An Autosegmental Theory of Quirky Mutations

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1. Introduction[1]

Morphemes can phonologically manifest themselves in different ways. The familiar case is of morphemes as *objects*: strings of one or more segments. Other morphemes could be more aptly described as *processes*, for instance truncation or metathesis.

There is at least one class of morphological phenomena whose disposition with respect to this dichotomy is controversial. These are the cases in which some morpheme manifests itself, in whole or in part, as a change to the segmental features, tone, or moraic pattern of some other morpheme. I will adopt the traditional label of *mutation* to refer to this category.

Mutation has typically been viewed in autosegmental frameworks as an instance of 'object'-type morphology. The central claim of autosegmental phonology (Goldsmith 1976) is that tones, features, and length/weight (that is, moras, in the currently prevailing view) are representational entities in their own right, not simply attributes of segments. Mutation can therefore be analyzed as the docking onto bearing units of features, tones, and/or moras which are underlyingly floating – that is, which are present as objects in the underlying representations of mutation-triggering morphemes.

An alternative possibility is to view the featural, tonal, and length changes that obtain in mutation as processes, rather than as the realization of objects. Within OT, there are two major proposals about how to account for 'processes'-type morphology – MORPHREAL constraints (Kurisu 2001, among others) and Transderivational Anti-Faithfulness (or TAF: Alderete 1999). Proponents of each have suggested that mutation might come under their purview and that floating autosegments could therefore be wholly or partly eliminated from phonological theory.

Constraints of the MORPHREAL family may be viewed as enforcing faithfulness to morphemes: they demand that every morpheme have an 'exponent' or a 'realization' in the output, with 'exponent' and 'realization' variously defined. TAF (as well as certain formulations of MORPHREAL) may be thought of as calling for the distinctiveness of morphemes: these constraints demand that affixed forms differ from unaffixed ones in some way, specified to varying degrees.

In this paper, I will be arguing in favor of the autosegmental view, suggesting instead that attested patterns of mutation are the result of constraints demanding faithfulness to and distinctive realization of *structure*. I propose three new constraints to govern the behavior of floating autosegments (defined informally for the moment):

(1)
MAXFLT: All autosegments that are floating in the input have output correspondents.

NOVACDOC: Floating features cannot dock onto segments that already bore the same feature value in the input.

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NOTAUMORDOC: Floating autosegments cannot dock onto bearing units that are exponents of the same morpheme.

The remainder of this paper is organized as follows: Section 2 motivates MAXFLT by examining cases of mutations that change more than one feature at a time, or in which a mutation-triggering morpheme has segmental content. Section 3 motivates NOVACDOC as a means of analyzing feature polarity. Section 4 argues that NOVACDOC is violated in cases of so-called ‘quirky’ mutation, in which not all mutated segments undergo the same featural change. Section 5 introduces the motivation for NOTAUMORDOC and presents a case in which it is violated. Section 6 presents a case of roots mutating affixes, which neither MORPHREAL nor anti-faithfulness can account for. Section 7 offers concluding remarks.

2. Multi-featural mutation and MAXFLT

A straightforward example of multi-featural mutation comes from Nuer, a Western Nilotic language spoken in Sudan and Ethiopia. ‘2nd group’ verbs in this language (Crazzolara 1933) undergo featural alternations to the final consonant in the infinitive in the four inflectional situations shown in the paradigms in (2); the alternating consonants are bolded:

(2)

	‘overtake’	*‘hit’*	*‘pull out’*	*‘scoop hastily’*
Infinitive/verbal noun	co**b**[2]	jaa**ç**	gu**ð**	kɛ̂**p**
3rd. sg. ind. pres. act.	có**β**ɛ́ jɛ	jaa**y**ɛ̀ jɛ̀	gú**ð**ɛ́ jɛ̀	kɛ́**β**ɛ́ jɛ̀
1st pl. ind. pres. act.	còɔ**f**kɔ jɛ	jaa**ç**kɔ jɛ	gwɔ̀**θ**kɔ̀ jɛ	kɛ̀a**f**kɔ̀ jɛ
Negative pres. pple.	cò**p**	jaa**c**	gu**t̪**	kɛ**p**
Past pple.	co**f**	jaa**ç**	gu**θ**	kɛ̀**f**

Based on these facts, Lieber (1987) identifies the four inflectional suffixes illustrated as having the underlying representations shown in (3):

(3)

3rd. sg. ind. pres. act. =	[+voi, +cont] ɛ
1st pl. ind. pres. act. =	[-voi, +cont] kɔ
Negative pres. pple. =	[-voi, -cont]
Past pple. =	[-voi, +cont]

In cases where two features change between the infinitive and the inflected form, it is clear that both floating features in the UR of the inflectional affix must be forced to dock onto the last consonant of the root. The constraint that I propose to be responsible for this is given in (4):

(4)
MAXFLT (*in constraint definitions, I=input, O=output)*
$\forall F \in I$, where F is a feature:
$[\neg[\exists S \in I$ such that S is a segment and F is attached to $S]] \rightarrow [\exists F' \in O$ such that $F \Re F']$
Likewise, *mutatis mutandis*, for floating tones and moras.

Informally, MAXFLT says: if a feature F is floating in the input, then it has an output correspondent. This constraint is similar in spirit to, though different in implementation from, Zoll’s (1996)

[2] Crazzolara (1933), p. 6, reports that “whether a b or a f is pronounced it is often hard to say.” Given the ambiguity, Lieber (1987) argues that the last consonant in 3rd. sg. ind. pres. act of verbs like ‘overtake’ is in fact [β], since in other verbs the corresponding consonant is continuant (except when it’s an alveolar, a place for which Nuer has no voiced continuant).

MAX(SUBSEG), which uses correspondence between floating features and the segments that they dock to.

I will assume throughout that output floating features are banned in the languages under consideration, either because a markedness constraint *FLOAT is high-ranked in these languages, or because it is a property of GEN (and therefore a universal property of languages) that candidate outputs cannot contain floating autosegments. If either of these is the case, satisfaction of MAXFLT will imply feature-docking.

A constraint like MAXFLT that militates in favor of preserving all autosegments that are floating in the input has two desirable empirical consequences. First, if ranked above the faithfulness constraints violated in mutation, it will yield mutation even when the triggering morpheme contains segments in addition to floating features, as shown in tableau (5):

(5) Nuer: 'pull out-neg. pres. pple.'

guð + [-voi]$_2$[+cont]$_3$ kɔ | [+voi]$_1$	MAXFLT	IDENT(contin)	IDENT(voi)
a. gwɔð-kɔ / \ [+voi]$_1$[+cont]$_3$ ~~[-voi]$_2$~~	[-voi]$_2$!		
b. ►gwɔθ-kɔ / \ [-voi]$_2$[+cont]$_3$			*

(throughout, floating features that delete and fail to dock are ~~struck through~~)

The winning candidate, (5b), violates IDENT(voi) by docking a floating token of [-voi] to an underlyingly [+voi] segment. However, (5b) still wins because to avoid this violation by deleting the floating [-voi], as candidate (5a) does, violates the higher-ranked MAXFLT.

A related effect of MAXFLT is that mutation can change more than one feature, again provided that the triggering morpheme has more than one floating feature in its underlying representation:

(6) Nuer: 'overtake-1st. pl. ind. pres. act.'

cob + [-voi]$_2$[+cont]$_3$ kɔ	MAXFLT	IDENT(contin)	IDENT(voi)
a. coɔb-kɔ ~~[-voi]$_2$[+cont]$_3$~~	[-voi]$_2$!, [+cont]$_3$		
b. ►coɔf-kɔ / \ [-voi]$_2$[+cont]$_3$		*	*
c. coɔβ-kɔ \ ~~[-voi]$_2$~~[+cont]$_3$	[-voi]$_2$!	*	
d. coɔp- kɔ / [-voi]$_2$~~[+cont]$_3$~~	[+cont]$_3$!		*

The optimal candidate, as desired, is (6b), which has docked both of the floating features in the 1st person plural indicative present active suffix, thereby violating both IDENT(contin) and IDENT(voi). Despite these violations, it still wins because to avoid one or both of these violations by deleting one or both of the floating features violates a higher-ranked constraint, MAXFLT.

The ability of MAXFLT to give the correct result in (5-6) crucially distinguishes it from constraints of the MORPHREAL family. These constraints are notably diverse in their definitions; three general types can be identified, as given in (7-9):

(7) "Preserve something"
e.g. Akinlabi's (1996) PARSE-MORPH:
Some part of every morpheme must be preserved in the output.

(8) "Preserve something distinctive"
e.g. Gnanadesikan's (1997) MORPH-REAL or de Lacy's (2002) MORPHDISF:
Some part of every morpheme that will makes a difference on the surface must be preserved in the output.

(9) "Make something different"
Kurisu's (2001) REALIZE-MORPHEME:
The phonological realization of an affixed form must not be identical to the phonological realization of the related unaffixed form.

Constraints of type (7-8) have been proposed as mechanisms for driving the docking of floating features, but crucially, they quantify existentially rather than universally: they only demand the preservation of some portion of a morpheme, possibly with a requirement that it be surface-distinct. As such they cannot induce feature-docking when the morpheme with which some floating features are affiliated also has segmental content, as (10) shows:

(10) Failure of MORPHREAL to induce mutation when trigger contains segments

guð +$[-voi]_2[+cont]_3$ kɔ	MORPHREAL	IDENT(contin)	IDENT(voi)
a. 💣 gwɔð-kɔ ~~$[-voi]_2[+cont]_3$~~			
b. ► gwɔθ-kɔ / \\ $[-voi]_2[+cont]_3$			*!

(cf. success of MAXFLT in (5))

Both candidates in (10) satisfy MORPHREAL, because the output contains the segments [kɔ], which are affiliated only with the negative present participle suffix. Therefore, to dock the floating [-voi], as in (10b), will incur a gratuitous and therefore (incorrectly) fatal violation of IDENT(voi).

Kurisu's (2001) version of MORPHREAL, described in (9), is intended in part to eliminate the need for representational devices like floating features; however, by demanding a single phonological difference between affixed and unaffixed forms, it faces the same kind of difficulty illustrated in (10). Kurisu offers a means to obtain such double morphemic exponence using Sympathy (McCarthy 1999), but it is not clear that this will in general be successful. Beyond difficulties with Sympathy theory itself, this approach cannot account for greater than double exponence, as in Dinka (Andersen 1995), a close relative of Nuer, in which, for instance, certain verb classes mark 2nd pers. with a suffix -kạ̀, as well lowering of and insertion of high tone on the root vowel.

3. Polarity and NOVACDOC

Perhaps the most challenging morpheme-realization processes are those that involve exchange process such as feature polarity: [+F] segments are converted to [-F] and [-F] to [+F]. An example comes from another Nilotic language, DhoLuo (Okoth-Okombo 1982), which is spoken in Kenya. In this language the plural and genitive morphemes reverse the [voice] value of the last consonant in the root:

(11)

Nom.Sg.	bat	kidi
Nom.Pl.	bede	kite
Gen.Sg.	bad	kit
Gen.Pl.	bede	kite
	'arm'	*'stone'*

Clearly a single autosegment cannot be responsible for a change from [+voi] to [-voi] and vice versa. Therefore, what I suggest is that the genitive and plural morphemes in DhoLuo have two lexically-listed allomorphs:

(12)
Plural: {[+voi]; [-voi]}
Genitive: {[+voi]E; [-voi]E}
(E represents a vowel that surfaces as [e] or [ɛ] under ATR harmony)

Following Mascaró (1996) and many others, I assume that when a morpheme has multiple listed allomorphs, each candidate produced by GEN stands in correspondence with, and therefore needs to be faithful to, only one of the allomorphs. All of these candidates then compete in a single tableau.

The constraint I propose to be crucially responsible for picking the correct allomorph is given in (13):

(13)
NOVACUOUSDOCKING
$\forall F \in I$, where F is a feature: $[\neg[\exists S \in I$ such that S is a segment and F is attached to $S]] \rightarrow$
$[[\exists F' \in O$ such that $F \Re F'$ and F' is attached to a segment $\delta' \in O] \rightarrow$
$[\neg[\exists \delta \in I$ such that $\delta \Re \delta'$ and δ is attached to a feature identical to $F]]$

Less formally, this says: if a feature F is floating in the input, then if F has an output correspondent F′ that's docked to a segment δ′, then δ isn't in correspondence with an input segment that already bore a feature value identical to F. Or, informally: you can't dock floating features onto segments that already bore the same feature-value in the input.

Tableau (14) illustrates the effect of NOVACDOC:

(14)[3] DhoLuo: 'arm - genitive.sg.'

bat + {$[-voi]_2$, $[+voi]_3$} | $[-voi]_1$ *Inputs:*	*Outputs:*	MAXFLT	NOVAC DOC	IDENT (voi)
bat $[-voi]_2$ | $[-voi]_1$	a. bat | $[-voi]_{1,2}$		$[-voi]_2$!	
bat $[+voi]_3$ | $[-voi]_1$	b.▶ bad | $[+voi]_3$			*

The undominated MAXFLT ensures that any viable candidate must preserve the floating feature in the allomorph to which it bears a correspondence relation. The winning candidate is (14b), which stands in correspondence with the [+voi] allomorph. Docking that [+voi] to an underlyingly [-voi] consonant violates IDENT(voi). Candidate (14b) still wins with this violation because to dock the [-voi] of the

3 I assume for simplicity that idendical feature-values linked to the same segment simply fuse (either because that's for free or because UNIF(feature) is low-ranked).

other allomorph onto an underlyingly [-voi] consonant violates the higher-ranked NoVacDoc. Another imaginable candidate, in which the floating [-voi] were to dock non-vacuously to the /b/, yielding *[pat], is ruled out by alignment constraints demanding that the genitive morpheme appear at the right edge of the prosodic word, i.e. that it be a suffix; see McCarthy (2003: §7) for relevant discussion. When the final consonant of the root is voiced, NoVacDoc will exercise a preference for the [-voi] allomorph, yielding the polar reversal of [voice]. Lastly, since the plural morpheme consists of a segment as well as the (polar) feature change, this is another case of a segmentally contentful morpheme triggering mutation, and so MorphReal constraints will, for DhoLuo, face the same problems discussed in section 2.

4. 'Quirky' mutation as NoVacDoc violation

As with any other OT constraint, NoVacDoc is violable. In this section, I will argue that it is violated in so-called 'quirky' mutations (the term is Lieber's (1987)), where not all mutated segments undergo the same featural change. An example is the so-called 'mixed mutation' of Breton (Press 1986):

(15)
b → v *spirantization*
d → t ***devoicing***
g → γ *spirantization*
gw → w *deletion*
m → v *spirantization*
(Triggered by *e* "that", *ma* "that/if", and the progressive marker *o*)

Setting aside the deletion of /g/ before /w/, the generalization here is that coronals devoice while non-coronals spirantize. This is counter to what markedness would lead us to expect, since coronal fricatives are less marked. To account for this odd pattern, I propose, first of all, that the triggering morphemes have two listed allomorphs, with different sets of floating features:

(16)
Allomorph 1: [-cor, +cont]
Allomorph 2: [+cor, -voi]

We then assume several crucial rankings: if MaxFlt dominates NoVacDoc, then the winning candidate will have to dock every feature in the chosen allomorph, even if to do so is vacuous. Second, if Ident(cor) dominates NoVacDoc, then the winning candidate will be one which has chosen an allomorph whose floating value of [coronal] matches the underlying [coronal] value of the segment to which it has docked. Finally, MaxFlt must dominate the Ident constraints that disfavor the changes to [voice] and [continuant].

Tableau (17) illustrates how these rankings yield correct allomorph selection when the targeted segment is coronal:

(17) Selection of [+cor, -voi] allomorph

{[+cont, -cor], [-voi +cor]} + /d/ *Inputs:*		Ident (cor)	Max Flt	Ident (cont)	Ident (voi)	No Vac Doc
[-voi]$_3$[+cor]$_4$ + d	a. ► t / \\ [-voi]$_3$[+cor]$_4$				*	[+cor]$_4$
[+cont]$_1$[-cor]$_2$ + d	b. v / \\ [+cont]$_1$[-cor]$_2$	*!		*		

The winning candidate, (17a), vacuously docks a floating [+cor], but to avoid the concomitant NOVACDOC violation by choosing the other allomorph, as in (17b), violates the higher-ranked IDENT(cor).

Conversely, as tableau (18) shows, when the targeted segment is non-coronal, the other allomorph is chosen:

(18) Selection of [-cor, +contin] allomorph

{[+cont, -cor], [-voi +cor]} + /b/ *Inputs:*		IDENT (cor)	MAX FLT	IDENT (cont)	IDENT (voi)	NO VAC DOC
$[+cont]_1[-cor]_2$ + b	► a. v / \ $[+cont]_1[-cor]_2$			*		$[-cor]_2$
$[-voi]_3[+cor]_4$ + b	b. t / \ $[-voi]_3[+cor]_4$	*!			*	

Again, the winning candidate violates NOVACDOC, which can only be avoided by violating the higher-ranked IDENT(cor). Admitting the use of floating features, and allowing them to dock vacuously – something for which MORPHREAL and anti-faithfulness have no analogue – makes it possible to use the feature [coronal] as a diacritic, and thereby produce this highly unusual mutation pattern.

5. The need to ban tautomorphemic docking

Our final new constraint is needed to plug a few typological worries posed by a floating-feature theory of mutation. One problem is that, in almost all attested cases, when a mutation-triggering morpheme has segmental content, its floating features do not dock onto those segments when they are prevented from docking onto the segments of the normally-mutated morpheme. For instance, in the negative present participle of the Nuer word for 'pull out', which we take as input /guð + [-voi, +cont] kɔ/, [+cont] can't dock non-vacuously on the stem-final consonant. It doesn't then dock on the /k/ of the suffix, giving hypothetical *[guθxɔ] to avoid the NOVACDOC violation.

A second worry is that mutation can be non-structure-preserving. For instance, in Javanese, the elative form of adjectives is marked by tensing of the stem-final vowel, even though tense vowels are normally banned in closed syllables (Dudas 1975):

(19) Javanese elative
[alʊs] ~ [alus] 'refined, smooth'
[aɲɛl] ~ [aɲil] 'hard, difficult'

The analysis which suggests itself is that the UR of the elative morpheme is floating [+ATR], and that the relevant ranking is MAXFLT >> MARK >> FAITH. But then roots could support a tense vowel in closed syllables if their URs contained a floating [+ATR], faithfulness to which would overpower markedness.

For both of these cases, something needs to rule out tautomorphemic docking, and to dominate MAXFLT, compelling deletion of floating features if they cannot dock heteromorphemically. I propose to do this directly, using the constraint in (20):

(20) NOTAUMORDOC
∀F∈I, where F is a feature: [¬[∃S∈I such that S is a segment and F is attached to S]]→
[[∃F′∈O such that FℜF′ and F′ is attached to a segment δ′∈O] →
[[∃δ∈I s.t. δℜδ′]→[¬[F and δ are affiliated with the same morpheme]]]
Likewise, *mutatis mutandis*, for floating tones and moras.

This says, simply, that floating autosegments cannot dock to bearing units that are affiliated with the same morpheme. As defined in (20), NoTauMorDoc will rule out the undesirable results in Nuer and Javanese just mentioned. However, again, since we are working in OT, it is necessary to find a case where this constraint is violated. One example comes from San Agustín Mixtepec Zapotec (Beam de Azcona 2004), where the 1st person possessive pronominal enclitic inserts a high tone on the final syllable of the possessed noun (compare the 2nd person clitic, which has no such effect):

(21) H docks on L-toned nouns with 1st person posessor

le	le le	le na
|	| |	|\ |
L	L L	LH L
'name'	'your name'	'my name'

However, when the last syllable of the possessed noun has high or rising tone – that is, when its final TBU already bears an H - the H surfaces on the clitic:

(22) H docks on 1st person clitic when noun has an H

los	los le	los na
|\	|\ |	|\ |\
LH	LH L	LH LH
'tongue'	'your tongue'	'my tongue'

These facts suggest the following analysis: first, MaxFlt is undominated, forcing preservation of the 1st person clitic's underlying floating H. Normally, this H will dock onto the possessed noun, satisfying NoTauMorDoc. However, the constraints that prevent adding another H to a TBU that already has one – which could be NoVacDoc or some version of the OCP – dominate NoTauMorDoc, forcing tautomorphemic docking in cases like (22) in order to satisfy MaxFlt. [4]

6. An exception to Strict Base Mutation

One important property of both MorphReal and anti-faithfulness is that they permit affixes to mutate their bases of affixation, but not roots to mutate affixes. Alderete (1999) refers to this property as Strict Base Mutation. An autosegmental theory, however, does not impose such a restriction.

One example of roots mutating affixes comes from Chukchee, which Kenstowicz (1979) analyzes as having dominant/recessive ATR harmony. Oddly, a number of roots and affixes behave as dominant in the harmony system even though they are underlyingly vowelless (Krause 1979, p. 13):

(23)

vowelless roots behaving recessively:

ŋət-ək	γe-nt-ə-lin	"to cut off/he has cut off"
rəγ-ək	γe-rγ-ə-lin	"to dig, scratch/he has dug, scratched"

(24)

vowelless roots behaving dominantly:

təm-ək	γa-nm-ə-len	"to kill/he has killed"
təm-ək	γa-tw-ə-len	"to say/he has said"
rəw-ək	γa-rw-ə-len	"to split/he has split"[5]

[4] Only complication: for a seemingly idiosyncratic group of nouns, the H appears on both the noun and the clitic: làd 'body' ~ làd lè 'your body' ~ lǎd nǎ 'my body'. No semantic or phonological generalizations appear to distinguish the set of nouns that do this, so there may simply be two noun classes which take different 1st pers. possessive clitics.

[5] The appearance of [e] in [-ATR] consonants is treated by Kenstowicz (1979) as lowering of high vowels after laxing them through harmony; an OT analysis in terms of one's favorite theory of opacity might be possible, but this is in any case tangential to our present concern. Regardless of just what features are involved, how would we explain the dominance of some (but not all) vowelless roots without floating features?

If harmony is just feature spreading, then these facts suggest an analysis in which dominant vowelless roots contain a floating [-ATR] which docks onto affixal vowels.

7. Conclusion

In this paper I have argued that an autosegmental theory of mutation is more typologically satisfactory than one based on MORPHREAL or anti-faithfulness. The autosegmental theory presented here can easily account for multi-featural mutations, mutations triggered by morphemes with segmental content, 'quirky' patterns, 'back-up' tautomorphemic docking, and roots that mutate affixes; neither of the competing theories can satisfactorily account for all of these facts. It will still be necessary to employ either MORPHREAL or anti-faithfulness for other phenomena like subtractive morphology, but the elimination of floating autosegments cannot be a motivation for either.

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