1. INTRODUCTION

1.1. A repair strategy as opposed to a rule is an operation that applies to a phonological unit or structure in order to repair the violation of a structural or segmental phonological constraint of universal or language-particular type. It is context-free, the context being determined by the very constraint which justifies its application. In addition to being more economically described, repair strategies are ‘motivated’ in that they can give an explanation to phonological phenomena (Singh 1987). An approach in terms of constraints and repair strategies can also link apparently separate facts in a single language, by showing that several processes apply to preserve the same constraint (see the notion of ‘functional sameness’ in Kisseberth 1970). Such an approach can also link apparently separate facts in different languages, by showing that these languages are subject to the same type of constraints, triggering similar repair strategies (Paradis 1987d; Paradis in preparation; Singh 1987).

In contrast, phonological rules are contextual and arbitrary. Furthermore, they fail to show the connection between related facts. That is why much effort has been made since the seventies to eliminate them from the phonological component. Among others, we can mention Kisseberth (1970) and Kenstowicz and Kisseberth (1977), who defined some phonological processes that they named ‘conspiracies’, as the mere expression of phonotactic constraints. Singh (1980, 1981a, b, c) and Piggott and Singh (1985)

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called rules of this type 'repair strategies'. Singh (1985, 1987) further advocated that phonological rules do not exist; in other words, only repair strategies and general processes (named 'global alternations' below) such as 'spreading' are required in phonology.

In this article, I propose to address three different issues concerning constraints and repair strategies. Two will deal with the lexical theory proposed by Kiparsky (1985) and Mohanan (1986), and the proposal made by Singh (1981b, 1985, 1987). They are: 1) Can a given phonological constraint block a process or trigger a repair strategy either at the lexical or the post-lexical level? If the answer is positive, it suggests that the phonological component is a single block able to interact with the morphological component as well as with the syntactic one. It also leads to another question: 2) Can phonological processes (global alternations) apply in the lexicon, without being triggered by well-formedness conditions? Finally, the last issue is: 3) Since the notion of 'repair strategy' implies the violation of a constraint, in which circumstances can a process be blocked, and in which other circumstances is a constraint violated? This question will bring us to the proposal of Rice (1986) concerning 'invisibility', a notion which ensues from the Morphemic Tier Hypothesis (McCarthy 1986).

The language which will provide examples for the discussion here is Pulaar of Fouta Toro, a Fula dialect spoken in Mauritania and in Senegal.1

1.2. Two working hypotheses: Singh's proposal and Kiparsky and Mohanan's proposal

In Singh (1985), phonological alternations are divided into two types: global and local. The former pertain entirely to phonology, and are governed by well-formedness conditions. The latter are sensitive to morphological information and thus pertain to morphology.

'Alternations involving sounds divide themselves into two categories: global and local. The former are governed by well-formedness conditions (cf. Singh (in press)) and the latter constitute part of the morphological operations which in some theories are seen as triggering them (cf. Ford and Singh (1983)). Thus, a rule like \( r \rightarrow \theta \) in R.P. is a global rule because it is governed by the WFC that disallows /r/ in R.P. rhymes. A rule like German Umlaut, on the other hand, is part of the morphology of German.' (Singh 1985:280)

This dichotomy allows him to eliminate 'phonological rules', since rules which are not governed by well-formedness conditions are not phonological processes. 'What are called phonological rules, in other words, are merely positivistic descriptions of the effects of these repair strategies' (Singh 1985:276).

Global alternations as opposed to local alternations are characterized by their regularity (they are exceptionless), but also by the role they play in loan-phonology.

'Although generative phonologists have often used borrowing as evidence for motivating proposed rules of phonology, they have not bothered to ask the question: 'Why don't some rules of phonology play a role in language-borrowing?" The relationship between phonology, loan-phonology, and interphonology, in other words, has been typically seen as unidirectional and the borrowing evidence has been typically seen as icing on the cake. This paper suggests that although rules that play a role in the adaptation of foreign words are unquestionably rules of phonology, those rules that don't play such a role are perhaps not phonological rules at all. . . . It is interesting to note that only "governed" rules are used to nativize foreign words (cf. Hyman (1970), Levins (1974), Kaye and Nykiel (1979), amongst others). (Singh 1985:280–281)

From Singh's proposal, it follows that the phonological component cannot interact directly with the morphological one, since both components are ordered separate blocks. In other words, a given phonological process (a global alternation) cannot apply in both the phonological and the morphological components because phonological processes are ordered after all morphological operations (affixation). This contrasts with the theoretical position of Kiparsky (1985) and Mohanan (1986), where phonological processes may interact at all lexical levels with morphological operations.

These considerations led me to suppose that the phonological rules at each level of the lexicon and in the postlexical component constitute essentially independent mini-phonologies (Kiparsky 1982). Impressed with the much greater overlap between the levels in Malayalam, Mohanan (1982) viewed the phonology as a single unitary system. . . . More recent investigations suggest that severely restrictive principles govern the application of lexical rules. In many cases, it becomes possible to treat a lexical and a postlexical process as a single rule in spite of radical differences in mode and scope of application. . . . The picture that emerges is one in which the phonology - lexical and postlexical - is a single system of rules.' (Kiparsky 1983:36–37)

From Singh's proposal, it also follows that phonological constraints cannot hold in the lexicon, and, consequently, cannot govern any process pertaining to this component. This is tantamount to saying that there cannot be phonological repair strategies in the lexicon.

1.3. Assumptions and presentation

This is not the first time that the question of whether or not constraints can be effective in the lexicon has been addressed. Supporters of lexical phonology, Kiparsky (1982) among others, showed clearly that some constraints, such as the Structure Preservation Principle, the Elsewhere Condition, and the Strict Cyclicity Condition, pertain exclusively to the lexicon. It is even assumed that there is a constraint hierarchy: a constraint can hold in the lex-
constraint on \( V\!:\!C \) sequences, merely block an existing phonological process (viz. syllabification), and why must some other constraints undergo violations and then be repaired, as is the case for the constraint on geminates in Fula? Here I will argue that a constraint cannot accomplish any change by itself; that is, it can only block a process or be violated, and then be repaired by a phonological operation. This assumption is an extension of the theoretical position of McCarthy (1986) on the OCP (Obligatory Contour Principle), for which principle active effects are rejected.

‘Discussions of the OCP in its relation to phonetics (Goldsmith 1976) and to tone (Leben 1978) have sometimes assumed that the OCP, in addition to blocking ill-formed lexical representations, fuses derived sequences of identical elements into a single one. This more active OCP is, of course, completely incompatible with the account given for... . . . I reject the fusion interpretation of the OCP and hold instead to its blocking effect.’ (McCarthy 1986:222)

Also according to McCarthy (1986), constraints that behave like negative filters are more common than ones that behave like positive filters. ‘[The idea that universal or language-particular constraints on phonological well-formedness function as negative rather than positive filters is far more typical of the vast majority of uses of constraints in the literature.’ (McCarthy 1986:222)

This can be explained, I believe, by the fact that a negative filter, which is construed here as a blocking effect, is more economical than a positive filter, which has the effect of repairing, no matter if the repairing is analyzed here as being accomplished by the constraint itself or by means of a phonological operation. In other words, a negative filter, in blocking the application of a process or a rule, results in no change, while a positive filter must resort to the application of a mechanism expressly in order to cause a change. This is also why I will argue that ‘blocking’ has priority over ‘violating and repairing’, and assume that the latter solution occurs only under specific conditions (section 4).

Section 4 will deal specifically with violations of the configurational constraint which prohibits continuant geminates in Fula. I will examine the analysis proposed by Rice (1986), who discussed another type of configurational constraint violation, i.e. a violation of a constraint on certain complex segments: some noncoronal affixes arise at an intermediate stage of a derivation in Slave although they are prohibited by a phonological constraint. According to Rice, prohibited configurations can arise intermorphemically because they are not visible to constraints until the Tier Conflation takes place (see Younes 1983 and McCarthy 1986 for this mechanism). I will argue that this explanation does not hold for prohibited intermorphemic geminates, nor, of course, for any intramorphemic violations. I will rather explain the Fula violations by a constraint conflict, which is solved by a phonological level hierarchy as follows: metrical > syllabic > skeletal > segmental.
The phonological system proposed for Fula is the one presented in Paradis (1986a, 1986b, 1987c), that is, a system with three strata, two lexical and one postlexical, elaborated in the framework of Mohanan (1986). This proposal is essentially based on the behavior of the nominal class-marker suffixes. Roughly stated, Strata I and II are respectively the derivation domains of simple nouns and complex nouns. This is illustrated in (1).

(1) *Fula Phonological System*

```
Phonology

Stratum I: simple nouns
Lexical entries

Stratum II: complex nouns
(nominalizations, deverbals, etc.)

Syntax
Postlexical Level
```

The syllabic model adopted here is the one of Kaye and Lowenstamm (1984), which is similar to the one of Levin (1985). It consists of labeled constituents (onsets and rimes, the latter including a nucleus and an optional coda), in which timing units are simply represented with Xs, that is, without vocalic or consonantal specifications. It is important to note that Fula does not allow branching onsets or branching codas. I will also posit the following universal conventions:

i. **Segmental Licensing**: a timing unit (a slot) must be attached to a segment or be deleted (no floating slot).

ii. A segment must be attached to a syllabified slot or be delinked.

2. EFFECTS OF TWO PHONOLOGICAL CONSTRAINTS IN THE FULA LEXICON

2.1. The constraint against continuant geminates in Fula

The first constraint we will examine is a configurational constraint, shown in (2), which disallows continuant geminates in Fula.

```
Constraint on Continuant Geminates in Fula

*X X
```

I will point out that constraints on configurations (diphthongs, complex segments, geminates), defined here as any mapping involving 'branching' (see Archangeli and Pulleyblank 1986:66 for this definition), are quite common (see Paradis 1983a, b, 1987d for a discussion on disallowed diphthongs in Guéré). From Ruhlen (1975), it can be observed that geminates are highly restricted among languages: out of 775 languages, only 104 have consonantal geminates, and only 30 have all their consonants geminated. In some languages, consonantal geminates are restricted to certain classes, as in some French dialects, where geminates always consist of sonorants (e.g. [grammer] *grammaire* ‘grammar’ and [allocasyd] *allocation* ‘allocation’). In some other languages, consonantal geminates cannot even be associated with natural classes; this is the case of Ardi and Orok (Ruhlen 1975), among others, where geminates seem entirely random. From this, and according to Archangeli and Pulleyblank (1986:63), who argue that configurational constraints can refer to content and structure, I claim that configurational constraints can have different focuses: structural and segmental. This distinction enables us to distinguish between languages which do not allow geminates at all, and languages which allow certain types only. I posit that the former are governed by a configurational constraint with a structural focus, while the latter are governed by a configurational constraint with a segmental focus. Since Fula can have geminates (it allows the structure for geminates), the constraint in (2) is not a configurational constraint with a structural focus, but with a segmental one. This distinction will prove important in section 4.

All consonants can geminate in Fula (e.g. *raddo* 'hunt', *tikker* 'anger', *dotude* 'to pinch', *fo6dude* 'to applaud', *golfaade* 'to work') except the continuant ones (*ww, yyyy, jff, hh, rr, ss*), which never show up. When a continuant geminate happens to be derived, it results in a violation of the constraint in (2) (the reason for the violation through gemination is explained in section 4) and has to be fixed up. This is accomplished by a repair strategy, presented in (3), which changes the value of the problematic feature according to the focus of the constraint. In the case discussed here, the relevant feature is [continuant].
3. Feature Changing Strategy
   (+continuant) → (−continuant)

The application of the Feature Changing Strategy (see also Haraguchi 1987) can be observed in the third column of the examples in (4), where the following alternations are displayed: $w > bb$, $y > jj$, $s > cc$, $f > pp$.

4. Examples of Occlusivized Geminates (Stratum I)

<table>
<thead>
<tr>
<th>Stems</th>
<th>Various $M$</th>
<th>Occlusivization</th>
<th>Diminutive</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>saw</td>
<td>saw-ru</td>
<td>cabb-i ($di$)²</td>
<td>caw-el</td>
<td>stick</td>
</tr>
<tr>
<td>lew</td>
<td>lew-ru</td>
<td>lebb-i ($di$)</td>
<td>lew-el</td>
<td>month</td>
</tr>
<tr>
<td>fow</td>
<td>fow-ru</td>
<td>pobb-i ($di$)</td>
<td>pow-el</td>
<td>hyena</td>
</tr>
<tr>
<td>new</td>
<td>new-re</td>
<td>nebb-e ($de$)</td>
<td>new-el</td>
<td>bean</td>
</tr>
<tr>
<td>rew</td>
<td>rew-6e</td>
<td>debb-o ($do$)</td>
<td>dew-el</td>
<td>woman</td>
</tr>
<tr>
<td>way</td>
<td>way-6e</td>
<td>guji-o ($do$)</td>
<td>—</td>
<td>thief</td>
</tr>
<tr>
<td>lef</td>
<td>lef-ol</td>
<td>lepp-i ($di$)</td>
<td>lef-el</td>
<td>ribbon</td>
</tr>
<tr>
<td>hof</td>
<td>hof-ru</td>
<td>kopp-i ($di$)</td>
<td>kof-el</td>
<td>knee</td>
</tr>
<tr>
<td>nuf</td>
<td>nuf-ru</td>
<td>nopp-i ($di$)</td>
<td>nof-el</td>
<td>ear</td>
</tr>
<tr>
<td>sif</td>
<td>sif-ru</td>
<td>copp-i ($di$)</td>
<td>cof-el</td>
<td>chick</td>
</tr>
<tr>
<td>kos</td>
<td>kos-am</td>
<td>kocc-e ($de$)</td>
<td>—</td>
<td>curdled milk</td>
</tr>
</tbody>
</table>

Stems are isolated in the first column in (4). In order to show that the underlying consonant at the end of stems is a continuant one, as opposed to a spirantized stop, other forms of the same paradigm are given in the second and in the fourth columns: the consonant is always continuant when non-geminated. We can add to these forms caw-al ‘big stick’, cow-on ‘little sticks’, lew-al ‘big month’, and so on. In the third column, the Feature Changing Strategy applies after the gemination of the continuant consonant has taken place (a complete derivation will be presented in 2.2, where it will also be shown that the Feature Changing Strategy applies in the lexicon).

As we can see in (4), the gemination is triggered by the sufflation of a marker, whose strong form (given in brackets) may be $di$, $de$, $do$, $dum$ or $dam$ (henceforth of $V$). These markers have a special weak form, which consists of an initial empty skeletal slot followed by a vowel attached to its own skeletal slot. This is shown in (5a). In (5b), it can be seen that, after sufflation, the last consonant of the stem spreads to the empty suffix slot (no floating slot, see assumption (i) in section 1.3). This spreading will be discussed in detail in section 4. In (5c), the Feature Changing Strategy applies and the feature [+continuant] is changed into [−continuant].

5. a) Special Weak Variant for $dV$ Markers

\[
\begin{array}{c}
-XX \\
\downarrow \ \\
V
\end{array}
\]

b) Suffixion and Consonantal Spreading (ill-formed geminate creation)

\[
\begin{array}{c}
X-XX \\
\downarrow \ \\
C \\
V \rightarrow C \\
V
\end{array}
\]

[+cont] [+cont]

c) Feature Changing Repair Strategy

(+continuant) → (−continuant)

A curious fact, for which I have no explanation, is that the special weak variant for $dV$ markers only attaches to stems ending with a continuant consonant, but not systematically to all of them (e.g. bow- $di$ ‘bugs’, koy-$de$ ‘feet’). Given this, I will simply assume that the stems to which it attaches are specially marked for this variant, which will not be discussed any further since its precise behavior is irrelevant here.

2.2. The constraint against long segment sequences in Fula

The second constraint we will be concerned with prohibits long segment sequences of the $*V:C$ type as shown in (6).

6. $*V:C$²

Given the examples of gemination we have seen in (4) with CVC stems followed by $dV$ markers, the question arises of what happens with CV:C stems ending with a continuant consonant when followed by $dV$ markers. Does the constraint in (6) block the gemination so that the final continuant consonant surfaces or does the gemination occur, causing in this way the occlusivization of the continuant consonant, which finally surfaces as a non-geminate because of the constraint on $*V:C$ sequences? If we look at the examples shown in (7), we can see that the last scenario proves to be the right one.

7. Occlusivized Consonant after a Long Vowel

<table>
<thead>
<tr>
<th>Stems</th>
<th>Various $M$</th>
<th>Occlusivization</th>
<th>Diminutive</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>niiw</td>
<td>niiw-a</td>
<td>niib-i ($di$)</td>
<td>—</td>
<td>elephant</td>
</tr>
</tbody>
</table>
laaw     laaw-ol    laab-i (dfi)      laaw-el    road
faaw     faaw-ru    paab-i (dfi)      —         attic
maay     maay-ɔ    maay-e (dɛ)      maay-el    river
lees     lees-ɔ    leec-e (dɛ)      lees-el    bed

The geminated forms *niibbi, *laabbi, *paabbi, etc. are totally forbidden. However, we know that the occlusivized consonant in (7) went through a gemination stage; otherwise there would be no reason for the Feature Changing Strategy to have applied.

The consonantal simplification in (7) can be analyzed either as the deletion or as the non-syllabification of a prosodic unit. The first solution forces us to resort to a repair strategy in order to delete one of the prosodic units of the consonantal geminate, while the second one implies only the non-application of a syllabification rule. According to the theoretical position adopted in 1.3, which posits that 'blocking' has priority over 'violating and repairing', I opt for the second solution, where a rule is simply blocked. The rule in question here is a syllabification rule, namely the coda syllabification rule (for a complete analysis of syllabification rules in Fula, see Paradis 1986a:266). An example of a derivation is presented in (8), where the blocking effect caused by the constraint against *V:C: sequences on the coda syllabification rule is presented in (8c).

(8) Derivation (Strata I): [laabli] 'roads' (example (7))

a. Suffixation (see (5)) and Spreading
   (formation of an ill-formed geminate)
   
   b. Feature Changing
      (repair strategy)


c. Onset Syllabification Rule

(d. Coda Syllabification Rule
   (blocked because of the constraint against *V:C: sequences in (6))

e. Universal Conventions (i) and (ii) (in 1.3): Segmental Delinking and Skeletal Deletion (no floating slot)

In (8a), the nucleus is syllabified by a rule which is irrelevant here. Note only that this rule applies before all other phonological rules or processes (see Harris 1986 for another proposal of disjunctive ordering in syllabification rules). Since onset and coda syllabification rules apply after each morphological operation in Fula (see Paradis 1986a: 267, 1987c for Fula, and Halle and Mohanan 1985 for English, where syllabification rules are also analyzed as lexical rules), I assume that the constraint on long segment sequences presented in (6) holds in the lexicon. I also claim that the occlusivization of the continuant consonant occurs prior to the syllabification rules; otherwise how can the consonantal alternation at the end of the CV:C stems in (4) be explained? An alternative would be to allow the syllabification rules to apply postlexically. Such a proposal would, however, raise several problems in Fula, where some lexical rules are sensitive to syllabic information (e.g. the shortening rule for markers in Paradis 1986a: 112, 261, 271 and also in Paradis 1987c). Thus I conclude that both constraints, the one on *V:C: sequences and the one on continuant geminates, hold lexically and postlexically, which supports the theoretical positions in Mohanan (1986) and Kiparsky (1985).

Before ending the section, I will briefly discuss cases of apparent violation of the constraint against *V:C: sequences, which could lead us to conclude that the constraint does not hold postlexically. The apparent violations result from a consonantal assimilation rule, given in (9), which applies
regressively to coronal consonant sequences (e.g. $td > dd$, $dt > tt$, $dn > nn$, $tn > nn$).

(9) **Assimilation Rule**

![Diagram of Assimilation Rule]

When rule (9) applies after a long vowel, it generates problematic $V:C$ geminate sequences. This effect can be observed in the second column of the examples in (10). Note that the rule is optional.

(10) **Consonantal Assimilation (optional)**

<table>
<thead>
<tr>
<th>Non-assimilation</th>
<th>Assimilation</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>pɔɔnta</td>
<td>pɔɔnta</td>
<td>to make someone sew</td>
</tr>
<tr>
<td>sɔɔnta</td>
<td>sɔɔnta</td>
<td>to make someone buy</td>
</tr>
<tr>
<td>ttiidn</td>
<td>ttiina</td>
<td>to make someone harden</td>
</tr>
<tr>
<td>sɔɔnta</td>
<td>sɔɔnta</td>
<td>to buy again</td>
</tr>
<tr>
<td>tiidtn</td>
<td>ttiinta</td>
<td>to harden again</td>
</tr>
</tbody>
</table>

The fact that rule (9) is optional, that it does not contain any morphological information, and that it violates a phonological constraint (it changes a well-formed structure into an ill-formed one) leads me to analyze it as a postlexical rule of the ‘allegro’ type. According to Singh (1983), allegro rules often seem to generate violations because they are not governed by phonological constraints. As a matter of fact, ‘ungrammaticality’ is their defining property (Singh personal communication).

McCarthy (1986) also differentiates between phonetic implementation and phonology, which seems equivalent to the distinction made by Singh to differentiate phonological alternations from postlexical rules of the allegro type.

‘The alternative is to take seriously the idea that phonology and phonetic implementation are separate components with distinct vocabulary and formal properties. This is, in fact, Liberman and Pierrehumbert’s tack, and they propose that phonetic implementation consists of rules for interpreting (rather than transforming) the output of the phonology.’ (McCarthy 1986:252)

‘If a rule creates a distinction no language exploits lexically, then surely it is part of phonetic implementation. Phonetic implementation rules, conceived of interpretively rather than generatively, will not necessarily be sensitive to geminate integrity.’ (McCarthy 1986:253)

In the vocabulary of McCarthy (1986) and of Liberman and Pierrehumbert (1984), the rule in (9) would be a rule of phonetic implementation, and hence would not be seen as generating counter-examples to the constraint against $\ast V:C$: sequences at the postlexical level.

3. CAN PHONOLOGICAL PROCESSES APPLY IN THE LEXICON WITHOUT BEING TRIGGERED BY WELL-FORMEDNESS CONDITIONS?

The process I will discuss in this section is the Nasal Spreading Process (henceforth NS) in Fula. The NS is problematic for Singh (1985, 1987) since it shares the properties (established by Singh himself) of both ‘local alternations’ and ‘global alternations’. An alternative for Singh would be to give up some aspects of his definition of a global alternation. However, these aspects are so important in his model that the distinction between the two types of alternations would become vacuous. Another alternative would be to limit the phonological processes applying in the lexicon to ‘repair strategies’. This alternative is also dismissed since, as we will see, the NS can hardly be analyzed as a repair strategy.

The NS process pertains to Stratum I, and causes the propagation of a nasal consonant to the skeletal unit of the following consonant, provided this consonant is a voiced non-implosive stop. This is described in (11).

(11) **NS Process (Stratum I)**

![Diagram of NS Process]
Note that a universal principle automatically excludes implosives from the SD in (11): these are never prenasalized in any language. The feature [voice], however, has to be mentioned, since Fula does not allow prenasalized voiceless stops, although they are permitted in some languages such as Konyagi (see Santos 1977, where the prenasalized voiceless stops ʰt, ʰp, ʰk, etc. are posited and justified).

The application of NS can be observed in the examples given in (12).

(12) Examples of Prenasalization

a. within stems

/trim-ude/ → rimⁿdude to load a beast
/lemb-el/ → lemᵐbel second wife
/lum-aa-de/ → lumᵐbaade to swim
/jamamb-o/ → jamambⁿbo brow
/jamb-ere/ → jamᵐbere ax
/and-ud-e/ → anⁿdude to know
/wind-ude/ → winⁿdude to write
/kap-j-e/ → kapⁿje gombo
/pang-ude/ → pangⁿgude to become aggressive
/ping-ude/ → pingⁿgude to pleat

b. at the beginning of class-markers (Stratum I)

/adan-du/ → adanⁿdu first
/ken-du/ → kenⁿdu wind
/en-du/ → enⁿdu breast
/lam-de/ → lamⁿde vagina
/dem-gal/ → demⁿgal tongue

in (13), the nominal class-markers derived at Stratum II are never prenasalized, as opposed to those derived at Stratum I as in (12b).

(13) Words from Stratum II

/han-de/ → hande *hanⁿde to bray
/won-de/ → wonde *wonⁿde to be
/naam-du/ → naamdu *naamⁿdu table manners
/6am-gol/ → 6amgol *Bamⁿgol acceptance
/bon-gol/ → bongol *bonⁿgol nastiness

Note that the nominal class-marker suffixes can have the same form in some cases at both strata (e.g. lam-de 'vagina' (Stratum I) and won-de 'to be' (Stratum II). They do not have the same meaning though, nor do they enter into the same word-formation processes.

The minimal pairs in (14) bring further evidence for the necessity of differentiating between prenasalized and non-prenasalized consonants in Fula.

(14) Minimal Pairs with Prenasalized vs. Non-Prenasalized Consonants

a. /han-de/ → hanⁿde *hande today
/han-de/ → hande *hanⁿde to bray

b. /won-n-de/ → wonⁿde *wonde other
/won-de/ → wonde *wonⁿde to be

Although the NS process is limited to a lexical stratum, and hence is a local alternation in this respect, I assume that it is a phonological process since it displays all the other properties proposed by Singh (1985) to define such a process. 1. Aside from the lexical stratum it has for domain, it does not contain further morphological information in its SD (it is not limited to ad hoc morphemes, for instance). 2. It is exceptionless in that it always holds at Stratum I but never at Stratum II. 3. It applies to loan words. Its application can be observed intermorphemically as in saabunⁿde (/saaunde/) 'soap', which is a Fula borrowing from the French word savon. It can also be observed intramorphemically as in mapⁿgasin (/mangasin/) 'store' from the French word magasin, and in pingⁿgu (/ping-u/) 'shot' from the French word épingle. The fact that the NS applies to borrowing is unquestionably a problem for Singh (1985:281), for whom only phonological processes are susceptible to adjust loan words to a target language phonology (see section 1.2). If we posit that NS is a local alternation — although it is a productive and exceptionless process, it is minimally marked for morphological information, and it adapts borrowings — Then where is the formal distinction between 'global' and 'local' alternations?
As mentioned above, an alternative for Singh would be to limit the application of phonological processes in the lexicon to ‘repair strategies’, an alternative which would also account for the application of the Feature Changing Repair Strategy at the lexical level (section 2). However, no valid constraint in Fula seems to trigger NS. Indeed, the only constraint I can conceive is the one presented in (15), which makes false predictions. It prohibits sequences with a nasal followed by a voiced stop.

(15)  

\[
\begin{array}{c|c|c|c}
\text{N} & \text{C} \\
\text{cont} & \text{son} & \text{vce}
\end{array}
\]

This constraint is strange because it forces us to assume that sequences such as \(mb, \text{nd}, \text{pj}, \text{gg}, \text{md}\) are forbidden, while all other NC type sequences are allowed: sequences such as \(nd, nt, ns\) are very common in Fula. The constraint in (13) would also be particularly odd since it is presumed to trigger a repair strategy, NS, which aims at bringing closer two segments that are not supposed to go together according to the constraint itself. I reject the possibility of having such a constraint and, at the same time, the alternative of limiting phonological processes applying in the lexicon to ‘repair strategies’.

Therefore, I must conclude that the NS process in Fula is a general phonological process which applies in the lexicon. This shows again that the difference between lexical and postlexical phonology cannot be reduced to the dichotomy morphology/phonology, where these components are two separate ordered blocks, since there are processes, such as NS, which seem to be part of both components. This last conclusion brings further evidence in favor of the theoretical positions of Mohanan (1986) and Kiparsky (1985), where phonology, both lexical and postlexical, is analyzed as a single system of processes.

4. WHY DO CONSTRAINT VIOLATIONS OCCUR?

If we assume that the purpose of constraints is not to be violated, we also assume that it is important to provide explanations for constraint violations. In section 2, we have seen that phonological processes can be triggered by phonological constraints in both the lexicon and the postlexicon. More specifically, we observed a repair strategy, the Feature Changing Strategy in (3), and the blocking effect of a constraint, the constraint against \(*V:C\) sequences in (6), on the Coda Syllabification Rule (derived in (8)). The problem with these facts is: if we assume that ‘blocking’ has priority over ‘violating and repairing’ (section 1.3), then constraint violations are logically not expected at all.

Let us consider again the case of the continuant geminates discussed in section 2. Remember that, although prohibited in Fula by the constraint given in (2), this type of geminate is generated in the course of a derivation given in (8), triggering in this way the Feature Changing Strategy presented in (3). Given the constraint on continuant geminates, and the assumption according to which ‘blocking’ has priority over ‘violating and repairing’, one would have expected the continuant consonant \(w\) in (8a) not to attach to the following skeletal slot. In other words, one would have expected the consonantal spreading process to be blocked in the same way that the coda syllabification rule is blocked in order not to violate the constraint on \(*V:C\) sequences. This is also problematic for the Structure Preservation Principle (Kiparsky 1982, 1985; Pulleyblank 1983), which is infringed here.

This principle aims at preventing rules of lexical phonology from creating structures or introducing features that are not used distinctively as part of lexical entries.

Rice (1986) discusses another case of configurational violation which occurs in Slave, an Athapaskan language from Northern Canada, where prohibited non-coronal affricates are generated in the course of a derivation. This is accomplished by a process known as the D-Effect Rule, which combines a prefix \(d\), a classifier, with the initial consonant of a stem. Since the prefix \(d\) analyzed as having no skeletal slot, it has to form an affricate with the following consonant, that is, a configuration with two segments attached to the same timing unit. The process applies even when the first consonant of a stem is a non-coronal, violating in this way a configurational constraint, shown further, which prohibits non-coronal affricates. Some ill-formed sequences such as \(*d-\gamma\) and \(*d-\nu\) are derived, and repaired at a later stage by a strategy which is irrelevant here.

Rice (1986) provides us with an interesting account for these facts. According to the Morphemic Tier Hypothesis (McCarthy 1986), she assumes that the classifier \(d\) lies on a separate tier. This enables her to explain the constraint violations by the fact that the ill-formed configurations are not visible to the constraint on non-coronal affricates until the Tier Conflation, which fuses morphemic tiers, takes place (see McCarthy 1979, 1986 for this mechanism). This is illustrated in (16), where the [−cont] feature above the skeletal \(X\) slot stands for the classifier \(d\), while the features below the skeletal slot represent the velar consonant \(\gamma\). As can be observed, her analysis is couched in the Underspecification Theory proposed by Archangeli (1984)
and Archangeli and Pulleyblank (1986), and in the theoretical framework of Clements (1985), where segmental features are hierarchically organized.

(16) **Representation of \( d \cdot \gamma \) at the point of word formation**

\[
\begin{align*}
&\text{[-cont]} \\
&\quad \circ \quad \text{manner} \\
&\quad \circ \quad \text{supralaryngeal} \\
&\quad \circ \quad \text{root} \\
&\quad \circ \quad \text{[ + cont]} \\
&\quad \circ \quad \text{manner} \\
&\quad \circ \quad \text{place} \\
&\quad \circ \quad \text{[ - ant]} \\
&\quad \circ \quad \text{[-cor]}
\end{align*}
\]

The constraint proposed by Rice to exclude non-coronal affricates is shown in (17).

(17)

\[
\begin{align*}
&\text{X} \\
&\quad \circ \quad \text{root} \\
&\quad \circ \quad \text{supralaryngeal} \\
&\quad \circ \quad \text{manner} \\
&\quad \circ \quad \text{place} \\
&\quad \circ \quad \text{[-cor]}
\end{align*}
\]

It can be seen that this constraint is not concerned with anything above the skeletal slot \( X \). According to Rice, as long as the feature \([-\text{cont}]\) in (16) remains above \( X \), the constraint does not detect any malformation, and thus does not have any blocking effect on the D-Effect Rule. The violation is noticed when the Tier Conflation takes place. Since Tier Conflation is a morphological process too general to be blocked, Slave has to resort to a repair strategy.

The explanation provided by Rice (1986) for Slave would, however, not work for Fula since the analysis in Paradis (1986a:236) proved that there are no morphemic tiers in this language. But even if there were, it would not account for the type of violation which faces us here. In Slave, the problem results from a structure with two segments attached to a single skeletal slot. In Fula, it is the opposite: the problem results from a structure with two skeletal slots attached to one single segment. One could postulate separate tiers for the skeletal level in Fula, but there is no evidence to sustain such a proposal. Moreover, it is assumed in Paradis (1986a:227–239) that this violation, i.e. the derivation of continuant geminates, also occurs intramorphemically. Given this, we must look for another solution.

I assume instead that the constraint violation displayed in (8a) follows from a conflict of two constraints: the obligatory Segmental Licensing Convention for skeletal slots presented in convention (i) of section 1.3 (no floating slot); and the constraint against continuant geminates presented in (2). I will also assume that constraint conflicts are solved by a phonological level hierarchy (henceforth PLH) which is as follows: metrical > syllabic > skeletal > segmental. The PLH determines which constraint has precedence in a constraint conflict, according to the focus of the constraint. In this conflict, the PLH determines that the Segmental Licensing Convention has priority, because it is unquestionably a skeletal constraint, while the constraint against continuant geminates is a configurational constraint with a segmental focus. Recall that this last point has been discussed in length at the beginning of section 2.1, where it was shown that a configurational constraint with a structural focus would be a constraint which would, for instance, prohibit any type of geminate. In other words, the continuant consonant \( w \) in (8a) spreads to the following skeletal slot in order to license the floating skeletal unit, which cannot remain unlinked. For convenience, this is reproduced again in (18).

(18) = (8a)

\[
\begin{align*}
&\text{R} \\
&\quad \text{N} \\
&\quad \text{X} \\
&\quad \text{X} \\
&\quad \text{X} \\
&\quad \text{X} \\
&\quad \text{a} \\
&\quad \text{w} \\
&\quad \text{i}
\end{align*}
\]

From this, two important questions arise: why does spreading occur automatically? And why is it the continuant consonant, precisely the type of consonant that cannot geminate in Fula, which spreads to the floating slot? Actually, there are three other possible scenarios:

i. link the vowel \( i \).
ii. fill the slot with a default segment.
iii. delete the skeletal slot.
The vowel i cannot be linked because a nuclear segment does not spread to a non-nuclear position if a non-nuclear segment is available. Moreover, nouns cannot end with long vowels in Fula. As to the second scenario, the only default segment available in Fula is u, a segment which is always inserted for syllabic reasons (CVCC-CV → CVCC-u-CV), and in a nuclear position only; there is no default consonant. The default vowel u can certainly not be inserted in (18) since there is no syllabic purpose and since adjacent nuclei are prohibited in Fula (Paradis 1986a). The third scenario, where the skeletal slot is deleted, is ruled out as well. According to the PLH, a slot, which has priority over a segment, cannot be deleted because of a segmental restriction (viz. a segmental feature). Therefore, the spreading of the constituent consonant seems to be the last resort. It causes a minimal violation, that is a violation of a segmental type, which can be minimally repaired in changing the value of a feature. Note that Prunet and Tellier (1984) brought further evidence in favor of the PLH. They showed that foot formation processes (metrical focus processes) reduce the skeletal level in Fula, simply by not incorporating some skeletal slots in the metrical structure, when these slots would generate an ill-formed metrical structure.

All these facts lead me to conclude that phonological processes do not freely violate phonological constraints. Actually, violations occur when there is a constraint conflict, which must be solved in some way. I argue that this is accomplished by the PLH. The question which arises at this point is: are morphological operations (affixation) also respectful of phonological constraints? In other words, are they sensitive to this type of constraints? The answer seems to be 'no'. Given the case of Slave described by Rice (1986), where a violation is caused by a prefixation operation, and the case of Fula, where an ill-formed suffix (a suffix containing a floating slot, see (5a)) is attached to stems, I conclude that morphological operations are not governed by any phonological constraints (see Paradis 1987d, in preparation, and Paradis and Prunet in preparation for further arguments supporting this proposal).

If we posit that the association of the D-prefix to the first slot of a stem in Slave is part of the morphological operation (not the result of a phonological process), the violation is easily handled, without invalidating the Structure Preservation Principle. The hypothesis that affixes without timing unit attach directly to stems is supported by the case of Guéré, a Kwa language. In Guéré, object pronouns consist of a single vowel without slot and attach directly to the last slot of a stem. This, in some cases, creates ill-formed light diphthongs, which are repaired by a Vocalic Raising Feature Changing Strategy (e.g. zr-e → zrU-e 'beg it', from Paradis 1987d).

In Rice's proposal, the violation caused by D-prefixation is only postponed until Tier Conflation takes place, but not at all avoided or solved by this mechanism. The fact that Tier Conflation, which is a morphological operation (Archangeli and Pulleyblank 1986), was never reported to be blocked because of a phonological constraint also proves that morphological operations are not concerned with phonology. If the attachment of no-slot affixes to stems is analyzed as morphological and if we assume that morphological operations do not respect phonological constraints, then Tier Conflation may play no role in explaining constraint violations (see also Lieber 1987, where it is argued that the Morphemic Tier Hypothesis, and hence Tier Conflation, should be completely abandoned). Since Rice (1986) does not bring further justification to support the hypothesis of morphemic tiers in Slave, the solution I propose may also eliminate the need for this cumbersome theoretical apparatus in this language altogether.

3. CONCLUSION

This paper has emphasized the importance of addressing questions concerning constraints and constraint violations in phonology. In order to do this, I have first considered some aspects of the phonological and morphological theory of Singh (1985, 1987), which is highly concerned with phonological constraints. Despite the fact that I have adopted several of Singh's views, such as the notion of 'repair strategy' (some phonological processes apply to preserve a constraint) and the necessity of limiting arbitrariness in phonology, I have also rejected an important aspect of his model.

In sections 2 and 3, I have shown that morphology and phonology are not two separate ordered blocks without interaction, as proposed in Singh (1987). Section 2 aimed basically at showing that phonological constraints can be effective in the lexicon, since repair strategies can apply at this level. It was also claimed that constraints can have two different effects: they can either block a phonological process (e.g. the constraint on *V:C: sequences in Fula) or trigger a repair strategy (e.g. the constraint on continuan geminates in Fula). I have argued that the former effect, since it results in no change, has priority over the second one, which consists of an obligatory change. For further evidence in favor of the double effects of constraints (i.e. 'blocking' and 'repairing'), the reader is referred to Yip (1988) on OCP.

In section 3, we have seen that the phonological processes which apply in the lexicon cannot be limited to repair strategies, since the Nasal Spreading Process in Fula, which is not triggered by any phonological constraint, holds in the lexicon, specifically at Stratum I. The fact that NS is a very productive and regular process which also adapts borrowings led me to the conclusion that 'global alternations' (general phonological processes) must be theoretically allowed to apply in the lexicon, i.e. they must be enabled to have lexical domains (which is more general, I believe, than being
marked for specific information regarding lexical categories or a specific affix). Otherwise, the distinction between 'local' and 'global' alternations becomes vacuous. All these facts also supported the proposals of Kiparsky (1985) and Mohanan (1986), according to which the phonological and the morphological components are multi-connected in the grammar.

Section 4 was devoted to constraint violations, for which I have attempted to provide some explanations. I have argued that phonological processes are basically respectful of phonological constraints (they are 'structure preserving'), while morphological operations (affixation) are insensitive to them. It was claimed that violations following from phonological processes, a problem for the Structure Preservation Principle as well (Kiparsky 1982, 1985; Archangeli and Pulleyblank 1986), are caused by constraint conflicts. These constraint conflicts must be solved in some way, which is accomplished, I have argued, by a phonological hierarchy (viz. metrical > syllabic > skeletal > segmental). This hierarchy determines the precedence of a constraint according to its focus (segmental, skeletal, etc.) I have also argued, in accordance with Archangeli and Pulleyblank (1986), who claim that configurations can refer to both 'content' and 'structure', that configurational constraints may have different focuses, segmental and structural, a distinction which proves important in determining precedence in a constraint conflict.

Finally, I have discussed the proposal of Rice (1986), who is concerned with another case of configurational constraint violation. She resorts to the notion of 'invisibility', which follows from the Morphemic Tier Hypothesis (McCarthy 1986), to explain a problematic case of prefixation in Slave: a prefix generates ill-formed complex segments at the beginning of stems. She contends that violations can occur intermorphemically in Slave because morphemes lie on separate tiers. This keeps the ill-formed configurations that a phonological process such as 'link' (link the prefix) may generate from being immediately detected by the configurational constraints. Violations are detected only at a later stage, when Tier Conflation takes place. The solution proposed by Rice to account for violations in complex-segment configurations, however, does not hold for violations which occur in geminate configurations nor for intramorphemic violations. This induced me to consider an alternative where no-slot affixes (i.e. affixes which have no skeletal slot), the type of affix Rice is concerned with, are not simply concatenated but directly linked to stems. In other words, I have proposed that 'affixation', in those cases, results in a morphological attachment to a stem slot, a solution which is supported by the case of Guér. In this way, the violation found in Slave, which is now viewed as resulting from a morphological operation, is no longer a problem for the Structure Preservation Principle. This also renders useless the Morphemic Tier Hypothesis and its counterpart, Tier Conflation, in accounting for constraint violations.

NOTES

1. The data, an excerpt from the lexicon presented in Paradis (1986a), were gathered by the author with the help of two informants.
2. Strata I and II are differentiated on both phonological and morphological grounds. Some of the arguments which justify this dichotomy are given below.

Strata I: simple nouns

a) The singular nominal class-marker suffixes are usually nonpredictable on semantic grounds; word-formation processes are less productive.

b) Plural markers are chosen according to the singular marker.

c) Nominal markers undergo a shortening rule.

d) Nasal consonants spread to the following voiced stops.

e) Consonantal sequences are governed by a sonority constraint (see Paradis 1986a: 209–226 for this constraint).

Stratum II: complex nouns (nominalizations, deverbals, etc.)

a) The singular nominal class-marker suffixes are usually predictable on semantic grounds: the word-formation processes are very productive.

b) Most of the nouns have no plural or a specific one.

c) No shortening rule for markers except in one specific context.

d) No nasal spreading process (section 3).

e) No sonority constraint.

3. Fulá has approximately (it depends on the dialect) 25 nominal class-marker suffixes which trigger consonantal alternations at the beginning of stems. These alternations are however irrelevant for the present paper (see Arnott 1970, Lieber 1984, and Paradis 1986a: 63–111, 1987a, among others, for a discussion of these alternations).

4. This constraint may seem better captured by a principle called the Prosodic Government Principle. This universal principle was proposed first by Lowenstamm and Kaye (1986), where it was informally stated, and by Lowenstamm (1987), where it was expressed as follows:

Prosodic Government Principle:

a. The leftmost skeletal position in R (the Rime) is the head of R.

b. R is not well-formed unless its head e-commands every skeletal position in R.

The Prosodic Government Principle (henceforth PGP) prohibits the following structure, because the head of R in this type of syllable does not e-command the skeletal position under the coda node.

```
  \*R
N   C
X   X   X
head
```
However, if we consider the following examples, we see that this type of syllable is very common both intramorphemically and intermorphemically in Fula.

**PGP Violations in Pulaar of Foua Toro (Fula)**

a. **intramorphic**
   - kaak-t-e: spits
   - paabl-u-de: to yawn
   - paaml-u-de: to lend
   - fsof-erre: rest
   - naabl-u-de: to pray
   - ecel-ol: cut

b. **intermorphic** (derivations from Stratum I)
   - maay-d3: dead person
   - caak-ri: curdled milk
   - loop-re: mud
   - ceer-gal: divorce


c. **intermorphic** (derivations from Stratum II)
   - haak-de: to return
   - suus-gol: daring

To these examples, I can also add paak-y-l 'public hair', kaak-erl 'fast' (diminutive), data I gathered from Fula Kunda in the course of my research in Senegal, and fsof-u-de 'to hunt and pursue' (Gaden 1931:96). As for the forms in (b) and (c), there are hundreds of them in Fula. As Fula does not allow branching onsets or branching codas, the first consonant of the consonantal cluster within words in these examples must be syllabified under the coda of the first syllable. This syllabification violates the PGP. The hypothesis of a consonantal appendix (see Hayes 1980 for this theoretical proposal) cannot account for the PGP violations, since none of the consonants within clusters occurs at the end of a word. If we add appreciate within words, the PGP loses all possibility to be invalidated, and simultaneously all scientific interest. The hypothesis that a non-geminate consonant cannot be delinked in order to avoid the creation of a floating segment is also rejected, because in any of these examples containing Y:CC sequences, the PGP could be preserved in having the long vowel shortened, which does not occur. Consequently, I conclude that the PGP as formulated by Lowenstein (1987) is too powerful to account for the data in Fula. It wrongly predicts that the examples above cannot exist. It may also be too powerful for words such as steelfa 'star' and millle 'thousand' in Latin.

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