be no metathesis on the vowel–initial verbs as the plural marker does not occur to the right of the root.

(342) Lack of Metathesis in the Multiplanar Model



The Levels Model, however, makes different predictions based on whether the constraint is active in Level 1 or Level 2. If the constraint is active at Level 1, metathesis is expected on vowel–initial verbs, as at this level the plural occurs to the right of the root.

(343) Metathesis at Level 1

	{okox, n, ee}	METATHESIS	LINEARITY
a.	okox-n-ē	*	
☞ b.	oko-n-x-ē		*

But at Level 2, where the plural marker becomes an onset for the word, the wrong result is obtained.

(344) *[x-oko-n-ē] vs. [n-okox-ē]

This indicates that metathesis cannot apply at Level 1. Only if this constraint occurs at Level 2 is the correct result obtained. Here the plural does not occur to the right of the root in vowel–initial verbs so the environment for metathesis is not met.

(345) * x-oko-n-ē vs. n-oko-x-e

The conclusion reached, then, is that metathesis must apply at Level 2 in the Levels Model.

There is also a constraint which affects the plural when it follows /t/ or /d/ in the Northern dialect or /t/, /d/ and /x/ in the other dialects. (Recall that when the plural follows x in the Northern dialect there is metathesis). This constraint requires that the coronal assimilate to the following /n/.[63]

A /t/, /d/ or /x/ immediately preceding the first person plural assimilates to the plural as shown in (346).

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[63]According to Bliese (1981:236), some ideolects also have this rule for /d/, as shown below, but the majority of consultants do not.

First Sg.	First Plural	Gloss
cid-é	cin-n-é	*we killed*

(346) Coronal-Nasal Assimilation

	First Sg.	First Pl.	Gloss
a.	barit-ē	barin-n-ē	*we learned* [B237]
b.	wagit-ā	wagin-n-ā	*we look* [B237]
c.	fax-ā	fan-n-ā	*we wanted* [B237]
d.	gex-ē	gen-n-ē	*we went* [B237]
e.	had-ē	han-n-ā	*we help* [RJH396]
f.	rad-ē	ran-n-ā	*we fall* [RJH396]

Other root–final consonants do not assimilate, as shown in (347).

(347) Lack of Coronal-Nasal Assimilation

	First Plural	*Gloss*	Source
a.	ab-n-ē	*do*	[B110]
b.	nak-n-ē	*drink*	[B64]
c.	hay-n-ē	*put*	[B190]
d.	rub-n-ē	*send*	[PH21]

The final consonant of the root does not assimilate to the first person plural in vowel-initial verbs, however, as seen in (348).

(348) Lack of Assimilation in Vowel-Initial Plurals

	First Plural		Gloss
a.	n-aacit-e-m	*n-aacin-e-m	*That by which we walk* [B30]
b.	n-amāat-u-(h)	*n-amāan-u-(h)	*That we come* [B70]
c.	n-emeet-ē	*n-emeen-ē	*We came* [B171]

As discussed above, the Levels Model makes different predictions about constraints affecting an affix when it immediately follows the last segment of the root on vowel-initial verbs. If Coronal Nasal Assimilation were to play a role at Level 1, then (349b) would be the optimal form because (349a) violates Coronal Nasal Assimilation.

(349) Coronal-Nasal Assimilation

	{ogox, n, ee}	Coronal Nasal Assim.
a.	ogox-n-e	*
✖ b.	ogon-n-e	

The outputs for Level 1 would be as shown in (350).

(350) fan–n–ē ogon–n–ē

As shown previously, Level 2 has no effect on the ordering of the consonant–initial morphemes and produces the output [fan-n-ē]. On the vowel–initial verbs, however, Level 2 ensures that the person marker is a prefix to avoid an ONSET violation. The result would be the incorrect *[n–ogon-ē] instead of the correct [n-ogox-ē]. It cannot be then, that Coronal Nasal Assimilation holds at Level 1. It may, however, play a role in Level 2. If the Coronal Nasal Assimilation constraint holds of Level 2, where the plural is to the left of the root, then the correct [n-ogox-ē] will be produced.

(351) Coronal-Assimilation at Level 2

	ogox-n-ee	Coronal Nasal Assim.	IDENT (Feature)
a.	n-ogon–e		*
☞ b.	n-ogox–e		

The final relevant assimilation constraint involves a regressive assimilation of first person plural *-n* to a preceding [r] or [l]. (352) shows that /n/ does not assimilate to other root–final consonants.

(352) Lack of Liquid-Nasal Assimilation

	Verb	*Gloss*	Source
a.	ab-n-ē	*do*	[B110]
b.	nak-n-ē	*drink*	[B64]
c.	hay-n-ā	*put*	[B190]
d.	rub-n-ē	*send*	[PH21]

As shown in (353) the plural assimilates to a root-final [l] or [r].

(353) Liquid Nasal Assimilation in Consonant-Initial Verbs

	Input	Output	Gloss
a.	sel-n–ē	sel-l-ē	*finish* [B47]
b.	sool-n-ā	sol-l-ā	*we stand* [RJH396]
c.	kal-n-ē	kal-l-ē	*we prevented (it)* [PH216]
d.	kor-n-ē	kor-r-ē	*we climbed* [B238]
e.	digir-n-ē-h	digir-r-ē-h	*we played* [PH216], [RJH73]
f.	fer-n-ā	fer-r-ā	*we climb on* [RJH396]

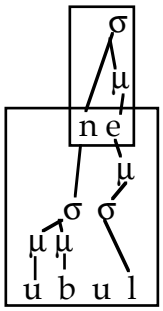
Like the previous assimilation rules, the plural in vowel-initial forms does not show this assimilation.

(354) Lack of Liquid Nasal Assimilation in Vowel-Initial Verbs

a.	n-ubl-ē	*l-ubl-ē	*we saw* [B113]
b.	n-uy-duur-ē	*r-uy-duur-ē	*we caused to return* [B219, 204]

As shown previously, both models make the same predictions regarding the consonant–initial roots. Where they differ is with respect to the vowel–initial forms. The Multiplanar Model predicts that there should be no assimilation on the vowel–initial verbs as the plural marker does not occur to the right of the root.

(355) Lack of Assimilation in the Multiplanar Model



The Levels Model, however, makes different predictions based on whether the constraint is active in Level 1 or Level 2. If the constraint is active at Level 1, we expect to find Liquid Nasal

Assimilation on vowel–initial verbs, as at this level the plural occurs to the right of the root.

(356) Liquid-Nasal Assimilation in Level 1

	{ubul, n, ee}	Liquid-Nasal	IDENT (Feature)
a.	ubl-n-ē	*	
☞ b.	ubl-l-ē		*

But at the next level, where the plural marker is an onset for the word, the wrong result is obtained.

(357) Liquid Nasal Assimilation Cannot Occur at Level 1

*[l-ub-n-ē] vs. [n-ubl-ē]

Only if this constraint occurs at Level 2 is the correct result obtained, because here the plural does not occur to the right of the root and should not be affected by Liquid Nasal Assimilation.

(358) Liquid-Nasal Assimilation at Level 2

	ubul + n + ee	Liquid-Nasal	IDENT (Feature)
a.	l-ubl-ē		*
☞ b.	n-ubl-ē		

The conclusion reached, then, is that Liquid Nasal Assimilation must only apply at Level 2.

In this section I have shown that there are four constraints which apply to either person or plural when either follows a root. All of these constraints apply only to consonant-initial verbs.

The Multiplanar Model predicts that if there are any constraints which apply to a variable-position affix based on its adjacency to the right edge of the root, they will apply to the affixes on the consonant-initial roots but not the vowel-initial roots. This is exactly the case in Afar, where there are four relevant assimilation constraints, none of which apply to the vowel–initial verbs.

The problem with the Levels Model with respect to the assimilation constraints is that it is a complete accident in the Levels Model that the assimilation constraints never affect the vowel-initial verbs. There is no a priori reason that all four of the assimilation constraints would play a role only at Level 2. In fact, the Levels Model predicts that some constraints would play a role at Level 1 while others would be important in Level 2. What is expected is that in some cases the variable-position affixes would show the effects of the assimilation constraints on the vowel-initial verbs (when the constraints are ranked high enough in Level 1), while in others they would not (when the constraints are ranked high at Level 2). This prediction is not borne out by the Afar data.

In this chapter I have shown that a linear Multiplanar Model is unable to account for the fact that plural precedes aspect in forms like [rab-n-ē] but follows aspect in forms like [t-okm-e-n]. In a linear Multiplanar Model there is a more optimal form that would avoid a violation in the affix (suffix) plane: *[t-okom][n-e] vs. [t-okom][e-n]. I have also shown that this data can be accounted for in an analysis which posits two levels in Afar. But this analysis is fraught with problems. It requires otherwise unmotivated constraints and its division into levels is ad hoc. Further, it is unable to capture the fact that there are morpheme structure constraints which apply to affixes as a group. Finally, it is an accident in the Levels Model that all assimilation rules affecting the variable-position affixes apply only at Level 2. In this model, there is no reason that some of the constraints would not apply at Level 1. The Multiplanar Model on the other hand, predicts that all assimilation rules will apply only to the consonant–initial verbs, exactly the result that is found.

5. Some Final Thoughts

In Chapter 1 I introduced the morphology of two other languages: Huave, which has variable-position affixes and Arabic, which has previously been analyzed in a nonlinear model. In this section I briefly reanalyze Huave and Arabic. Although Huave is analyzed by Noyer (1993) in an OT framework, it differs from the model proposed here in that it is a serial analysis. If serial analyses are allowed in OT, then there is no reason for planes: planes are only necessary in Afar to maintain the claim that constraints apply in parallel. If it can be shown that Huave requires a serial analysis, then there is no reason that Afar cannot be analyzed in a serial model as well. I show that Huave can be analyzed in a parallel Multiplanar Model.

Next I turn to Arabic, showing that it can be analyzed in the Multiplanar Model proposed here. McCarthy (1995) claims that a basic tenet of Optimality Theory is "richness of the base: the lexicon consists of anything in that there are no language-particular constraints on lexical forms" (McCarthy 1995:33). In other words, any input must be able to yield the predicted output. This means that languages analyzed in pre-OT as having vowels and consonants on different tiers in the input must find a new analysis in OT. I show that Arabic, previously

argued to have vowels and consonants on different tiers in the input can be accounted for in the Multiplanar Model proposed here.

I then go on to examine Optimal Domains Theory (Cole and Kisseberth 1994), where the domains appear to bear a resemblance to planes. After this I discuss the possibility of eliminating levels in Axininca Campa through the use of the Multiplanar Model. Finally, I indicate directions for future research.

Huave

As discussed in Chapter 1, Noyer argues that the alternating locations of variable-position affixes in Huave is the result of the fact that these affixes have no linear morphological specification, i.e., they are not specified as either prefixes or suffixes. Phonological constraints determine the linear position of the affixes in the surface string. I remind the reader of his data and analysis.

According to Noyer, all Huave verbs have a "theme-vowel" which is either prefixed or suffixed to the root as a result of syntactic constraints. Examples of these are shown in (359).

(359) Theme Vowels in Huave (Noyer 1993:3, 4)

a. **a**-rond	b. rond-**o**-m
TH-hang	hang-TH-nonpast
(s)he hangs [something]	*(s)he is hanging*

c. **a**-ts'ak [acáaig]
TH-unfasten
I place [round object]

d. **a**-ts'ey-iw' [aceyíu]
TH-hang
(s)he hangs [something]

e. **i**-wit' [iwít]
2-raise
you (sg.) raise

f. t-**e**-sond'-in [tesohndíin]
past-2-remove-pl
you (pl.) removed

The variable-position affixes—past, nonpast and first person—always attach outside the theme vowel, whether the theme is a prefix or a suffix.

(360) Huave Variable-position Affixes (Noyer 1993:5)

a. **t**-a-wit'
past-TH-raise
(s)he raised (it) up

b. wit'-i-**t**
raise-TH-past
(s)he rose up

c. ap-**m**-a-wit'
fut-nonpast-TH-raise
(s)he will raise (it) up

d. ap-wit'-i-**m**
fut-raise-TH-nonpast
(s)he will rise up

e. sa-**n**-a-wit'
fut-1-TH-raise
I will raise (it) up

f. sa-wit'-i-**n**
fut-rise-TH-1
I will rise up

Noyer uses two phonological constraints to account for the position of these affixes, FINAL CODA and PARSE. FINAL CODA requires that words end in a consonant.

(361) FINAL CODA (Noyer 1993:6)
*... V#

Noyer uses an additional constraint, PARSE, to prevent a consonant from occurring next to another consonant at a word edge (*CC... or *...CC).

(362) PARSE (Noyer 1993:8)
All segments are prosodically licensed.

FINAL CODA prohibits a variable-position affix from occurring to the left of the root when the theme vowel is a suffix.

(363) FINAL CODA (Noyer 1993:8)

			FINAL-CODA	PARSE
	a.	(t)wit'-i	*!	*
☞	b.	wit'-i-t		

If the theme vowel is prefixed to the root, however, the variable-position affix cannot follow the root or a fatal PARSE violation would result.

(364) PARSE (Noyer 1993:8)

			FINAL-CODA	PARSE
☞	a.	t-a-wit'		
	b.	a-wit'-<t>		*!

None of this is a problem for the model proposed here. The claim here is that some languages require planes, not necessarily that all of them do.

Noyer goes on to examine more complex data, however, claiming that a serial (cyclic) model is necessary to account for the Huave data. I show that the Huave data poses no threat to the parallel model. Noyer provides the following examples. In *sa-wit'-i-n-on*, *sa* marks first person future, *wit'* is the root, *i* is the thematic vowel, *n* is the variable-position affix and *on* marks the verb as augmented.

(365) Data proposed to require cyclicity. (Noyer 1993:9; Fig. 17 & 18)

a. sa-wit'-i-n-on
(1) fut-raise-TH-1-aug
we (excl.) will rise

b. ap-m-a-lik'-iaw
fut-nonpast-TH-scold-3pl
they will scold

The variable-position affix, *-n*, is the one to focus on. The question arises as to why the affix is optimal in this particular position. There are other positions it could appear in without violating syllable structure constraints. For example, it could precede the root as shown in (366a). A similar observation can be made with the *m i*n (366b). There is no a priori reason it couldn't follow the root.

(366) Possible Positions for Variable-position Affixes

a. *sa-n-wit'-i-on

b. ap-a-lik'-m-iaw

To account for the fact that the optimal forms are the ones in (365), rather than the forms in (366), Noyer states that "[w]ell-formedness conditions need to be evaluated at the end of each cycle" (Noyer 1993:9). His analysis is shown below.

Consider first the forms in (367a & b). Neither FINAL CODA nor PARSE will rule out either form.

(367) FINAL CODA and PARSE

		FINAL CODA	PARSE
a.	sa-.wi.t'-i-.n-on		
b.	sa-n-.wi.t'-i-on		

Noyer suggests that the variable-position affixes appear in their correct places because the derivation is cyclic. Constraints are minimally evaluated after the attachment of the theme vowel and variable-position affixes as well as at the end of a word. Assuming that the theme vowel is attached as a suffix by some high-ranking constraint that is never violated, the possibilities for the first cycle are shown in (368).

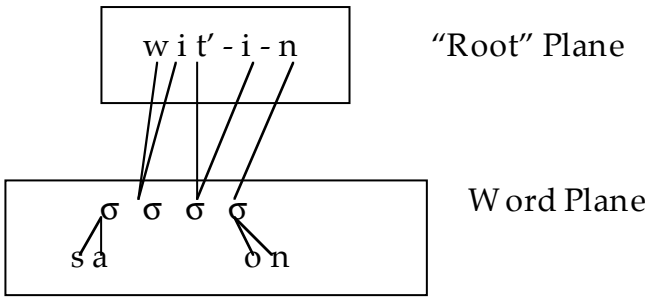
(368) First Cycle

			PARSE	FINAL CODA
	a.	n-wit'i	*!	
	b.	wit'-n-i		*!
☞	c.	wit'-i-n		

The variable-position affix will have to attach following the theme vowel. If it attaches to the left of the root, a PARSE violation will result because the *n* will be unable to syllabify (348a). If it is attached between the root and the theme vowel it will violate FINAL CODA (368b).[64] (368c) is then the optimal output. The remaining affixes are attached to this, producing the correct *sa-wit'-i-n-on*.

It is also possible to analyze this data in the Multiplanar Model.[65] 2 planes are necessary as shown in (369), with constraints applying simultaneously to all planes.

(369) Huave in the Multiplanar Model



The output candidates in this model are shown in the tableaux in (370). (370a) is nonoptimal because it has a FINAL CODA violation on the root plane whereas the optimal output has no FINAL CODA violations.

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[64] It is also possible that there is a high-ranking constraint requiring that a theme vowel attach to a root.

(370) The Multiplanar Analysis

	{n, wit', i, sa, on}	FINAL CODA	PARSE
a.	[n-wit'-i] [sa-n-wit'-i-on]	*!	*
☞ b.	[wit'-i-n] [sa-wit'-i-n-on]		

As seen above, Huave can be analyzed in a parallel fashion with the Multiplanar Model. I now turn to a language that has previously been analyzed in a serial nonlinear model.

Arabic

As discussed in Chapter 1, McCarthy argues that in Arabic consonantal roots must be a single morpheme and he captures this fact by proposing that morphemes occupy their own planes. What he does not establish, however, is that all morphemes must have their own planes: only that roots must. He proposes that affixes need to be on their own planes for two additional reasons: to identify morphemes that are targets of phonological rules and to avoid violations of the No Crossing Constraint. I show here, however, that all that is needed is for affixes to occur on a separate plane from the root, exactly the model proposed here. Below I show how this works.

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[65] From the data Noyer presents, it is possible to construct several parallel analyses

Recall (from Chapter 1) that in the eighth binyan, there is a *-t-* infix that occurs between the first and second root consonants. This /t/ is subject to an assimilation constraint requiring that it assimilate to the first consonant of the root when that consonant is a glide.

(371) Assimilation of the Reflexive (McCarthy 1981:380)

/wʔd/	–>	ttaqad	*to receive a promise*
/ysr/	–>	ttasar	*to pay with a dreydl*

The representation proposed by McCarthy would be similar to that in (372a), where, since the affixal *-t-* is not on the root tier it can be identified and therefore is subject to the assimilation constraint. The same, however, is true of the data in the Multiplanar Model proposed here as shown in (372b). Notice that the reflexive /t/ does not occur between vowels so there is no problem with both affixes occupying the same plane.

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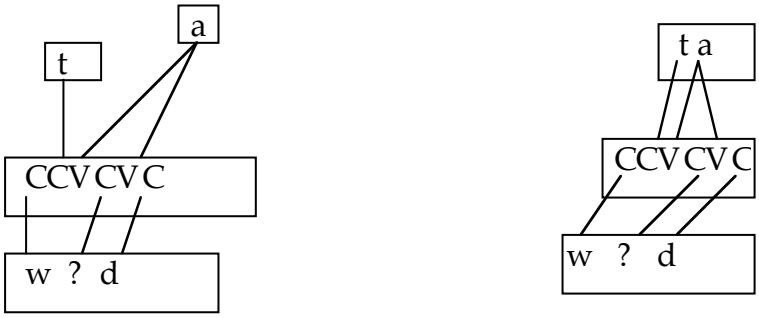
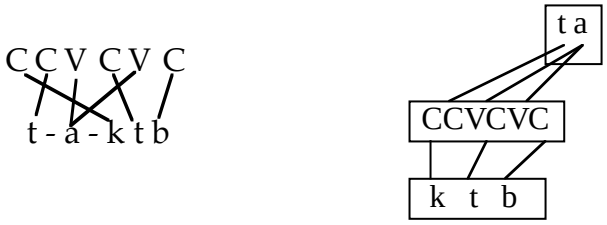
which can account for Huave. The point here, however, is not to argue for the best parallel analysis, but simply to show that Huave is consistent with a parallel model.

(372) McCarthy's Model The Multiplanar Model



Apparent violations of the No Crossing Constraint such as with the reflexive can also be accounted for in the model proposed here. If the reflexive *-t-* is on the same plane as the root, association lines will cross. There is no problem with the analysis proposed here, however.

(373) A Linear Model The Multiplanar Model



Arabic, then, poses no problem for the analysis proposed here. The root requires its own plane, but affixes do not each require their own separate plane: the data can be accounted for if all affixes are on the same plane.

Optimal Domains and the Multiplanar Model

Cole and Kisseberth (1994) propose a model that shares some properties with the one proposed here to account for transparency and opaqueness in harmony systems. In particular, they propose harmony domains, "structures which are defined by universal constraints, and which are explicitly encoded in phonological representation" (Cole & Kisseberth 1994:2). Basically, they suggest that a harmony domain is an explicit phonological structure just like a syllable or foot, and that harmony is the realization of a feature on anchors within that domain. The specifics of their proposal regarding harmony per se are irrelevant to the issues here. The question is what relationship the domains in Optimal Domains Theory have to the planes in the Multiplanar Model? Are they formal variants of one another? The answer is both yes and no. Domains are simply linear planes and are therefore potentially a subset of the planes available in the Multiplanar Model. Domains are defined phonologically, however, whereas planes are defined morphologically. Several avenues for future research are suggested. Given that planes are defined morphologically and domains are defined phonologically, is there any relationship between planes and domains? Is there data which suggests that phonological domains must, at times, be nonlinear?

Possibilities for Axininca Campa

If the Multiplanar Model eliminates the need for a Levels Model in the analysis of Afar, perhaps it eliminates the need for a Levels Model at all in Optimality Theory. For example, it may be that the Multiplanar Model obviates the need for levels in Axininca Campa. First I briefly introduce the facts that cause McCarthy and Prince (1993) to posit the existence of levels. I then suggest that the Multiplanar Model might account for the data without levels.

McCarthy and Prince state that although there is some overlap in the morphological properties of prefixes and suffixes, "their phonological properties are quite different, both in character and in degree of generality" (McCarthy and Prince 1993:24). They propose that the grammar is organized as follows.

(374) The Levels Model for Axininca Campa
(McCarthy & Prince 1993: 24)

Each level has its own distinct constraint hierarchy and the output of one level becomes the input to the next.

They propose this model, in part, because the syllabification constraints at the prefix-root junction must be ranked differently from those which apply at the root-suffix juncture. At the prefix level, V + V and C + C sequences are resolved by deletion, not epenthesis. In other words, FILL >> PARSE (or DEP >> MAX).

(375) Violation of parse in Prefixal Allomorphy (McCarthy & Prince 1993: 25)

a.	/ir-saik-i/	i<r>saiki	[isaiki]	'will sit'
b.	/no-ana-ni/	n<o>anani	[nanani]	'my black die'

At the suffix level, however, the exact opposite holds true. Problematic sequences are resolved by epenthesis rather than deletion: PARSE >> FILL.

Additionally, suffixal material must be able to "see" prefixal material. In other words, prefixal morphology and phonology cannot follow suffixal morphology and phonology. Some suffixes, for example, impose a bimoraic requirement on their base which can be satisfied by a combination of root and prefix.

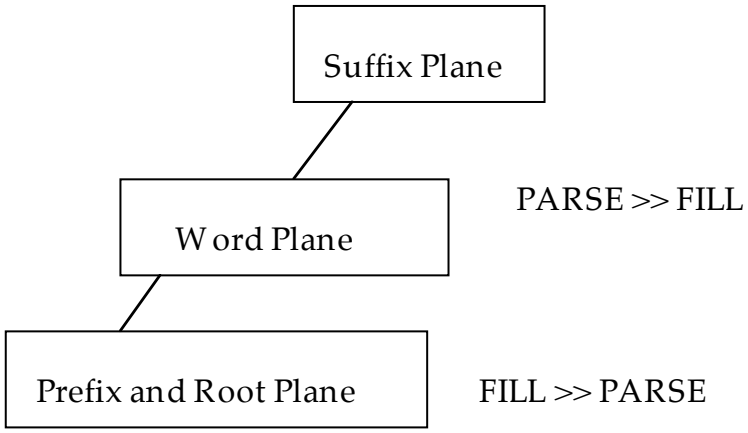
(376) Bimoraicity of Base of Suffixation (McCarthy & Prince 1993: 25)

a.	/na/	naTA-piro-~	'truly carry on shoulder'
b.	/no-na/	no-na-piro-~	'I truly carry on shoulder'

It may be possible to account for this in the Multiplanar Model, as shown below, where prefixes and roots constitute a single plane,

suffixes occupy their own plane, and both of these planes are syllabified together in the word plane.[66] This model allows for different hierarchies to be associated with each plane as shown in (377). Additionally, on the word plane, suffixes which require a bimoraic base will be able to "see" the prefix and root combination.

(377) A Possibility for Axininca Campa in the Multiplanar Model



Conclusions

In this thesis I have shown that the output representations in Optimality Theory must be enriched in order to maintain the claim of parallelism. Additionally, I have argued that a parallel Multiplanar Model is preferable to a serial Levels Model without planes. This proposal raises as many questions as it answers. I have suggested that it

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[66] There are other possible planar layouts that might also account for the Axininca

may account for other data that have been analyzed as requiring levels, but this still needs to be shown. It is also possible that this model can be used to account for data that has been analyzed as requiring cyclicity (e.g., Kenstowicz 1994). Finally, once additional phenomena have been examined, a theory of planes must be developed. Specifically, the question arises as to what can trigger different planes. For example, can a single affix trigger a new plane? Through the exploration of this model, a more thorough understanding of the phenomena that resist a parallel analysis may be gained.

Campa data. Only a detailed analysis of this data within the Multiplanar Model will show exactly how the planes must be organized.

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