Marco Svolacchia

PHONOLOGICAL PITFALLS IN THE BUSINESS OF GETTING A LIVING: THE STRANGE CASE OF SOMALI STOPS

UNIVERSITY OF ROMA TRE

1. Introduction*

Among the phonological phenomena of Somali still not fully understood, stop voicing is particularly interesting for a number of reasons.

The first is descriptive: notwithstanding the familiarity of the process, Somali stop voicing, as is stated in the literature, qualifies as a "crazy rule". Surprisingly, this fact does not seem to have attracted the attention of scholars, in spite of its pervasiveness in the derivation of Somali. The first aim of this paper is to provide a better analysis to the phenomenon (§§1–3).

The second reason is more ambitious: in order to solve the descriptive puzzle, some current outstanding phonological issues must be confronted with, what qualifies it as a case study. Topics such as synchronic chain shifts, opaque domains, and the nature of the architecture of the phonological component will be addressed (§4).

1.1. Some background[1]

As a general reference for the discussion to follow, take note of *the inventory of Somali obstruents*. The classification of segments in the table is superficial, in that no assumption is made concerning *underspecification* (e.g., /s/ is listed as "voiceless", according to its phonetics) or exact *feature specification* (e.g., gutturals are conventionally subcategorized with the IPA

labels). Finally, /ʤ/ (/ʧ/ in the centre-northern varieties) is conveniently listed here among the stops:

LABIAL	*CORONAL*		*DORSAL*		*RADICAL*	
	FRONT	*BACK*		*UVULAR*	*PHARYNG.*	*LARYNG.*
		–DIFF *+DIFF*				
b	t d	ɖ ʤ	k g	q		ʔ
f	s	ʃ		χ	ħ ʕ	h

Because of their relevance for the phenomena at issue, take notice of the following properties:

- the absence of /p/;
- the presence of *gutturals* ("uvulars", "pharyngeals", "laryngeals");
- the presence of /ɖ/, retroflex voiced, either described as "glottalised" (von Tiling 1925; Amstrong 1934; Moreno 1955) or "pharyngealised" (Cardona 1981).

The *syllable inventory* of Somali is (C1)V1(V2)(C2), in which V2 can be the 2nd half of a geminate (e.g. *moos* 'banana'), or a glide (e.g. *weyn* 'big').

1.2. Distribution of stops

Voiceless stops do not occur in syllable coda position in Somali. The alternations showed by the following examples, both verbs and nouns, illustrate:

(1)

a.			b.		
	ilko	'teeth'		*ilig*	'tooth'
	adkee	'toughen'		*adag*	'be tough'
	arkay	'he saw'		*aragtay*	'you saw'
	gunta	'bind (PL.)!'		*gunud*	'bind (SING.)!'
	guntay	'I bound'		*gunudday*	'you bound'

In the forms in (1.a) – ending in a suffix beginning with a vowel – the stops in syllable onset position are *voiceless*, whereas in the forms in (1.b) – unsuffixed or ending in a suffix beginning with a consonant – the stops in syllable coda position are *voiced* (recall that $p \rightarrow b$ does not occur because /p/ is not part of the inventory of Somali).

Note that voiceless and voiced stops are not in complementary distribution, as voiced stops do occur freely after a consonant:

(2)
mindi 'knife'
xargo 'ropes'
hilbo 'meats'

1.3. The Prepausal Voicing rule

There is a long tradition in Somali studies of accounting for the aforementioned alternation with a voicing rule in "syllable final position", neutralising the contrast between voiceless and voiced stops, that can be made explicit as follows in a SPE format:

(3) PREPAUSAL VOICING

$$\begin{bmatrix} -\text{cont} \\ -\text{voice} \end{bmatrix} \rightarrow [+\text{voice}] / \_\_]_{\sigma}$$

The formulation is mine, since Moreno (1955: §8.b) – the first, as far as I know, to describe the process in such terms – gave an informal description of it. Since then, this has become the standard analysis (see, among others, Cardona 1981: 12-18). (Abraham (1968: 326) advocates for a rule in which both the coda position and a preceding vowel are, *redundantly*, relevant: [–cont, –voice] → [+voice] /V__]$_{\sigma}$).

Prepausal Voicing, which can be provisionally considered as observationally adequate, entails some obvious problems as far as the understanding of the process is concerned. The syllable

coda is clearly not a typical voicing position; on the contrary, it is the standard devoicing position, as evidenced by a great number of languages, some of them very well known (say German, Russian or Turkish, among many others).

Another puzzling fact about the Prepausal Voicing rule is that there is a different rule in Somali by which voiced obstruents (partially) devoice in the very same context, syllable coda position (Cardona 1981: 11-13). That is to say that the same phonological element triggers two opposite processes in the same language.

As a consequence, there does not seems to be any chances to give some substantial support to this rule – call it "phonological naturalness", "phonological explicativeness" or related notions – which in past phonology would have been regarded as a manual example of a "crazy rule". However, this is not a conclusive point, since the relation between phonological naturalness and descriptive adequacy is a long debated issue, which has been dealt with differently in different frameworks and in different decades, and which is far from being solved.

Leaving aside this outstanding problem, in the next section we will investigate the Somali voicing rule in more detail to ascertain if there is a better alternative to the Stop Prepausal Voicing rule. Minimally, this quest would be an exercise in determining how a historically natural rule becomes "crazy" as a consequence of the reanalysis processes performed by new generations of native speakers. More ambitiously, this investigation could offer a better synchronic (I-grammar) analysis of the voicing rule.

2. A reanalysis of stop voicing

2.1. The Postvocalic Voicing rule

A fact that does not seem to have attracted the attention of previous investigators is that, due to the syllable structure of Somali (which does not license a $[VCC]_{\sigma}$ sequence), every

consonant which occurs in syllable coda position also occurs after a vowel. Thus, in order to reanalyse the stop voicing rule, a good candidate as the triggering context is "preceding vowel", as illustrated in (4) below:

(4) **POSTVOCALIC VOICING**

$$\begin{bmatrix} -\text{cont} \\ -\text{voice} \end{bmatrix} \rightarrow [+\text{voice}] \,/ V\_\_$$

It goes without saying that (4) is a very familiar rule, extremely widespread among languages. One obvious advantage of (4) over Prepausal Voicing is that it embeds its motivation: it is that specific type of assimilation process that is conventionally named "lenition", which spreads the two features associated with vowels: [continuancy] and [voice]. The triggering context varies slightly among languages: it often consists of a preceding vowel (or just a sonorant), as in the Somali case, or of both a preceding and a following vowel (or sonorant) in other cases. Some instances of postvocalic lenition are the /s/ voicing for most Northern Italian speakers (as in *gas* 'gas' [gaz]), or the spirantization in Biblical Hebrew and Aramaic (commonly known as the "*begadkefat* rule"), or, again, the spirantization of voiced stops in Spanish.

Another advantage of this analysis is that it overcomes the phonetic ambiguity of the trigger context: while the voicing rule is triggered by a preceding vowel, the (partial) devoicing rule is triggered by the coda position, the standard context for devoicing, as expressed in (5) below:

(5) **PREPAUSAL DEVOICING**

$$\begin{bmatrix} -\text{cont} \\ +\text{voice} \end{bmatrix} \rightarrow C_0 \,/\_\_ \,]_{\sigma}$$

Besides the general interpretation of the process, Postvocalic Voicing yields some other descriptive advantages. A pervasive process in Somali is the voicing of the initial stop in every functional morpheme when attached to a base ending in a vowel.

The most familiar case is determiners, which are affixed to the headed noun ((6a) and (6b) exemplify masculine and feminine nouns, respectively):

(6)
a. *nin-ka/kii/kan/kaas/kayga/kee* 'the/this/that/my/which man'
man-the/the (aforement.)/this/that/my/which?
b. *naag-ta/tii/tan/taas/tayda/tee* 'the/this/that/my/which woman'
woman-the/the (aforement.)/this/that/my/which?

The point is that when the noun ends in a vowel the determiner's initial stop becomes voiced:

(7)
a. *ey-gee* 'which dog?'
dog-which?
b. *aqalla-daas* 'that house'
house-that

(To be precise, in some conditions that it is not relevant to discuss here, masculine determiners undergo *debuccalization*: e.g. *bare-ka* (teacher-the) → *baraha* 'the teacher'; or *deletion*: e.g. *rah-ka* (frog-the) → *raha* 'the frog').

The same process occurs in *clitic clusters*. Prepositions (sometimes referred to in the literature as "postpositions")[2] beginning with a voiceless stop (*ku* 'in', *ka* 'from') become voiced after a clitic pronoun (8a) or preposition ending in a vowel (8b); the clitic object pronoun *ku* 'you' (the only specimen of its category beginning with a stop) switches to *gu* when preceded by *la*, the impersonal pronoun, the only element that precedes clitic pronouns in the Verbal Complex (8c):

(8)
a. *na-ga* 'from us'
us-from
b. *u-gu* 'into'
to-in
c. *la-gu*
IMP. PRON.-you

Other instances of the same process take place in *verbal* inflection or derivation. A number of verbal endings begin with the voiceless stop /t/ (no verbal ending beginning with /k/ occurs in Somali), which converts to /d/ when preceded by a stem ending in a vowel. Compare the forms in (9a) with the forms in (9b) :

(9)
a. *cun-tay* 'you ate'
eat-2S.PAST
cun-teen 'you (pl.) ate'
eat-2P.PAST
b. *akhri-day* 'you read'
read-2S.PAST
lahay-deen 'you (pl.) had'
have-2PL.PAST

A verb initial voiceless stop becomes voiced after a derivational prefix ending in a vowel. As an example, the forms of *ahaansho* 'to be' beginning with /t/ (*tahay* 'you are/she is', *tihiin* 'you (pl.) are') alternate with forms with a beginning /d/ after *lee-*:

(10)
lee-dahay 'she has'
lee-dihiin 'you have'

The middle formative {*-at*} becomes *ad* after a stem ending in a vowel. Compare the alternations in the following examples:

(11)
a. *dub-t-ay* 'I baked for myself'
bake-MIDDLE-1S. PAST
gur-t-ay 'I collected for myself'
collect-MIDDLE-1S. PAST
b. *joogs-ad-ay* 'I stopped myself'
be- MIDDLE-1S. PAST
iibs-ad-ay 'I bought for myself'
buy-MIDDLE-1S. PAST

The middle formative shows up as *t* when its vowel undergoes syncope, but as *ad* when syncope does not apply (in stems ending in a consonantal cluster): i.e., it is voiceless after a consonant, whereas it is voiced after a vowel (syncope will be dealt with below). There is one more variant of the middle formative, *a(t)*, that requires special attention (for which, too, see below).

Another instance of what looks overtly the same phenomenon takes place in words whose stem, both verbal and nominal, ends in a *guttural*. What follows is a sample of verbal forms whose stem ends in a guttural (in (12b), in which *kh* = [χ]; x = [ħ]; *c* = [9]), compared with the normal forms, in (12a):

(12)
a. *cun-ţay* '(you) ate'
eat-2S.PAST
fur-ţay '(you) opened'
open-2S.PAST
b. *faq-ḏay* '(you) consulted'
consult-2S.PAST
raac-ḏay '(you) followed'
follow-2S.PAST
tookh-ḏay '(you) boasted'
boast-2S.PAST
go'-ḏay '(you) cut'
cut-2S.PAST
bax-ḏay '(you) went out'
exit-2S.PAST
sooh-ḏay '(you) wove'
wave-2S.PAST

As noted in Cardona (1981: 20), who makes reference to the instrumental evidence by Farnetani (1981: 84), voicing is triggered by an epenthetic vowel (not marked in the orthography) which is inserted between the guttural and the inflectional ending. So, a form such as *baxday* is actually pronounced as [bax-ᵃday], in which "ᵃ" stands for a reduced vowel (i.e. a moraless vowel) with the same features of /a/. The epenthetic vowel varies depending on the preceding vowel, i.e. it is a shortened copy of the last vowel, in accordance to the fact that gutturals

do not block spreading of place features (see McCarthy 1994). This resembles a rule occurring in Biblical Hebrew, according to which the *hatep*, or "composed schwas", occur as epenthetic vowels between a guttural and a following consonant.

The same rule occurs in feminine nouns, when a determiner (e.g. *-ta* 'the', as in *naag-ţa* 'the woman') is attached to a stem ending in a guttural, as illustrated below:

(13)
buq-ḏa 'the book' *bac-ḏa* 'the sound of a slap'
taarikh-ḏa 'the history' *lo'-ḏa* 'the cattle'
qorrax-ḏa 'the sun' *bah-ḏa* 'the noble person'

The rule can be expressed as such:

(14) **GUTTURAL EPENTHESIS**
$\emptyset \rightarrow {}^{V_i}/V_i$ ["gutt"] __C (in which "ᵛ" is a reduced vowel)

In a rule governed approach, the voicing rule must follow the epenthesis rule (in which, as is common practice, "UR" is short for "Underlying Representation"):

(15)

[[cun]$_V$ tay]$_{2S.PAST}$	[[bax]$_V$ tay]$_{2S.PAST}$	LEXICAL FORM
cuntay	baxtay	UR
——	bax^{a}tay	GUTTURAL EPENTHESIS
——	bax^{a}day	POSTVOCALIC VOICING

2.2. More evidence for Postvocalic Voicing

There is some more evidence in favour of Postvocalic Voicing, which comes from domains other that the strict descriptive evidence.

Lenition

Nearly the same context, intervocalic position, triggers a similar rule, spirantization of voiced stops (see Cardona 1981: 11-12), as illustrate below in (16a) and formulated in (16b):

(16)
VOICED STOP SPIRANTIZATION
a. *laba* [laßa] 'two'
hodon [hoðon] 'wealthy person'
xigaal [ħiGaal] 'relative'
b. [−cont, +voice] → [+cont] /V__V

As is well known, spirantization is the other face of lenition: the fact that stops in Somali undergo intervocalic spirantization harmonizes pretty well with Postvocalic Voicing, but it collides with the idea of a prepausal voicing rule. Put in other words, we could imagine for the stops of a language to be characterized by the feature [+lenition] (or, in an Optimality Theory approach, by a low ranking of the IDENT(voice) and IDENT(cont) constraints), which determines, according to the specification of the requirement, that stops in a language would undergo either both voicing and spirantization, or only spirantization, or, finally, only voicing. In this view, Somali would be a language that generalizes lenition, a situation by no means uncommon among the languages of the world, both on a synchronic and a diachronic basis.

Prepausal voicing in a constraint based framework

In a constraint based framework, such as Optimality Theory, there is no obvious way of deriving Prepausal Voicing, or any other crazy rule for that matter. The reason is fairly obvious: in order for the theory to have some predictive force, the constraints must be universal, restricted in number, well motivated and non contradictory among each others. The fact that, among other things, there is a conjunction of constraints such as *VOICED-OBSTRUENT & NO-CODA (see Smolensky 2006) rules out the possibility for a prepausal voicing of stops process to exist. Either this or the conclusion that standard Optimality Theory must be inadequate in some respect.

To be sure, this is not a dramatically compelling argument, in that it is clearly theory internal. Nonetheless, since Optimality

Theory, a purely constraint based theory, has been the indisputably dominant paradigm in the last fifteen years, the argument should retain some force.

It is not the aim of this paper to deal with the problem of how to derive unnatural derivations in a constraint driven framework. I will limit here to suggest a couple of possibilities.

One is to distinguish, as Chomsky (1981) did for syntax, between a "core grammar" and a "peripheral grammar", in which the peripheral grammar would either consist of specific rules or of specific constraints.

The other possibility is to integrate in the inventory of standard constraints – which are based on markedness properties of performance nature – some acquisitional markedness constraints, that determine the strategies by which a child constructs its grammar on the basis of the state-of-the-art data. These acquisitional constraints (e.g., "input recoverability", to make one rough, tentative example) could explain the emergence of phonological restructuring processes in languages (phonologization, dephonologization, reinterpretation of alternations, etc.), and consequently the existence of crazy rules.

One last consideration that has to be mentioned is that "crazy" rules must remain as such: there must be some reason why the system prevents that unnatural processes become normal. This seems to suggest that performance constraints have a tendency to be ranked higher than acquisitional constraints, or, maybe put in a more perspicuous way, acquisitional constraints become compelling only when some serious derivational opacity emerges due to some intricate language change.

Diachrony

It is noteworthy that Postvocalic Voicing has a diachronic mirror image rule, which singles out Somali among the other East Cushitic languages (see Sasse 1979), as the following forms, all reflexes of the reconstructed Proto East Cushitic word **maṯ* 'head', show:

SOMALI maḍaħ
BAYSO meṭe
RENDILLE maṭaħ
ARBORE meṭe
ELMOLO meṭe'
OROMO maṭaa
KONSO maṭṭa

Note that the diachronic rule has brought a neutralization in voice between stops in all the contexts in which the voiceless stop is no longer recoverable, i.e. when it is preceded by a vowel which is both underlying (i.e. non epenthetic) and does not delete (because does not meet the requirements of the syncope rule):

(17) **STOP VOICE NEUTRALIZATION**

SOMALI	OROMO	
aḍi(-ga)	*aṭi*	'you'
lug	*luk(-a)*	'foot'
maḍax	*maṭaa*	'head'
gaḍ-	*gaṭ-*	'sell'

In contrast, when the stop is preceded by an epenthetic vowel (as formulated in (18a) and exemplified in (18b) below), the voiceless stop is recoverable from the alternation (19):

(18) **EPENTHESIS**

a. $\emptyset \rightarrow V_i / V_i \_\_ CC]\sigma$
   [insert a copy of the stem vowel before an unsyllabified consonant]
b. *hiliḅ* 'meat' *hilb-o* 'meats'
   qodoḅ 'article' *qodb-o* 'articles'

(19) **STOP VOICE ALTERNATION**

iliɡ 'tooth' *ilk-o* 'teeth'
gunuḍ 'knot' *guṇ-ay* 'I knotted'

3. Developing the analysis

In this section will deal with some problems, both of a descriptive and a theoretical nature, that the analysis we have proposed faces.

3.1. Apparent counterexamples

An outstanding empirical problem that Postvocalic Voicing seems to confront with is the fact that voiceless stops do occur in postvocalic position, both in nouns (20a) and verbs (20b):

(20) **POSTVOCALIC VOICELESS STOPS**

a. *bakayle* 'hare' *rati* 'camel'
   luki 'hen' *ukun* 'egg'
b. *fetesh* 'search!' *hitiq* 'walk slowly!'
   cakis 'hinder!' *sukul* 'pound!'

A closer examination, though, shows that what you see is not what you get. First of all, there is a curious gap in the phonemic inventory of geminate consonants in Somali: while all non guttural consonants may geminate, both underlyingly and in derived environments, geminate voiceless stops do not occur. Forms in (21) below exemplify voiced stops:

(21) **GEMINATE VOICED STOPS**

aaḅḅe 'father'
saḍḍex 'three'
caɡɡo 'feet'

This fact is bewildering for two reasons:

a. it is a gap in the phonemic inventory of Somali for which no obvious explanation is available;
b. it is in contrast with known markedness properties, which state that a voiceless obstruent is less marked (then more expected) than a voiced one.[3]

Both inconsistencies can be explained in a straightforward way if it is assumed that the gap in the inventory of geminate stops holds only at surface level, as voiceless stops do occur at underlying level, as we are going to bring evidence for.

3.2. Anti-syncope

In previous discussion we came across the syncope rule, which is crucial for the point we are going to make. Consider

the following forms, alternating between singular and plural:

(22)
xàrig 'rope' *xarg-ò* 'ropes'
maàlin 'day' *maalm-ò* 'days'
gàrab 'shoulder' *garb-ò* 'shoulders'

In a word, an unstressed short vowel is deleted, modulo syllable constraints are not violated. Some examples of a violation of syllable requirements that blocks rule application are in (23) below, in which the intermediate vowel is preceded by a consonant cluster or a geminate (for the *n/m* alternation, note that /m/ → [n] word finally in Somali):

(23)
shimbir 'bird' *shimbir-ò* 'birds'
gumbur 'hill' *gumbur-ò* 'hills'
xuddun 'navel' *xuddum-ò* 'navels'

The rule can be formulated as follows:

(24)
SYNCOPE
[–stress]
V → Ø /VC__CV]$_{W}$

The interesting fact is that when the preceding consonant is a voiceless stop the syncope does not take place:

(25)
khatar 'danger' *khatar-ò* 'dangers'
ukun 'egg' *ukum-ò* 'eggs'
bukur 'small container' *bukur-ò* 'small containers'

The conclusion to be drawn is that postvocalic voiceless stops behave like geminates. The context which blocks syncope is formulated in (26) below (in which a bar over V indicates its deletion):

(26)
ANTI-SYNCOPE CONFIGURATION
$\overline{V}$ [–cont, –voice] *Ψ C V

Owing to a number of reasons that it is not relevant to discuss here, the other virtually possible anti-syncope configuration (VC*Ψ [–voice, –cont] V) never seems to occur.

More evidence in favor of this analysis comes from stems in which the consonants which flank the target vowel are identical; here too the rule is blocked:

(27)
ANTIGEMINATION CONFIGURATION
V C_i *Ψ C_i V
òlol 'flame!' *ololay* '(it) flamed'
fududèe 'enlighten!' *fududeeyey* '(he) lightened!'

The process involved here, Antigemination, is not triggered by a syllabic constraint, but by OCP (see Goldsmith 1976; McCarthy 1986); nonetheless the situation is identical: the syncope takes place provided some major constraint (i.e. higher ranked) is not violated.

It must be stressed that Syncope and Anti-syncope are not confined to nouns; on the contrary, they are wholly productive. As an example, the stative verb formation rule is as follows (see Puglielli & Ciise M. Siyaad 1984):

(28)
STATIVE VERB FORMATION
Verb + *an* → Stative Verb

The examples below illustrate:

(29)
kars-an-aa
cook-STAT-3S.PRES. '(it) is cooked'
caagg-an-aa
reject-STAT-3S.PRES. '(he) astains'

When the requirements are met, syncope occurs, as the following examples show:

(30)
taag-n-aa 'it stays'
bad-n-aa 'it is numerous'

Again, if one of the adjacent consonant is a voiceless stop, syncope is blocked, thus behaving like a geminate (cf. *caagg-an-aa* in (29) above):

(31)
cok-an-aa '(it) is full of water'
moot-an-aa '(it) is dead'

Therefore, there is good reason to posit an unconditioned rule of voiceless stop reduction, such as the following:

(32)
VOICELESS STOP REDUCTION

$$\begin{bmatrix} -\text{gutt} \\ -\text{cont} \\ -\text{voice} \end{bmatrix}$$

$C_i\text{:} \rightarrow C_i$

As a consequence, the following derivations for Syncope and Anti-syncope can be assumed, in which Syncope must precede Voiceless Stop Reduction (the formalization adopted here is unorthodox: a barred form does not undergo the process under consideration for the violation represented; as is common practice, "SR" stands for "Surface Representation"):

(33)

xarig-ò	xuddum-ò	khattar-ò	UR
xar.gò	~~xud.(d).mò~~	~~khat.(t).rò~~	SYNCOPE
–	–	khatarò	V.LESS STOP REDUCTION
xargò 'ropes'	*xuddumò* 'navels'	*khatarò* 'dangers'	SR

Like Postvocalic Voicing, Stop Reduction has a diachronic support, as evidenced by the comparison with other varieties of

Somali. Singleton voiceless stops of Standard Somali correspond to geminates in some Southern Somali dialects, as the following examples show (see Reinisch 1904):

STANDARD SOMALI	SOUTHERN SOMALI
ukun 'egg'	*ukkun*
mataan 'twin'	*mattaan*

Words with a geminate voiceless stop also occur in the toponyms of Southern Somalia (see Svolacchia 2009):

Buur-ti Bakkal 'Poinciana Mountain' (cf. STAND. SOMALI *bakal* 'poinciana')
mountain-the poinciana
Ceel Mokkoy-le 'Sycamore Mountain' (cf. STAND. SOMALI *mokoy* 'sycamore')
pit sycamore-with

Finally, in loanwords from Arabic or Italian, even recent ones, geminate voiceless stops adapt in Somali with singletons (see Zaborsky 1967):

ARABIC	SOMALI	
dukkaan	*dukaan*	'shop'
rukkaab	*rukaab*	'passengers'
ITALIAN		
baracca	*baraako*	'cabin'
salotto	*salooto*	'sitting room'

Interestingly, in the yet recent Somali orthographic tradition there is a stigma against double *t*'s and *k*'s (I am indebted to Giorgio Banti for this personal communication). Since orthographic stigmas exist in relation to systematic violations, this calls for speakers who pronounce underlying voiceless geminate stops long. In effect, speakers of Central Somalia pronounce postvocalic voiceless stops with distinctly more length and tension than expected, as the instrumental data confirm (see Farnetani 1981: 72). All these considerations advocate for the psychological reality of geminate voiceless stops in Somali.

3.3. More evidence for Voiceless Stop Reduction

There is more evidence that Voiceless Stop Reduction is part of the grammar of Somali and not just a rule of its history: it also applies in derived environments.

In given configurations, when a voiceless stop adjoins to another voiceless stop (either stem or suffix initial), the result is not a geminate stop but a singleton. As an example, the middle formative rule (already mentioned in (2.1) above) is as follows:

(34)
MIDDLE VERB FORMATION
Verb + *at* → Middle Verb

When an agreement suffix beginning with /t/ is adjoined to the middle stem the result is not a geminate but a singleton:

(35)

UNDERLYING	SURFACE	
aha-at-tay	*ahaat̲ay*	'(you) became'
be-MID-2S.PAST		
iibs-at-teen	*iibsat̲een*	'(you PL.) bought'
buy-MID-2P.PAST		

Notice that the expected anti-syncope effect takes place, as the following examples, agent noun derivations from a middle stem, illustrate (from Puglielli 1984: 21-26):

(36)

UNDERLYING	SURFACE	
a. gur-at-tó	*gur-at̲-ó*	'who gathers for herself'
gather-MID-F.AG.		
b. fiirs-at-tó	*fiirs-at̲-ó*	'who looks for herself'
search-MID-F.AG.		
c. gur-at-é	*gur-t̲-é*	'who gathers for himself'
gather-MID-M.AG.		

The form in (36a), with an underlying voiceless geminate stop, does not undergo syncope, likewise the form in (b), with

a consonant cluster preceding the target vowel; in contrast, the masculine form in (c), with an underlying singleton voiceless stop, undergoes syncope.

The same reduction process occurs when it is fed by assimilation of a stem final voiced stop to a following voiceless stop at the beginning of a *derivational* suffix. Cases in point are the by now familiar middle formative {-at}, in (37a) below, and the abstract noun derivational suffix {*-tooyo*}, in (37b):

(37)
REGRESSIVE VOICE ASSIMILATION

UR	SR	
a. gaad-at-ay	*gaat̲ay*	'(I) chose for myself'
choose-MID-1S.PAST		
daad-at-een	*daat̲een*	'(they) overflowed'
overflow-MID-3P.PAST		
b. qaad-tooyo	*qaat̲ooyo*	'fast (N)'
fast(VERB)-NOUN^{ABSTR}		
xad-tooyo	*xat̲ooyo*	'theft'
steal-NOUN^{ABSTR}		

Recall that in the forms in (37a) above the adjacency between the coronal stops is derived through syncope; e.g., the derivation of *gaatay* would be as follows:

gaad-at-ay	UR
gaad-t-ay	SYNCOPE
gaat-t-ay	REGR. VOICE ASSIMILATION
gaatay	V.LESS STOP REDUCTION

3.4. Domains of application

In the discussion so far we have not specified the domain of application of Postvocalic Voicing, nor the domain of the rules Postvocalic Voicing interacts with. The evidence for Postvocalic Voicing is as follows (in which the numbers refer to the examples and rules discussed above):

- it is phonetically motivated;
- it does not have exceptions and does not require morphological information;
- it applies to productive derivational (10-11) and inflectional morphemes (9);
- it applies in derived and underived environments;
- it applies within words or clitic groups (i.e. in determiners, which are cliticized to the right of nouns (6); within clitic groups (7));
- it is structure-preserving;
- it is not cyclic, as shown by the middle formative {-at}, in which the stop is not affected by Postvocalic Voicing even though it is preceded by a vowel at the underlying level. In fact, if the rule applied cyclically, the derivation of forms such as *gurté* (from /gur-at-é/ 'who gathers for himself'; see (35) above) and *iibsateen* (from /iibs-at-teen/ 'you bought'; see (36) above), would be as follows:

(38)

[[gur] at]	[[iibs] at]	1ST CYCLE
[gurad]	[iibsad]	POSTVOCALIC VOICING
[[gurad] é]	[[iibsad] teen]	2ND CYCLE
[gurdé]	———	SYNCOPE
———	[iibsaddeen]	PROGR. VOICE ASSIMILATION
*gurdé	*iibsaddeen	SR

In order to derive forms such as *gurté* and *iibsateen*, Postvocalic Voicing must not apply to the 1st cycle; it must apply after Syncope, for the former, and C_i-C_i Fusion caused by affixation of {-at}, for the latter:

(39)

CYCLIC PHONOLOGY

[[gur] at]	[[iibs] at]	1ST CYCLE
[gurat]	[iibsat]	
———	———	SYNCOPE
[[gurat] é]	[[iibsat] teen]	2ND CYCLE
[gurté]	———	SYNCOPE
———	[iibsat:een]	C_i-C_i FUSION

POSTCYCLIC PHONOLOGY

gurté	iibsat:een
———	——— POSTVOCALIC VOICING
———	——— PROGR. VOICE ASSIMILATION
———	iibsateen V.LESS STOP REDUCTION
gurté	*iibsateen* SR

A remark is in order as far as Progressive Voice Assimilation is regarded. Regressive Voice Assimilation occurs before a derivational suffix, but before an inflexional suffix the assimilation is progressive. To see this, compare the form in (37) above, repeated below in (40a), a middle stem with an inflectional suffix, with the form in (40b) below, a base stem with an inflectional suffix:

(40)

PROGRESSIVE VOICE ASSIMILATION

a.	**b.**	
gaad-at-ay	gaad-tay	UR
gaad-t-ay	———	SYNCOPE
gaatt-ay	———	REGR. VOICE ASSIMILATION
———	gaad-day	PROGR. VOICE ASSIMILATION
gaatay	———	V.LESS STOP REDUCTION
gaatay	*gaadday*	SR
'(I) chose for myself'	'(I) chose'	

Clearly, Regressive Voice Assimilation occurs at an earlier stage with respect to Progressive Voice Assimilation. This is in line with the fact that inflectional affixes are adjoined after derivational affixes.

Finally, Epenthesis (see (18) above) must precede Postvocalic Voicing and follow Syncope:

ilk	[[ilk] o]	UR
—	———	SYNCOPE
ilik	———	EPENTHESIS
ilig	———	POSTVOCALIC VOICING
ilig	*ilko*	SR
'tooth'	'teeth'	

As for the upper limit, Postvocalic Voicing does not apply

between words, as in compounds (e.g. *hiyikac* 'become emotional', from *hiyi* 'emotions' and *kac* 'rise'), or phrasal verbs (e.g. *ku tuf* 'bless').

The conclusion that can be drawn from the aforementioned properties of Postvocalic Voicing (PV) is that it is a *postcyclic lexical rule*. This conclusion is consistent with the intrisic order of rules. No cyclic rule is fed by PV, and PV is fed by a rule, Guttural Epenthesis – see (12-15) above – that is patently a very late rule (phonetically motivated, not structure preserving, applies without exeptions, applies within the clitic group), but not postlexical (it does not apply in compounds: e.g. *libaaxbadeed* 'shark', from *libaax* 'lion' and *bad-eed* 'sea-GENITIVE' is pronounced without an epenthetic vowel).

Some derivational problems still persist: why do verbs with a derivational suffix ending in /t/ to which an inflectional suffix beginning in /t/ is attached resist Postvocalic Voicing (via C_i-C_i Fusion), as in (a) below, while underived verbs whose stem ends in /t/ do not (i.e. Postvocalic Voicing bleeds C_i-C_i Fusion), as illustrated in (b) below?

a.	**b.**	
gaad-at-tay	sumat-tay	UR
———	sumad-tay	POSTVOCALIC VOICING
———	sumad-day	PROGR. VOICE ASSIMILATION
gaadattay	sumadday	C_i-C_i FUSION
gaadatay	———	V.LESS STOP REDUCTION
gaadatay	*sumadday*	SR
'(you) chose for yourself'	'(you) branded'	

One might assume that C_i-C_i Fusion is blocked in cases like (b) above because of the Strict Cycle Condition. The difference between the two cases is that, while the inflectional suffixes belong to the same cycle of the middle voice formation rule, as in (a) above, they belong to a previous cycle with respect to the root. Hence, the root (*sumat*, in the example) is an opaque domain for C_i-C_i Fusion:

a.	**b.**	
gaad	sumat	ROOT
[gaad] at	[sumat] Ø	1ST CYCLE (STEM DERIVATION)
[gaadat] tay	[sumatØ] tay	2ND CYCLE (INFLECTION)
gaad-at:ay	———	C_i-C_i FUSION
———	sumad-tay	POSTVOCALIC VOICING
———	sumad-day	PROGR. VOICE ASSIMILATION
gaadatay	———	V.LESS STOP REDUCTION
gaadatay	*sumadday*	SR

This contrast shows up in nouns as well, as evidenced by a root both verbal and nominal, such as {moot:} 'die/death', which exhibits a voiceless geminate stop underlyingly. Compare the pair below:

a. /moot:-ta/ → *moodda* 'the death'
a. death-F.the
b. /moot:-an-aa/ → *mootanaa* 'he dies'
b. die-STAT-3S.PRES.

The form /moott-ta/ undergoes Degemination (because the 2nd parte of the geminate is not syllabified), then Postvocalic Voicing, and finally Progressive Voice Assimilation; the form /moott-an-aa/, on the other hand, resists Postvocalic Voicing because it does not degeminate (as it is fully syllabified) and finally undergoes Voiceless Stop Reduction. The derivation is illustrated below:

a.	**b.**	
moot:	moot: ROOT	
[moot:] Ø	[moot:] an	1ST CYCLE (STEM DERIVATION)
[moot] Ø	———	C^{UNSYLL} DEGEMINATION
[[mootØ] ta]	[[moot:an] aa	2ND CYCLE (INFLECTION)
———	———	C_i-C_i FUSION
mood-ta	———	POSTVOCALIC VOICING
mood-da	———	PROGR. VOICE ASSIMILATION
mood:a	———	C_i-C_i FUSION
———	moot-an-aa	V.LESS STOP REDUCTION
moodda	*mootanaa*	SR
'the death'	'he dies'	

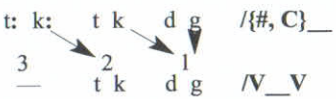
4. Issues of interpretation

The analysis we have been carrying so far is unsatisfactory in at least one major regard: it does not offer a unified interpretation of facts. This is the issue we are going to deal with in this section.

4.1. Chain shifts

An obvious fact that has been ignored so far is that Postvocalic Voicing and Voiceless Stop Reduction are closely related: Voiceless Stop Reduction is triggered, in a manner of speaking, by Postvocalic Voicing. The reason is that Postvocalic Voicing leaves a gap in the system of stops (because voiceless stops merge with voiced stops), which is filled by voiceless geminate stops, as is illustrated below:

(41)



The shift reduces the contrast among three series of stops (apart from voiced geminates, of no relevance here) to a contrast among two. Nonetheless, the contrast between series 3 and 2 is maintained, but at a lesser degree of consonantal force.

More light on the phenomenon is shed by some data from Lower Juba Maay (LJM), a southern dialect of Somali which differs considerably from Standard Somali (see Comfort & Paster 2009: 208-209). In LJM underlying (non implosives) stops surface as voiced "fricatives" (actually, approximants) intervocally, due to "Intervocalic Lenition", exemplified below (N.B. There is a rule of devoicing in syllable final position not mentioned by the Authors):

(42)

irbit 'needle'	*irbið-o* 'needles'
ɖek 'ear'	*ɖeʏ-o* 'ears'
ilbap 'door'	*ilbaβ-o* 'doors'

There are surface exceptions to this rule within lexical items, as shown below in (43a):

(43)

a. *hidik* 'star'	b. /hiddik/
mukulal 'cat'	/mukkulal/
buubuŋ 'snail'	/buubbun/

However, since there are no surface geminate stops, the Authors assume a rule, "Geminate Reduction", which changes all geminate stops into their singleton counterparts. As a consequence, they propose that intervocal stops are geminate underlyingly, as shown in (43b) above. One major evidence for the rule is that it also applies in derived environments, as shown in (44):

(44)

UR	**SR**
diik-ki	*diiki* 'the rooster'
rooster-the(MAS)	
gedut-ti	*geðuti* 'the red one'
red-the(FEM)	

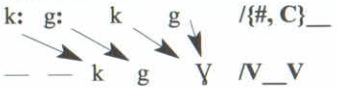
The point is that, as the Authors remark, the underlying C_i: vs. C_i distinction is still preserved intervocally because, while geminates are reduced to singletons, singletons undergo lenition: e.g., /k:/ surfaces as [k] intervocally, while /k/ surfaces as [ɣ]. The pair of examples below illustrate:

(45)

UR	**SR**
diik-ki	*diiki* 'the rooster'
rooster-the(MAS)	
dibi-ki	*diβiʏi* 'the bull'
bull-the(MAS)	

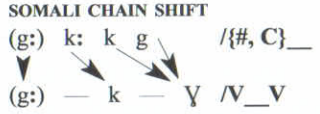
The situation is then as follows (in which velar stops stand for the entire set of stops):

(46)
L.J. MAAY CHAIN SHIFT



The system undergoes a reduction of one series out of four; however, the contrast between geminates and their singleton counterparts is preserved, even though, as in Standard Somali, at a lesser degree of consonantal force. The difference is that the chain shift is more complex than in Standard Somali, because also voiced geminates are part of it. Nonetheless, the Standard Somali chain shift is more similar to that of LJM than it seems. Recall (see in (16) above) that intervocalic stops, both derived and underived, undergo a process of spirantization; as a consequence, a more accurate description of the Somali chain shift is as follows:

(47)
SOMALI CHAIN SHIFT



Voiced geminates do not alternate and no [g] surfaces intervocally. Historically speaking, it seems that LJM, having generalized the chain shift, has taken a step ahead of Standard Somali in the process.

4.2. The analysis of chain shifts

In current phonological theory, both rule-based and constraint-based, there is no obvious way of capturing this sort of generalizations. In the European structuralist phonology, on the contrary, such considerations were at the very heart of its concern, both in synchronic and diachronic analyses. However,

because of the intrinsic differences, there is no consistent way of integrating these ideas in a rule-based approach. A *rule-based approach* does have the machinery for deriving the desired surface forms, but the result comes at a high price: breaking the chain shift into distinct rules, and then imposing the convenient counterfeeding order on the rules. In this vein, the Somali lenition would be treated as follows (in which the numbers indicate the order of application):

(48)

1. $\begin{bmatrix}-\text{gutt}\\-\text{nasal}\\-\text{cont}\end{bmatrix} \rightarrow \begin{bmatrix}+\text{voice}\\+\text{cont}\end{bmatrix} / \text{V\_\_V}$ (e.g. aka/aga → aɣa)

2. $\begin{bmatrix}-\text{gutt}\\-\text{cont}\\-\text{voice}\end{bmatrix}$ C_i: → C_i / V__V (e.g. ak:a → *aka*)

The first problem with this analysis is that the order of rules is arbitrary, because it does not descend from some independent property (e.g., cycles of morphological or syntactic derivation). One might wonder why, in spite of this, a particular rule order works. The answer is probably that (at least in most cases) it works because it echoes the actual historical change (a "drag chain"). Whatever the reason, chain shifts like the ones we have been discussing are obviously not rules of sound change but synchronic rules of sound alternation. In other words, they express a generalization about the pronunciation of stops in a specific domain (intervocalic) that a child who is construing his mother tongue grammar can't fail to take into account. In this regard, it is totally unclear what notions such as rule precedence could possibly mean.

The second problem is that the description fails to give a unified account of what is blatantly a single phenomenon, and its motivation is simply disregarded. This drawback is not accidental: SPE (and further refinements) is based on an atomistic notion of phonological processes, in which any rule is con-

sidered *per se*, without concern for the other rules in the system (modulo order of application, when required). In this regard, SPE phonology is a (hugely) refined version of Neogrammarian phonology.

As far as *Optimality Theory* (OT) is concerned, on the other hand, the very reason which led to its development was the existence of "conspiracies" (see Kisseberth 1970), i.e. indefinitely different phonological rules having in common a functional motivation, most typically to prevent the system from surfacing ill-formed outputs. Consequently, OT is in some sense more connected with Saussurian phonology than SPE phonology. Still, standard (or "classical", as someone call it) OT has little to say about chain shifts. The reason is that OT has done a lot more work on defining the universal constraints of the phonological component and their relations among them than on defining the effects that the processes triggered by the constraints have on the system.

Another reason why OT is at pains with chain shifts – involving stepwise shift on a phonetic scale, and consequently overlapping – is that they necessarily create opaque domains. Opaque domains are, notoriously, one of the most difficult phenomena to come up with in OT. The reason is that in OT constraints cannot refer to information which is not present in the surface representation, nor relevant information can be inherited by derivation, which is flat in OT (underlying/"input" vs. surface/"output" representation). Nonetheless, some more or less ingenuous proposals to overcome this shortcomings have been advanced.

Flemming (1996) proposes an OT analysis of a vowel shift (in Nzebi) relying on constraints which refer directly to the preservation of contrasts within a given phonetic dimension (the raising is constrained by the need to maintain at least two vowel height contrasts). Leaving aside some descriptive issues in this analysis, the intrinsic problem is that it relies on constraints which refer to contrast, a property of underlying representations, a solution which is inconsistent with one of the

basic tenets of OT, i.e. constraints only refer to output representations. It is not surprising that McCarthy – in a recent book devoted to explaining how to perform analyses in an OT framework – in discussing how to proceed with the proposal of new constraints, explicitly recommends to avoid constraints (among others) that refer to "contrast" (McCarthy 2003: 38). Indeed, the approach advocated by Flemming (1996) is inconsistent with most theories of phonology: it is a "global" procedure, which defines a system in which constraints can both refer to underlying and surface information. This is theoretically highly undesirable because it multiplies the number of potential grammars, thus creating huge problems of unpredictability, indeterminacy, and learnability.

Kirshner (1996), in a paper devoted to vowel shifts, maintains that a substantial class of synchronic chain shifts can be handled within a non-derivational theory of phonology. Beside familiar markedness constraints, requiring vowel raising in given conditions (e.g., morphological conditions), he adopts "distantial faithfulness" constraints, which are in fact a sort of "quasi-faithfulness constraints", i.e. they impose a limited range of departure from the input vowels, assuming some phonetic scale. For ingenious this solution may be, it faces some problems:

(a) distantial faithfulness could work for some cases of chain shift, but not for all;
(b) distantial faithfulness constraints are a global devise in disguise. The whole idea of faithfulness means nothing more than underlying forms do not alter, modulo they conflict with properties of some sort of the phonological component. Imposing restrictions that filter the output representation on the basis of properties of the input representation is, once again, a double access to phonological information. Whatever the reality of the phonological component may be, this is not consistent with OT. Then either distantial faithfulness constraints are not a solution to (some) chain shifts, or OT must be significantly revised (or both).

Kirshner (1998), a remarkable study specifically dedicated to consonant lenition, presents a different approach, consistent

with the basic tenets of OT, in which particular patterns arise from conflict between a principle of effort minimization ("LAZY"), relative to specific contexts, and faithfulness, in combination with perceptually-based fortition constraints (building upon some proposals of Jun 1995 and Flemming 1996). As for effort minimization, specific constraints are derived via threshold values (e.g., one for voiced stops, one for voiceless fricatives, etc.). There are many aspects of this proposal that make it appealing:[4]

- it can deal with both the categorical and gradient effects of lenition, and with both the stable and variable behavior of lenition;
- it builds on a notion, effort minimization, which is explicitly and consistently defined in terms of measurable (albeit hypothetically) articulatory parameters (expressed in numerical values) assigned to specific segments in relation to specific contexts;
- building on a trans-featural notion, effort minimization, lenition can be treated in a unified way, a result which is impossible in featured-based analyses (recall that, cross-linguistically, lenition affects features, among others, as different as [voice], [continuancy], [sonority], [stridency], [place], [length], and "[segment]").

In the next paragraph we will discuss an analysis of the Somali lenition that builds on Kirshner (1998)'s proposal.

4.3. A constraint-based analysis of the Somali chain shift

Following Kirshner (1998), the threshold values of articulatory effort in *intervocalic* position, for the segments which are relevant for the present analysis, are illustrated below:

(49)
THRESHOLD VALUES OF ARTICULATORY EFFORT INTERVOCALLY

STOPS	voiceless	147
	voiced	144
SINGLETONS		
	voiceless	85
	voiced	75

The relevant constraints are as follows:

FAITHFULNESS CONSTRAINTS
[IDENT(+long) & IDENT(+voi)] (= local conjunction of [+long] and [+voice]): requires an underlying voiced geminate to have an identical correspondent at surface level.
[IDENT(+long) & IDENT (-voi)] (= local conjunction of [+long] and [-voice]): requires an underlying voiceless geminate to have an identical correspondent at surface level.

MARKEDNESS CONSTRAINTS
LAZY_{147}: do not expend effort ≥147 intervocally.
LAZY_{75}: do not expend effort ≥ 75 intervocally.

On this basis, a possible account of the Somali intervocalic lenition is represented in the following tableaux (in which velar stops stand for the entire set of stops):

(50)
INTERVOCALIC VOICED STOP SPIRANTIZATION

/VGV/	[ID(+long) & ID(+voi)]	LAZY_{147}	[ID (+long) & ID(-voi)]	LAZY_{75}
a.→ VγV				
b. VGV				*!*
c. VKV				*!**
d. VG:V		*!		****
e. VK:V		*!		*****

By this ranking, the best candidate for an underlying singleton voiced stop is a non strident fricative (strident fricatives, not considered here for sake of simplicity, are ruled out by LAZY_{75} because their effort value, intervocally, is allegedly higher than 75). Geminates are, obviously, ruled out on effort minimization grounds (by LAZY_{147}, redundantly, given LAZY_{75}). Singleton stops, finally, are ruled out by LAZY_{75} (note that the number of violations is determined by the number of the effort threshold values that are exceeded by a segment). With a singleton voiceless stop in the input, the situation is perfectly identical, as illustrated below:

(51)

INTERVOCALIC VOICELESS STOP SPIRANTIZATION AND VOICING

/VKV/	[ID(+long) & ID(+voi)]	$LAZY_{147}$	[ID (+long) & ID(-voi)]	$LAZY_{75}$
a. → VγV				
b. VGV				*!*
c. VKV				*!**
d. VG:V		*!		****
e. VK:V		*!		*****

As for geminate stops, the ranking must ensure that it yields the different behavior between voiceless and voiced stops. This is achieved by ranking the effort constraint $LAZY_{147}$ (banning intervocal geminates) over the faithfulness constraint relative to voiceless geminate stops (see (52) below), but the reverse with voiced geminate stops, in which [ID(+long) & ID(+voi)] is sufficient to rule out all the other candidates (see (53) below):

(52)

INTERVOCALIC GEMINATE VOICELESS STOP REDUCTION

/VK:V/	[ID(+long) & ID(+voi)]	$LAZY_{147}$	[ID (+long) & ID(-voi)]	$LAZY_{75}$
a. → VγV				
b. VGV			**!	*!*
c. VKV			**!	*!**
d. VG:V		*!	*	****
e. VK:V		*!	*	*****

(53)

INTERVOCALIC GEMINATE VOICED STOP STABILITY

/VG□V/	[ID(+long) & ID(+voi)]	$LAZY_{147}$	[ID (+long) & ID(-voi)]	$LAZY_{75}$
a. → VγV	*!		***	
b. VGV	*!		**!	**
c. VKV	*!		*	***
d. VG:V			*	***
e. VK:V	*!	*		****

To account for the L.J. Maay lenition (see (42–46) above), on the other hand, in which also voiced stop geminates undergo reduction, the ranking need be as follows (in which the two faithfulness constraints rank together):

(54)

CONSTRAINT RANKING FOR L.J. MAAY LENITION

$LAZY_{147}$ >> IDENT(+long) & IDENT (+voi), IDENT (+long) & IDENT (-voi) >> $LAZY_{75}$

4.4. A systemic view of chain shifts

Notwithstanding the many advantages of Kirshner (1998)'s proposal (some aspects of which transcend a specific phonological theory), it is dubious that it can satisfactorily account for chain shifts. Indeed, it is dubious that standard OT framework (Prince & Smolensky 1993), in general, is a good basis to deal with chain shifts, both synchronic and diachronic.

One reason is that it does not explain many instances of asymmetrical behavior displayed by the segments involved in the shift. A case in point are geminates in Somali: why is it that voiceless geminates undergo reduction, whereas voiced geminates do not? In other words, why does the phonology of Somali conspire to prevent voiced geminate stops to lenite? There is nothing related to effort minimization that seems to explain such an asymmetry. In fact, on the basis of Kirshner (1998)'s threshold values, the opposite is to be expected: the difference in articulatory effort between voiceless and voiced geminate stops is hardly impressive, whereas the improvement in effort minimization for geminate reducing to singletons is more advantageous for voiced stops (144−75=69) than for voiceless stops (147−85=62).

One possible answer is that outputs are scanned for the effects that they have on the system, a notion that was more or less explicitly assumed in Saussurian phonology. In order to clarify this, let us consider again the effects of Somali lenition, which exemplifies a situation which takes place in many lan-

guages. When a geminate voiceless stop reduces to a singleton at surface level, it comes to contrast with a voiced fricative and a geminate voiced stop (as illustrated in (47) above). The derived perceptual distance between the akin segments, in terms of the features involved and their saliency, remains robust:

g:	≠	k	≠	ɣ
	O.K.		O.K.	

On the other hand, when a geminate voiced stop reduces to a singleton at surface level, it comes to contrast with a voiced fricative and a voiceless voiced stop. The derived perceptual distance between the voiced stop and the voiced spirant is much less robust:

k	≠	g	≠	ɣ
	O.K.		?	

The assumption that the contrast [g] vs. [G] is not robust comes from typological evidence: few languages have a contrast between a stop and a non strident fricative in their phonemic inventories, the contrast between a stop and a strident fricative being preferred (see, among others, Clements 2004).

In Kirshner (1998)'s proposal, and in similar approaches, a chain shift is treated as an epiphenomenon, arising from an articulatory constraint (some kind of effort minimization) that affects all the segments involved. The very idea of a "drag chain" (or "push chain", for that matter) – the notion that when a segment of the system changes, the entire system restructures, mediating between the conflicting forces of effort economy and maximal contrast – is totally lost. This is not an accidental state of affairs in standard OT, but it derives from its

assumption of the architecture of the phonological component: markedness constraints are well-formedness conditions on output forms, competing among them and with the structure preserving vocation of input forms. Contrast considerations, then, can only apply at input level. As a consequence, the tacit assumption is that the system does not care about *real* contrast, i.e. at surface level, the level at which this property is really relevant. So, if this line of reasoning is correct, in OT contrast itself is treated as an epiphenomenon.

Notwithstanding the possibility that chain shifts (even diachronic chain shifts) are ultimately a cognitive delusion, there is some evidence deriving from developmental phonology that casts some light on the problem.

Phonological chain shifts are a well-documented phenomenon in phonology acquisition. In a seminal case study by Smith (1973), an interesting phenomenon of chain shift adaptation was identified (and later dubbed by Macken 1980 as the "puzzle-puddle-pickle problem"). The following examples illustrate (drawn by Dinnsen & McGarrity 2004: 6-7):

(55)
THE PUZZLE-PUDDLE-PICKLE PROBLEM
a. *'puzzle'* → *'puddle'* (**STOPPING**)
pʌd] 'puzzle'
pɛnt] 'pencil'
b. *'puddle'* → *'pickle'* (**VELARIZATION**)
pʌg] 'puddle'
bɑk] 'bottle'
c. *'pickle'* → *'pickle'* (**PRESERVATION**)
pIk] 'pickle'
təɪk] 'circle'

Interestingly – while a coronal stop undergoes velarization before /l/ in final position (neutralizing with velar stops) for some reason (either due to assimilation to the velarized lateral, or due to coronal dissimilation) – a coronal stop derived by a fricative stop does not. In a rule-based approach the descriptive problem is trivially solvable by means of rule-ordering, as

illustrated below, even though no explanation is provided:

pʌz]	pʌd]	pɪk]	UR
—	pʌg]	—	VELARIZATION
pʌd]		—	STOPPING
pʌd]	pʌg]	pɪk]	SR

A standard OT approach, on the other hand, is challenged by a typical opaque domain via counterfeeding: /d/ → [g], /z/ → [d], [d] *→ [g]. So, the output is not explainable simply on the basis of output well-formedness conditions, because whatever the constraint on [dl] sequences is, this is not a surface-true generalization.

Some analyses have been proposed to solve the puzzle-puddle-pickle-problem puzzle in an OT framework. Interestingly, Dinnsen *et al.* (2001) remark that a solution in terms of pure constraint ranking is impossible, and propose an analysis which crucially relies on a locally conjoined constraint, ID(manner) & ID(place), requiring that corresponding segments must be identical in terms of either [place] or [manner] features. So, /z/ → [g] is eliminated because it violates both faithfulness constraints, while /z/ → [d] wins because it only violates ID(manner). In other words, surface segments are allowed to depart from underlying segments, but up to a point, even when high-ranking well-formedness constraints exert pressure on the system.

The interesting point is that, while this stepwise-restrained nature of (both synchronic and diachronic) phonological processes is a familiar pattern in chain shifts, no explanation is offered. Since this shortcoming can hardly be accidental, it must derive from some serious limitation in standard OT. If these considerations are true, this suggests that a general notion of some sort (e.g., a general constraint on divergence from an underlying item) is at work here and need be incorporated in OT. Finally, one could suggest that this constraint is a reflex of a general property of phonological systems, contrast, sometimes treated as an epiphenomenon in OT (see Kirshner 1995

for an example). We will leave this question open, pending further investigation.

4.5. Counterfeeding opacity in Somali lenition

Similar considerations are suggested by some other derivational problems we have already met in the foregoing discussion. One such case is Anti-syncope, discussed in (26) above, which occurs in words with a voiceless stop preceding the target vowel (e.g. *khatar* 'danger' → *khatarò* 'dangers', vs. *xarig* 'rope' → *xargò* 'ropes'). Recall that, as far as syncope is concerned, an intervocal voiceless stop behaves like a geminate (cf. *xuddun* 'navel' → *xudduмò* 'navels'), even if it undergoes reduction (i.e. reduction counterfeeds syncope).

In order to derive this result in a rule-based approach, it is sufficient to order Voiceless Geminate Stop Reduction after Syncope, as shown in (33) above (i.e. the derivation of, e.g., *khatarò*, 'dangers' is as follows: /khattar-ò/: 1.(SYNCOPE)→ n.a.; 2.(V.LESS GEM. STOP RED.)→ [khatarò]).

In a standard OT framework, the analysis of Anti-syncope does not follow straightforwardly. To show this, let us assume that the constraint responsible for vowel reduction in weak position is FT-BIN, requiring for a metrical foot to be binary. Since this constraint does not produce syllable structure violations, *C^{unsyll} (banning unsyllabified segments, as candidate (b) in tableau (56) below) must have a higher rank than FT-BIN, i.e. *C^{unsyll} >> FT-BIN. Moreover, in order to permit syncope to apply, FT-BIN must be ranked over MAX–V (= no vowel deletion), i.e. FT-BIN >> MAX–V. Finally, [ID(+long) & ID(+voi)] (non deletion of a geminate voiced stop) must outrank FT-BIN to prevent outputs such as [xud.mò], with geminate reduction, i.e. [ID(+long) & ID(+voi)] >> FT-BIN.

The resulting tableaux, integrated by the other relevant constraints already discussed above, are in (56) below, which represent the analyses of a word, respectively, without a preceding geminate (i), with a preceding voiced geminate (ii), and with a preceding voiceless geminate in the UR (iii):

(56)

A TENTATIVE OT ANALYSIS OF ANTI-SYNCOPE

i. /xarig-ò/	*C[unvoi]l	[ID(+long) & ID(+voi)]	LAZY$_{147}$	[ID (+long) & ID(-voi)]	FT-BIN	MAX–V
a. xarigò					*	
b. → xargò						*

ii. /xuddumò/	*C[unvoi]l	[ID(+long) & ID(+voi)]	LAZY$_{147}$	[ID (+long) & ID(-voi)]	FT-BIN	MAX–V
a. →xuddumò					*	
b. xud.d.mò	*!					*
c. xud.mò		*!				*

iii. /khattar-ò/	*C[unvoi]l	[ID(+long) & ID(+voi)]	LAZY$_{147}$	[ID (+long) & ID(-voi)]	FT-BIN	MAX–V
a. khat.ta.rò			*!		*	
b. khat.t.rò	*!		*			
c. kha.ta.rò				*	*!	
d.*→khat.rò				*	*	
e. khað.rò				**!	*	

While the constraint hierarchy yields the right results for the first two forms, for forms with an underlying voiceless geminate stop it wrongly predicts **khatrò* to be the winner, instead of the extant form, *khatarò*.

It would be trivial to come out with a solution to this problem by positing a high ranking constraint prohibiting voiceless stops in syllable coda position. However, there are a couple of reasons to discharge this solution. The first is that, a bit ironically, such a constraint is the OT parallel to the crazy rule that was the starting motivation for this study: substituting a crazy rule with a crazy constraint does not seem a great improvement. The second reason is that assuming this *ad hoc* constraint would result in hocus-pocus phonology: the alleged "no

voiceless stop in syllable coda position" is the very candidate the OT analysis I have been trying to develop needs to prevent to win.

As a result, my assumption is that there is no solution in a standard OT approach to the Somali opacity problem induced by lenition in a counterfeeding relation with syncope, an instance of "underapplication opacity" (following the typology of opaque generalizations in Baković 2007).

Many proposals have been advanced in order to overcome this sort of problems. What they have in common, though, is that they adopt solutions that depart more or less significantly from the standard OT view of the architecture of the phonological component.

It goes beyond the purpose of this study to discuss these proposals (for which I refer the Reader to Anntila 2005). I will only remark that the essence of the problem is that in a form like *khatarò* the voiceless stop is phonologically ambiguous: it shows up at surface as a singleton, but it still behaves for some phonology as a geminate. This calls for some derivational history, as it is explicitly recognized by Stratal/Derivational OT, and in a more disguised manner in some more or less deviant OT analyses – e.g. Comparative Markedness theory (see McCarthy 2003), among others, on which some recent analyses of lenition have built (see Jacobs & van Gerwen 2009, to make an example).

5. Conclusions

In this final section I will try to sum up the results of the foregoing discussion. First of all, I have argued for an analysis of Somali stop voicing which is strikingly different from the traditional one, "stop voicing in syllable final position". I have brought evidence that there is no such "crazy rule" in the grammar of Somali, the responsible of stop voicing being the familiar postvocalic voicing rule.

Secondly, I have shown that voicing is just part of a more

general phenomenon in the phonology of Somali, lenition, which results in a chain shift, determining a number of processes as different as voicing, spirantization, and geminate reduction.

Thirdly, I have discussed some theoretical issues related to the analysis of chain shifts, a well attested phenomenon among the languages of the world and in developmental phonology, arguing that both a rule-based approach and a constraint based approach are inadequate to give a full account of them, and suggesting that some general, systemic constraint, ultimately related to contrast, must be incorporated in the OT framework.

Finally, I have discussed an instance of underapplication opacity, whereby syncope fails to apply in expected contexts on the surface as a result of lenition in a counterfeeding relation. I argued that there is no principled account in a standard OT approach, and that the OT analyses that have been proposed to come to terms with opaque rules rely on some device that keeps track of information belonging to the underlying representation. This suggests that strict OT (flat derivation, parallel computation, richness of the base, constraints only) is not a plausible theory of the phonological component.

Notes

* I am more delighted than I can say to dedicate this paper to Annarita Puglielli, giving her back (a small amount of) what she has given me (generously) during all these years. Many thanks to Mara Frascarelli for the idea of this book (… and, of course!, her patience).

[1] For a sketchy description of the phonological system of Somali, see Cardona (1981), and Puglielli (1997). The examples mentioned in the following discussion are taken from a number of sources, but I owe specially to Saeed (1999).

[2] In fact, they are both and neither: they are prepositions incorporated in the so called Verbal Complex, i.e. head moved to the governing head, yielding the familiar mirror effect, and showing as postpositions in Phonetic Form (for an analysis of these and related facts, see Svolacchia & Puglielli 1999).

[3] This has been expressed in at least a couple of ways: by means of an *implicational universal* (in OBSTRUENTS, [+voice] → [–voice]; see Jakobson 1941), or a constraint (*VOICED-OBSTRUENT, as in OT).

[4] It is not our goal to give a full account of this work, which is richer than it might appear here, due to space limitation. Readers are referred to the original work.

References

Abraham, Roy Clive (1968). *Somali-English Dictionary*. University of London Press, London.

Amstrong, Lilias Eveline (1934). The phonetic structure of Somali. Mitteilungen des Seminars für orientalischen Sprache zu Berlin 37, 116–161.

Anntila, Arto (2005). Variation and opacity. Ms., Stanford University.

Baković, Eric (2007). A revised typology of opaque generalizations. Phonology 24, 217–259.

Cardona, Giorgio Raimondo (1981). Profilo fonologico del somalo. In: Cardona, Giorgio Raimondo & Francesco Agostini (eds.). *Studi Somali, Vol. 1, Fonologia e lessico*. M.A.E., Roma, pp. 3-26.

Chomsky, Noam (1981). *Lectures on Government and Binding*. Foris, Dordrecht.

Clements, Nick (2004). Features and Sound Inventories. Paper presented at the *Symposium on Phonological Theory: Representations and Architecture*, CUNY.

Comfort, Jade & Mary Paster (2009). Notes on Lower Jubba Maay. In: Matondo, Masangu, Fiona McLaughin & Eric Ptsdam (eds.), *Selected Proceedings of the 38th Annual Conference on African Linguistics: Linguistic Theory and African Language Documentation*. Cascadilla Proceedings Project, Somerville, MA, pp. 204-216.

Dinnsen, Daniel A. & McGarrity, Laura W. (2004). On the nature of alternations in phonological acquisition. Studies in Phonetics, Phonology and Morphology 10, 23-41.

Dinnsen, Daniel A., Kathleen M. O'Connor & Judith A. Gierut (2001). The puzzle-puddle-pickle problem and the Duke-of-York gambit in acquisition. Journal of Linguistics 37, 503–525.

Farnetani, Edda (1981). Dai tratti ai parametri: introduzione all'analisi strumentale della lingua somala. In: Cardona, Giorgio Raimondo & Francesco Agostini (eds.). *Studi Somali, Vol. 1, Fonologia e lessico*. M.A.E., Roma, pp. 27-107.

Flemming, Edward (1996). Evidence for constraints on contrast: The dispersion theory of contrast. UCLA Working Papers in Phonology 1, 86-106.

Goldsmith, John (1976), *Autosegmental Phonology*. Ph.D. dissertation, MIT.

Jacobs Haike & Robbie van Gerwen (2009). Romance lenition: Towards a formal account of a contrast maintaining phonetically motivated sound change. In: Torck Danièle & W. Leo Wetzels (eds.). *Romance Languages and*

Linguistic Theory 2006: John Benjamins, Amsterdam/Philadelphia, pp. 111–126.
Jakobson, Roman (1941). *Kindersprache, Aphasie und allgemeine Lautgesetze.* Almqvist u. Wilsells, Uppsala.
Jun, Jongho (1995). *Perceptual and articulatory factors in place assimilation: an Optimality Theoretic approach.* Ph.D. dissertation, UCLA.
Kirshner, Robert (1995). Contrastiveness is an epiphenomenon of constraint ranking. *Proceedings of the Berkeley Linguistics Society* 21, 198-208.
Kirshner, Robert (1996). Synchronic chain shifts in Optimality Theory. Linguistic Inquiry 27, 341-350.
Kirshner, Robert (1998). *An Effort-Based Approach to Consonant Lenition.* Ph.D. dissertation, UCLA.
Kisseberth, Charles W. (1970). On the functional unity of phonological rules. Linguistic Inquiry 1, 291–306.
Macken, Marlys A. (1980). The child's lexical representation: The 'puzzle-puddle-pickle' evidence. Journal of Linguistics 16, 1-17.
McCarthy, John (1986). OCP effects: Gemination and Antigemination. Linguistic Inquiry 17, 207-263.
McCarthy, John (1994). The phonetic and phonology of Semitic pharyngeals. In: Patricia A. Keating (ed.). *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology III.* Cambridge University Press, Cambridge, pp. 191–251.
McCarthy, John (2003). Comparative markedness. Theoretical Linguistics 29, 1-51.
Moreno, Martino Mario (1955). *Il somalo della Somalia.* Istituto Poligrafico dello Stato, Roma.
Prince, Alan & Paul Smolensky (1993). *Optimality Theory: Constraint Interaction in Generative Grammar.* Blackwell, Malden, MA.
Puglielli, Annarita (1984). La derivazione nominale in somalo. In: Puglielli, Annarita (ed.), *Studi Somali, Vol. 5, Aspetti morfologici, lessicali e della focalizzazione.* M.A.E., Roma, pp. 3-52.
Puglielli, Annarita (1997). Somali phonology. In: Alan S. Kaye (ed.). *Phonologies of Asia and Africa.* Eisenbrauns, Winona Lake, IN, pp. 521-535.
Puglielli, Annarita & Ciise Mohamed Siyaad (1984). La flessione del nome. In: Puglielli, Annarita (ed.), *Studi Somali, Vol. 5, Aspetti morfologici, lessicali e della focalizzazione.* M.A.E., Roma, pp. 55-112.
Reinisch, Leo (1904). *Der Dschäbärtidialekt der Somali-Sprache.* Carl Gerold's Sohn, Wien.
Saeed, John (1999). *Somali.* John Benjamins, Amsterdam/Philadelphia.
Sasse, Hans-Jürgen (1979). The consonants phonemes of Proto-East Cushitic (PEC): a first approximation. Afroasiatic Linguistics 7, 1-67.
Smith, Neilson V. (1973). *The acquisition of phonology: a case study.* Cambridge University Press, Cambridge.
Smolensky, Paul (2006). Optimality in Phonology II: Harmonic Completeness, Local Constraint Conjunction, and Feature Domain Markedness. In: Smolensky, Paul & Géraldine Legendre (eds.). *The Harmonic Mind. From Neural Computation to Optimality-Theoretic Grammar, Vol. 2.* Bradford Books/MIT Press, Cambridge, MA, pp. 27-160.
Svolacchia, Marco (2009). Insights into Somali place names. In: Puglielli, Annarita (ed.), *Studi Somali, Vol. 13, Lessons in Survival: the Language and Culture of Somalia. Thirty Years of Somali Studies.* Harmattan Italia, Torino, pp. 67-85.
Svolacchia, Marco & Annarita Puglielli (1999). Somali as a Polysynthetic Language. In: Mereu, Lunella (ed.), *Boundaries of Morphology and Syntax.* John Benjamins, Amsterdam/Philadelphia, pp. 97-120.
Tiling, Maria von (1925). Somali-Texte, und Untersuchungen zur Lautlehre. In: Meinhof, Carl (her.). *Beihefte zur Zeitschrift für Eingeborenen-Sprachen. Achtes Heft.* Reimer, Berlin, pp. 221-227.
Zaborsky, Andrzej (1967). Arabic Loanwords in Somali: Preliminary Survey. Folia Orientalis 7, 148-149.