Towards a Theory of Constraint Violations*

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1. Introduction

My goal in this paper is to provide some explanations for constraint violations and apparent constraint violations. In order to do this, I will examine eight constraints or sets of constraints, some in Fula (a West Atlantic language spoken in West Africa), and some in Guere (a Kru language spoken in the Ivory Coast). I will show that these constraints are preserved from violations thanks to blocking effects and repair strategies, i.e. phonological processes which apply in order to fix an ill-formed structure (cf. Paradis (to appear), Piggott & Singh (1985), Singh (1984), (1985)). In other words, it is argued that constraints can have two types of effect: they can block a phonological process, or they can permit a violation (under specific conditions defined below), and then trigger a repair strategy. The former effect has priority because it is more economical (it does not result in any change) and does not undergo an undesirable violation stage.

I will also show that only phonological processes, as opposed to morphological operations (affixation), respect phonological constraints. This contrasts with the theoretical positions of McCarthy (1986), Archangeli & Pulleyblank (1986) and Rice (1986), who posit “morphemic invisibility” following from the Morphemic Tier Hypothesis. I claim that morphological operations are an important source of violations for phonological constraints. I also argue that phonological constraints can have domains. These particular hypotheses enable us to avoid many problems regarding, for instance, violations to the Structure Preservation Principle proposed by Kiparsky (1982; 1985) and Pulleyblank (1983), and intra-morphemic violations (in which the Morphemic Tier Hypothesis can play no role), in addition to connecting apparently unrelated facts within a single language. In a more general perspective, the theoretical framework adopted below links a number of facts on a universal basis.

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As some constraints are universal (they are generally referred to as "principles") and others language-specific, it is important to determine how phonology is organized in the universal grammar (hereafter UG) and in particular languages. Obviously, it is not possible to build a theory of constraint violations without establishing what belongs to each grammar. Along with Chomsky, I will assume that the "human language consists of systems of universal principles, and what is language-particular, in large measure, is not a specific choice of rules but rather a specific choice of options that the general principles of the language faculty leave undetermined, within a narrow range: the parameters of variation" (Chomsky 1967, 6). The organization of phonology I assume for UG and any particular language is outlined in 1.1 and 1.2.

1.1. The Organization of Phonology in UG

First, UG contains principles, i.e. universal constraints (u-constraints), which can be construed as "limits" to what is possible in the language faculty. The principles relevant for this paper are:

1. DCP the Obligatory Contour Principle (proposed by McCarthy (1986)): adjacent identical segments are prohibited.

2. Prosodic Licensing: all phonological units must be prosodically licensed, i.e. belong to higher prosodic structure (Ito (1986:2)).

3. Priority for Spreading: from a nuclear position to another nuclear position and from a non-nuclear position to another non-nuclear position.

Second, UG contains parameters, i.e. options which can be selected. As opposed to principles, parameters only deal with possible alternations; they do not deal with what is linguistic or not. All parameters are possible options; impossible options are defined by principles. We will see that one of the most obvious advantages of parameters is that they can link supposedly separate facts either in a single language or in many different languages. These connections allow us to have a more restricted conception of what, for example, a phonological process can be and of what options are available in each language. The notion of "parameter", as well as that of "repair strategy", also eliminates the need for contexts and "triggers" (cf. Archangeli & Pulleyblank (1986), henceforth A & P, and Yip (1988) for this term) in process descriptions. This will be apparent from the discussion below.

The parameter model I propose here is in part that of A & P, where phonological processes are a limited set of two possible operations: Insert (any
phonological material, including a "path", i.e. a link between two items; for a formal definition of a path, cf. A & P, 58) and Delete (delete any phonological material, including a path). For convenience, I will use the term "Link" or "Spread" for "insert a path" and "Epenthesis" or "Insert" for "insert a segment or a slot" (the latter for syllabic purposes only). Similarly, "Delink" will be used for "delete a path" and "Delete" for "delete a segment or a slot". I believe that we must add a third possible phonological operation to this small set of processes, which is Change α, a process proposed first by Haraguchi (1987). Thus, the possible phonological processes I posit are:

(2) Parameters for phonological processes

Insert:
- link or spread (insert a path).
- epenthesis (insert a segment or a slot for syllabic purposes).

Delete:
- delink (delete a path).
- delete (a segment or a slot).

Change α:
- change the value of a feature when a constraint refers to a specific feature.

A language may or may not resort to these three phonological processes, which, I claim, can apply in two cases only: 1- in the case of a constraint violation, where phonological processes act as repair strategies; 2- in the case of a positive setting for a parameter, i.e. a "turned on" option for a parameter such as Spread Nasal, Voice, etc. in a specific language (cf. section 1.2, and, for a detailed discussion of positive settings, Piggott (1987); here, we will be mainly concerned with negative settings for parameters). In other words, the "triggers" for phonological processes, which are of two types, are always exterior to the processes themselves. Phonological processes are also restricted by other factors; for example, I claim that Change α can be used as a repair strategy only when a constraint refers to a specific feature, while Epenthesis (Insert a slot) is limited to syllabic purposes.

Another type of parameter deals with phonological content, which, as mentioned previously, always involves possible linguistic options; impossible options are ruled out by principles.
(3) **Parameters for phonological content**
   - groups of features allowed
   - segment sequences allowed
   - features spread (voice, nasal, round, etc.)
   - default segments (i, u, t, etc.)

For instance, the existence of the velar articulation in a particular language depends on a parameter (velar: off or on) as opposed to the root node which is fixed by a principle (cf. Clements (1965) and A & P among others). Similarly, the propagation of the nasal feature in a given language depends on a parameter (spread nasal: off or on), while the impossible propagation of the feature [injection] for implosive consonants depends on a principle.

Parameters also offer options concerning **phonological structures**, which are defined here as any mapping involving "branching" (cf. A & P, 61).

(4) **Parameters for phonological structures**
   - configurations (diphthongs, complex segments, geminates)
   - syllables (types of constituents)
   - metrical structures

Several restrictions concerning phonological structures will be discussed in section 3.

1.2. **The Organization of Phonology in a Specific Language**

The phonological component in a particular grammar contains settings for parameters, which can be construed as language-specific answers to universal questions, and rules, which are defined here as morphologized phonological processes. This organization is represented below, where it can be seen that the parameter settings deal, among other things, with processes, content and configurations.

(5) **Phonology in a particular grammar:**

a. Settings for parameters:
   i. processes
      - delete: off/on
      - insert: off/on
      - change α: off/on
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ii. content
   e.g. - implosives: off/ on
        - non-anterior nasals: off/ on
        - default segments: off/ on

iii. structures
   e.g. - geminates (both consonants and vowels): off/ on
        - all natural classes of geminate: off/ on
        - complex segments: off/ on
        - branching onsets, codas, rimes: off/ on

b. Rules (morphologized processes, e.g. Velar Softening in English and in French)

I do not claim, then, that there are no rules but rather that these are morphologically conditioned processes.

1.3. Assumptions about Constraints

What is the status of language-specific constraints, as opposed to universal ones (the principles)? How can the former be connected to UG? And what types of constraints are there? Do we really need language-specific constraints in addition to negative parameters and principles, or is there a more condensed way of expressing all these restrictions? The following hypotheses are tentative answers to these important questions.

(6) Hypotheses about constraints
   a. Language-specific constraints are negative settings for parameters.
   b. Principles or constraints involving:
      1) non-branching material are simple constraints;
      2) branching material are configurational constraints.
   c. Configurational constraints can refer to content and structure
      (cf. A & P, 63). I claim that they can have different focuses, i.e. either the content or the structure.

   These assumptions will become clear with the examination of the constraints in sections 2 and 3.

1.4. Assumptions about Constraint Violations

Where do constraint violations come from? Are there generalizations to be captured regarding morphology vs. phonology? Can constraints have different
domains in the phonological component, the way processes do (cf. Kiparsky (1985) and Mohanan (1986) for phonological process domains in terms of strata)?

This paper is certainly not the first attempt to answer these important questions. Previous proposals have already been put forward, partly or entirely in order to account for constraint violations. These proposals deal with the notion of "morphemic invisibility" following from the Morphemic Tier Hypothesis (cf. A & P, McCarthy (1979), (1986), Rice (1986)); or with the distinction between "lexical strata" (the structure preserving phonological domain) and the "postlexical stratum" (the non-structure preserving phonological domain; cf. Kiparsky (1982; 1985); or with the distinction between "global" (the constraint preserving) and "local" (the non-constraint preserving) alternations (cf. Singh (1984; 1985)).

However, in spite of the merit of these attempts, several problems remain, of which examples are given in sections 2 and 3. The most important are: 1- some violations occur intra-morphemically (this cannot be accounted for by the notion of "morphemic invisibility" which can only play a role intermorphemically since it deals with invisibility between morphemes); 2- constraints are violated in many cases at the lexical level (this is problematic for the Structure Preservation Principle, according to which underlyingly disallowed phonological material cannot be generated at the lexical level; cf. Kiparsky (1982; 1985) and Pulleyblank (1983)); 3- the distinction between global and local alternations does not hold in all cases (cf. Paradis (to appear) for a detailed discussion of this topic). I believe that these problems result from the lack of theoretical perspective and that they can be solved if the issue is addressed in a more global way in connection with UG, and if a theoretical refinement, the notion of constraint domain, is added. This is the task, I claim, that the following hypotheses, along with those in (6), allow us to accomplish.

(7) **Hypotheses about constraint violations**

a. Morphological operations (affixation) do not respect phonological constraints, but some are sensitive to phonological information (cf. the case of English with *black-en, whit-en* but *green-en, *lax-en; however, because of the existence of *canon, tenon, flax-en*, this is obviously not the result of a general constraint on sequences /nan/ and /san/. It is a language-specific phonological condition, cf. Halle (1973)).

b. Phonological processes do respect phonological constraints; they are blocked if their application results in a constraint violation.

c. **Blocking** is overridden only in the case of **conflicting constraints**.
d. Violations are fixed by means of repair strategies, which are simply phonological processes (insert, delete, change \( \alpha \)) which apply to preserve a constraint.

e. In a constraint conflict, the priority must be determined by a mechanism. I will assume here that priority is determined by a Universal Hierarchy, the Phonological Level Hierarchy (henceforth PLH), which is as follows: metrical \( > \) syllabic \( > \) skeletal \( > \) segmental (cf. Paradis, to appear).

f. Constraints can have different domains in the phonological component.

g. Violations can be caused by underlyingly ill-formed material.

1.5. Summary and Symbols Used

8) Summary

a. "Blocking" has precedence over "violating & repairing".

b. There are three sources of constraint violations:
   - constraint conflicts, i.e. violations following from a phonological process referred to as \( V-1 \);
   - affixation, i.e. violations following from a morphological operation, referred to as \( V-2 \);
   - inherently ill-formed material, referred to as \( V-3 \).

c. Precedence among conflicting constraints of different phonological levels (viz. segmental, metrical, etc.) is determined by the PLH.

d. There are two types of process trigger:
   - positive settings for parameters (e.g. spread nasal, voice);
   - constraint violations \( > \) repair strategies.

e. A single parameter can have different settings in a given phonological component, i.e. it can have domains.
(9) Symbols used
\( /\alpha, \upsilon / = \) non-ATR high vowels;
\( /\epsilon, \upsilon / = \) non-ATR non-high vowels.
\( \check{\upsilon} = \) low tone, \( \check{\check{\upsilon}} = \) mid tone \( \upsilon' = \) mid-high tone, \( \check{\upsilon'} = \) high tone.
\( \chi = \) implosive dental stop, \( \delta = \) implosive labial stop.
\( \upsilon \upsilon = \) diphthong; \( \upsilon \upsilon = \) complex consonant.
\( \check{\upsilon} = \) nasal vowel; \( \check{\upsilon} = \) palatal occlusive.

2. Simple Constraints

In this section, we will examine five simple constraints in Fula and in Guere, constraints involving no branching structure. Each constraint will be represented as a negative setting for a parameter, or as a principle, and will have its domain of activation specified. Effects of parameter settings will be subsequently described and discussed.

2.1. The Constraint on Vocalic Sequences in Guere (cf. Paradis 1983a,b)

Constraints on vocalic sequences are very frequent among languages. Some languages allow all types of vocalic combinations, for example, French (e.g. pêage [peage] 'toll', goêland [goeland] 'gull') and Japanese (e.g. kaori 'smell', kaes 'to return'), but others do not allow any. There is a third type which allows vocalic sequences, but only ones containing a high vowel; this is the case for English, within stems and words from stratum I (e.g. radio, alveolar but *sa, ae, etc.)\(^1\), and also for Guere. This is expressed through the parameter-settings in (10a,b).

(10) Parameters: a. \( V \ V \) (on) b. \( \check{V} \ V \) (off)

\[ [\ ] \quad [-] \quad [-\mathrm{H}] \quad [-\mathrm{H}] \]

Type: segmental
Domain: the lexicon.

2.1.1. Effects of the parameters in (10a,b)

Vocalic sequences are allowed but they must contain a high vowel, as shown in (11).

\(^1\) The only exceptions I know in English are poet and phæton. Words with the prefix co- are from stratum II (cf. Halle and Mohanan (1985)).
2.1.2. Effects of the parameter in (10b)

The negative setting in (10b) triggers two effects: Change $\alpha$ (vocalic raising in this case) and Delinking.

**Change $\alpha$.** This repair strategy changes the value of a feature which is selected according to the focus of the constraint. As the focus of the constraint in (10b) is [-high], the change will be [-high] $\rightarrow$ [+high]. A vowel is raised when followed by a non-high vowel. This is shown in (12), where $\omega, i, e, o$ are object pronouns selected according to nominal classes.

(12) 

$\begin{align*}
/\text{zr}\text{oo} & - o, e/ \rightarrow \text{zr}\text{oo}, \text{zr}\text{oe} \quad \text{make PRO beg} \\
/\text{pl}\text{ee} & - o, e/ \rightarrow \text{pl}\text{oo}, \text{pl}\text{ee} \quad \text{make PRO run} \\
/\text{tr}\text{ee} & - o, e/ \rightarrow \text{tr}\text{oo}, \text{tr}\text{ee} \quad \text{make PRO shake}
\end{align*}$

In these examples, the suffixation of pronouns creates non-high vowel sequences, identified as V-2 (i.e. constraint violations following from a morphological operation), which are repaired by vocalic raising (Change $\alpha$). Of course, the repair strategy does not apply when the vowel of the suffix pronoun is a high vowel, since (10b) is not violated.

(13) 

$\begin{align*}
\text{zr}\text{oo}, \text{zr}\text{oi}, \text{pl}\text{oo}, \text{pl}\text{ei}, \text{tr}\text{oo}, \text{tr}\text{ei} \\
(*\text{zr}\text{oo}, *\text{zr}\text{oi}, *\text{pl}\text{oo}, *\text{pl}\text{ei}, *\text{tr}\text{oo}, *\text{tr}\text{ei})
\end{align*}$

**Delinking** (delete a path). Violations can be repaired by another means than vocalic raising. When a vowel cannot be raised, as is the case with the low vowel $a$ in Guere, it is delinked from its skeletal slot and subsequently deleted (cf. section 3 for arguments in favor of the two stages Delink and Delete). The delinking of $a$, instantiated in (14), occurs when the low vowel is followed by a non-high vowel pronoun.

(14) 

$\begin{align*}
/\text{bl}a\text{a} & - o, e/ \rightarrow \text{b}\text{oo}, \text{b}\text{ee} \quad (*\text{bl}\text{ao}, *\text{bl}\text{ae}) \quad \text{make PRO beat} \\
/\text{ba}\text{a} & - o, e/ \rightarrow \text{b}\text{oo}, \text{b}\text{ee} \quad (*\text{ba}\text{oo}, *\text{ba}\text{ee}) \quad \text{make PRO carve}
\end{align*}$

However, $a$ remains when followed by a high vowel.

(15) 

$\begin{align*}
\text{bl}\text{ao}, \text{bl}\text{ai}, \text{ba}\text{o}, \text{ba}\text{i} \quad (*\text{bl}\text{oo}, *\text{bl}\text{ii}, *\text{bo}\text{oo}, *\text{bi})
\end{align*}$
It is always the first vowel of a sequence which undergoes a change in (12) and (14) because pronouns are "inalterable" in Guere: they cannot be manipulated. If the object pronoun is in the reverse position, that is, if it is followed by a vowel, the second vowel undergoes the change. A good argument in favor of this explanation is adduced by the behavior of possessive pronouns. These are composed of the object pronouns seen above followed by a possessive marker a'. When the possessive marker a' is preceded by a non-high vowel pronoun, it is not the vowel of the pronoun which undergoes a change, but the vowel of the possessive marker which is delinked, although it is the second vowel within the sequence.

(16) possessive pronouns: ọa', ọa'  
but /ọ-a'/ → ọc', /ọ-a'/ → ọc' (*ọa, *aa)

The constraint (10b) does not hold at the syntactic (postlexical) level. This is apparent from the following sentence where a non-high stem vowel is followed by a possessive pronoun with a non-high vowel without undergoing any change.

(17) ma ọla ọc gbe 'I beat his dog' (*ọla ọc gbe)

Before ending this section, I wish to point out that the constraint in (10b) does not result from the effects of the OCP, as one might think, since high vowel sequences ([+high] [+high]) do not undergo any dissimilation or deletion process in Guere (e.g. pi'o 'I prepare it', diui 'I make them crush').

2.2. Constraint on Labial Sequences in Guere

Guere is subject to another constraint, shown in (18), which prohibits sequences such as *gwy, *kwe, etc. (cf. also Paradis (1983a)).

(18) Principle: OCP

\[
\begin{array}{ccc}
X & X \\
| & | \\
[+round] & [+round]
\end{array}
\]

Identity: labial tier  
Domain: the whole phonological component except the morphemic level.

This constraint is in fact an effect of the OCP on the labial tier. What is language-specific here is the activation of the principle specifically on the labial tier, as opposed to any other tier (for a discussion of OCP-identity, cf. Yip (1988)). For example, the OCP does not apply to \(1\) when preceded by \(y\) (e.g. /ye' \(-3/) → yi'5  
*ji'5 'see PRU').
2.2.1. Effects

The constraint in (18) is preserved by two repair strategies: Change α (delabialization in this case) and Delinking.

Change α As seen in 2.1, this repair strategy changes the value of a feature according to the focus of the constraint. As the focus of the constraint in (18) is [+round], the change will be [+round] → [-round]. Here, Change α (delabialization) is triggered by a V-1, i.e. a violation following from a phonological process. The phonological process in question is vocalic raising. Actually, vocalic raising itself applies to repair a V-2 (a non-permissible non-high vowel sequence, cf. 2.1) generated subsequent to pronoun suffixation. In its turn, this repair strategy causes a V-1 when it applies to a stem vowel precisely in front of a rounded consonant. If the vowel raised, the stem vowel, is a back vowel (ə → ə̆), a V-1 is created (e.g. wo → *wo), which is repaired by delabialization (wo → go), as shown in (19). It is crucial to note that ə̆, as opposed to ə and ə, is not a rounded vowel in Guere.

(19) /wọọ - ə, e/ → goọ, goẹ 
'I make PRO shout'

Of course, if the vowel of the suffix pronoun is a high vowel, as in (20), the constraint against non-high vowel sequences in (10b) is not violated and, consequently, vocalic raising is not triggered. In its turn, vocalic raising, which does not apply, does not violate the constraint in (18) and, finally, there is no context for delabialization.

(20) Ṽọọ, Ṽọi 
'I make PRO shout' (*goọ, *goi)

The different stages of vocalic raising and delabialization are presented in the following derivation, where it can be seen that the causative suffix is a floating skeletal slot suffixed at the end of a verbal stem, to which floating object pronouns attach. Object pronouns in Guere, like many other suffixes, do not have a skeletal slot (cf. the formation of light diphthongs in 3.2)
(21) Derivation: \( [\text{gœ}] \)

a. Suffixation: violation of constraint (10b) against non-high vowel sequences (*œ).
   \[
   \begin{array}{c|c|c}
   \text{X} & \text{X} & \epsilon \\
   \hline
   \text{I} & \text{|} & \text{|}
   \end{array}
   \]

b. Two segmental constraints in conflict: (10b) and (16),
   OCP. Precedence: (10b) \rightarrow w \circ \epsilon
   Vocalic raising [+rd] [+rd]

(c) Violation of constraint (18) \rightarrow X X - X
   Change \( \alpha \) (delabialization)
   \[
   \begin{array}{c|c|c}
   \text{X} & \text{X} & \epsilon \\
   \hline
   \text{I} & \text{|} & \text{|}
   \end{array}
   \]

   g \circ \epsilon
   [-rd] [+rd]

I mentioned at the beginning of this paper that phonological processes, as opposed to morphological operations (affixation), do respect phonological constraints. I claimed that a V-1 does not arise spontaneously but is strictly restricted to one context: a constraint conflict. The derivation in (21) provides a clear illustration of this. The constraint in (18) is violated by a phonological process, vocalic raising, because there is a conflict between the constraints in (10b) and in (18). However, as the conflict involves two segmental constraints, it cannot be solved by the PLH (the Phonological Level Hierarchy, cf. 1.1). It is, in fact, solved in the same way violations are created: consecutively. The string is scanned from right to left, and violations are created and repaired in the same way, because the affixation rule which causes the first violation is a suffixation rule, i.e. a rule which attaches an affix at the right of a stem.

**Delinking.** This repair strategy applies as a last resort to the final part of a complex consonant when this final part is a rounded segment (viz. \( k\text{w}, g\text{w}, n\text{w} \rightarrow k, g, n \)) followed by a rounded vowel (viz. u, o, a), as shown in (22). Otherwise delabialization would produce ill-formed complex consonants (viz. \( k\text{w}, g\text{w}, n\text{w}\rightarrow^*k\text{g}, ^*g\text{g}, ^*n\text{g} \)), as well as ill-formed consonantal sequences.
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(22) a. /ŋw yö/ η yö *ŋw yö 'to hear'

b. stem singular plural gloss
/kw realloc ku *kw realloc kwi skin
/gw realloc go *gw realloc gw realloc tail
/kw realloc ko *kw realloc kwi kaolin

We know that the verb 'to hear' in (22a) is underlyingly /ŋw yö/ because /ŋ/ is always part of a complex consonant in Guere. The only context where the single velar nasal /ŋ/ surfaces is before a rounded vowel. Similarly, we know that the underlying consonants in (22b) are complex consonants, because they surface in front of the plural marker Ỉ (which is ATR-harmonized ǯ when preceded by a high ATR vowel). This suffixation causes the deletion of the rounded stem vowel, repairing in this way an inherently ill-formed portion of the stem. The alternative, which would be to analyze the second part of the complex segment, realloc, as the devocalization of the rounded stem vowel (viz. /ku - i/ ǯ kwi), is ruled out, as shown by the examples in (23), where no devocalization occurs.

(23) co realloc ci *cwi realloc month
d realloc d realloc *dwi realloc song
kpo realloc kpi realloc *kpwi realloc back

If the labialization in kw, gw, yö resulted from the devocalization of the rounded stem vowel, one would expect it to occur in front of any type of consonant. This is not the case since the forms *cwi realloc, *dwi realloc, *kpwi realloc are disallowed. The alternative of considering kw realloc to be a universally impossible phonetic sequence is also ruled out since an identical form kw realloc 'skin' exists and surfaces in Wobe, a related Kru language (cf. Paradis (1984)).

Before ending this section, it is important to note that all violations discussed in this section are intra-morphemic violations, i.e. violations which cannot be accounted for by the Morphemic Tier Hypothesis (cf. 1.4). While the derivation in (21) illustrates an intra-morphemic violation of the V-1 type, the examples in (22) display violations of the V-3 type, i.e. violations which do not result from any morphological operation or phonological process. The stems in (22) are inherently ill-formed since their underlying forms must be repaired as soon as they leave the dictionary to enter the first lexical stratum (cf. Mohanan (1986), among others, for this lexical organization).

Depending on the approach, a V-3 can be analyzed as a problematic underlying violation. If we assume that all phonological constraints are
automatically "morpheme structure conditions" (cf. Kipersky (1982)), and, at the same time, that all constraints are uniformly activated throughout the whole lexical component (cf. A & P, 35), we are faced with a problem: underlying violations. In contrast, if we assume that constraints can have domains, as phonological processes and morphological operations do, the problem can be dismissed. This is the solution adopted here. The examples in (22) do not violate the OCP on the labial tier (cf. (16)), since the constraint is not activated at this level. Rounded sequences are analyzed as ill-formed only at stratum I, where the constraint begins to be activated. In addition to solving a problem, this approach proves to be correct since, as is shown in the next section, constraint domains are required in other cases independently.

2.3. The Sonority Constraint on Homorganic Clusters in Fula

By and large, the Sonority Constraint in Fula requires that the first segment within homorganic clusters be more sonorous that the second one. This constraint will provide one more argument for constraint domains, since it holds at stratum I without holding at stratum II. It will also show that, as stated in (7b), "blocking" (a rule or a process) has priority over "violating and repairing".

The Sonority Constraint is in fact the result of two constraints: 1) an OCP on articulators shown in (24a), and 2) a parameter given in (24b), which controls the sonority within "fused segments".

(24) a) OCP
   identity: articulators
   repair strategy: fusion of the articulators

b) Parameter with respect to sonority within fused segments:
   The first part of a fused segment must be more sonorous than the second part: (on)

   domain: stratum I

Sonority Scale: \( \rightarrow + \) obstruents, nasals, l, r, glides, and vowels.

Without going into all the details, I argue that adjacent segments with identical articulators in Fula must share the same place node as the result of the OCP given in (24a). It also appears that the first part of a fused segment (including contour segments) must be more sonorous than the second one, which, as I claim, results from the parameter in (24b). Here, it is important to note that this parameter does not follow from a syllabic condition, as one might think, since
consonantal sequences are always hetero-syllabic. Indeed, onsets and codas are not allowed to branch in Fula.

The Sonority Constraint (I will continue to use this term although it involves two different constraints) accounts for the existence in Fula of the prenasalized contour segments mb, nd, pj, ng, the diphthongs al, ou, ei, ol, el, ai and the homorganic consonantal clusters ln, rl, rt, yr, mb, nd etc. It rules out the prenasalized contour segments *bm, *dm, *pn, *gn or *ts, *dz, the diphthongs *ua, *ue, *ua, *ia, *ie, *io as well as the consonantal clusters *nl, *ir, *tr, *ry, *br, *dn etc. at stratum I. It also has two additional effects: it can block the Shortening Rule for nominal markers (discussed below), and it can cause the delinking of a segment from its skeletal slot.

Blocking effect. Fula has approximately 26 nominal suffix class markers (depending on the dialect) which undergo a shortening rule (a morphologized deletion process) at stratum I. The rule, shown in (25), deletes the first slot of a marker, usually rendering the first consonant of the suffix phonetically null, e.g. -gal → -al -cum → -um -ki → i (cf. Paradis (1986a,b,c; 1987b) for more details on the functioning of this rule).

(25) Shortening Rule for markers in Fula \( X - X \rightarrow X - \emptyset \)

(Stratum I)

\[
\begin{array}{cccc}
S_1 & S_2 & S_1 & S_2 \\
1 & 1 & 1 & 1
\end{array}
\]

The markers we will be concerned with are RV markers (ru, re, ri). These behave in a special way since they can take the forms RV, the regular form at stratum I, dV (du, de, di) and VrV (uru, ere, iri). Actually, these suffixes have two segments but three skeletal slots (cf. derivations below). The extra slot floats at the beginning of the suffix; it is the one which is deleted when the Shortening Rule applies. This floating slot protects the slot attached to the coronal consonant L, which is never deleted, unlike the initial consonant of other markers. This can be observed in the following examples, from stratum I, where the Shortening Rule has applied but the coronal consonant still remains.

(26) RV

<table>
<thead>
<tr>
<th>am-re</th>
<th>turtle</th>
<th>*am-e</th>
</tr>
</thead>
<tbody>
<tr>
<td>fow-ru</td>
<td>hyena</td>
<td>*fow-u</td>
</tr>
<tr>
<td>sof-ru</td>
<td>chick</td>
<td>*sof-u</td>
</tr>
<tr>
<td>raab-ru</td>
<td>frog</td>
<td>*baab-u</td>
</tr>
<tr>
<td>tay-re</td>
<td>nugget</td>
<td>*tay-e</td>
</tr>
</tbody>
</table>

A derivation is given in (27), where the underlying form of RV markers and the application of the Shortening Rule is illustrated.
(27) **Derivation:** [fow-ru]

   a. Suff.  \( \text{XX} \text{X} - \text{XX} \)  
           \( |||| ||\)  
           fow ru  

   b. Shortening Rule  \( \text{XX} \text{X} - \text{XX} \)  
           \( |||| ||\)  
           fow ru

In (26), the **dV** variants of **rV** markers indicate, for reasons explained below, that the Shortening Rule failed to apply.

(26) **dV**  
    (blocking)  
    fal-de  shore  *fal-re  
    con-di  flour  *con-ri  
    far-de  baldness  *far-re

Blocking of the Shortening Rule prevents a V-1. If the floating slot had been deleted by the phonological rule, the marker consonant, \( r \), would have formed a disallowed coronal sequence (a V-1) with the last consonant of the stem, which is also a coronal, but not any more sonorous than the preceding one (viz. \( *lr, *nr, *rr \)). A derivation is given in (29), where the blocking effect triggered by the Sonority Constraint is illustrated.

(29) **Derivation:** [con-di]

   a. Suff.  \( \text{XX} \text{X} - \text{XX} \)  
           \( |||| ||\)  
           Short. Rule  \( |||| ||\)  
           con ri  (no V-1: *nr) con ri

   b. Blocking of \( \text{XX} \text{X} - \text{XX} \)  
           \( |||| ||\)  
           PLH > gemination of \( r \) (V-1)
           and occlusivization (repairing)
In (29b), the Shortening Rule is blocked in order to keep a separating slot between the slots attached to the coronals on each side, which cannot form a proper homorganic sequence (viz. *n-r). In (29c), a constraint conflict appears: on one hand, the skeletal slot must be licensed (cf. (1)) but, on the other hand, continuant geminates are disallowed in Fula. According to the PLH (cf. (7e)), the former constraint has priority. Therefore r must link to the floating slot, although it creates a disallowed type of geminate. When continuants undergo gemination, they are repaired by occlusivization (e.g. *rr, *ff, *ss, *ww → dd, pp, cc, bb); thus it is assumed here that the occlusivization of r in (29) is caused by gemination (a similar case is discussed in detail in section 3.3).

Degemination results from the fact that onsets and codas cannot branch in Fula (*con-dde, *cond-de; cf. section 3.3). The only possibility is to leave the first part of the geminate unsyllabified. The alternative, inserting a default segment, is rejected since vocalic epenthesis is not available at stratum I. Even if it were, it would create another problem: the geminate would not be attached to the first syllable (*con-u-dde), a situation which is disallowed in Fula because the first part of a geminate must be syllabified within the first syllable of a word (cf. section 3.3 for configurational constraints in Guere and in Fula). Linking n would not do either since the ill-formed coronal sequence *nr would remain without any possibility of triggering Change α (viz. occlusivization); I mentioned in 1.1 that this repair strategy modifies the value of the feature on which a constraint focuses. As the Sonority Constraint does not focus on any feature value, *nr could not be repaired by Change α.

Another set of examples with rV markers illustrates the blocking effect on the Shortening Rule. These are cases, shown in (30), where the floating slot is not filled with the marker consonant r but with the marker vowel.
(30) \( \text{yit-ere} \) eye \( \ast \text{yit-re} \) \( \ast \text{yit-de} \)
    \( \text{woj-ere} \) hare \( \ast \text{woj-re} \) \( \ast \text{woj-de} \)
    \( \text{woot-uru} \) unique \( \ast \text{woot-ru} \) \( \ast \text{woot-du} \)
    \( \text{kes-iri} \) new \( \ast \text{kes-ri} \) \( \ast \text{kes-di} \)

A derivation is given in (31), where it is roughly shown that the vocalic spreading
occurs through the dorsal tier (cf. Steriade (1986) for previous proposals of this
kind).

(31) **Derivation: [yit-ere]**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>N</th>
<th>N</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>syll.</td>
<td>y i t r e</td>
<td>y i t r e</td>
<td>y i t r e</td>
<td></td>
</tr>
<tr>
<td>b. Blocking of</td>
<td>Short. Rule</td>
<td>(no V-1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Voc. spreading &amp; X X X - X X X nuclear syll.</td>
<td>y i t r e</td>
<td></td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Here again, blocking of the Shortening Rule prevents a V-1. The marker
coronal \( r \) would have formed a disallowed coronal sequence with the last consonant
of the stems (viz. \( \ast tr \) and \( \ast jr, \ast sr \) in (30)). However, the spreading of \( r \) to
the floating slot would also lead to ill-formed sequences (viz. \( \ast td \) and \( \ast jd, \ast sd \) in
(30)), since the first coronal within these sequences would not be more sonorous
than the second one. As the last consonant of the stem cannot spread (with \( \ast yitt-re \), for instance, the violation \( \ast tr \) would remain), the only possibility left is to fill
the slot with a vowel, i.e. the vowel of the marker. In Fula, Vocalic Spreading is
always intramorphic and does not occur through all consonant types: it is
restricted to coronals under specific conditions (cf. Prunet (1986) for other
examples of coronal transparency in Fula such as the suffixes \( \ast toc, \ast tcc \) and the
pronouns \( \text{sd} \text{an}, \text{sd} \text{en} \)). Actually, vocalic propagation through consonants seems to
occur as a last resort (cf. Paradis & Prunet (forthcoming) for further investigation
of the topic).
Delinking. This repair strategy is triggered by a V-2: a plural suffix -li attaches to stems, in cases with a final n forming an ill-formed coronal sequence *nl. This violation of the Sonority Constraint is repaired by the delinking of n from its skeletal slot, to which an adjacent segment spreads; examples are given in (32).

\[
\begin{array}{ccc}
\text{sing.} & \text{plural} & \text{gloss} \\
\text{a.} & 6an-du & 6al-li & \text{body} \\
& 6un-du & 6ul-li & \text{weal} \\
\text{b.} & 6ooof-an-go & 6ooof-aa-li & \text{breath} \\
& 6hir-an-go & 6kir-aa-li & \text{jealousy} \\
\end{array}
\]

From these examples, it can be seen that the segment delinked within an ill-formed sequence is the first segment; this is the default case for Delinking in Fula. It can also be noted that the compensatory lengthening in (32a) differs from that in (32b); in (32a), it is the segment following the dissociated n which spreads (l), while in (32b) it is the preceding one (a). Examples in (32a) constitute regular cases: priority for spreading is from a non-nuclear position to another non-nuclear position (cf. 1.1) as described in the following derivation.

\[
\text{(33) Derivation: [6an-du]}
\]

\[
\begin{array}{cccc}
\text{N} & \text{N} & \text{N} & \text{N} \\
| & | & | & |
\end{array}
\]

\[
\text{a. Suff.} \quad \begin{array}{c}
XXX - X \\
\rightarrow \text{V-2} \quad | | | | \\
(*nl) \quad 6an-li
\end{array}
\]

\[
\text{b. Del. &} \quad \begin{array}{c}
XXX - XX \\
\text{non-nucl.} \quad | | \ | | \\
\text{spread.} \quad 6an-li
\end{array}
\]

The explanation of the compensatory lengthening discrepancy in (32) resides in the length of the words: as stipulated above, the first part of a consonantal geminate must be syllabified within the first syllable of a word. If this cannot be the case, consonantal gemination is blocked, and another adjacent segment spreads, i.e. the preceding vowel, as shown in (34).

\[
\text{(34) Derivation: [6ooof-aa-li] (*poofallli)}
\]

\[
\begin{array}{cccc}
\text{N}_1 & \text{N}_2 & \text{N}_3 & \text{N}_1 & \text{N}_2 & \text{N}_3 \\
\text{a. Suff.} \quad XXX -X X -XX & \text{b. Del. &} \quad XXX X -XX X -XX \\
\rightarrow \text{V-2} \quad | | | | & \text{nucl.} \quad | | | | \\
(*nl) \quad poof an li & \text{spread.} \quad poof an li
\end{array}
\]

Before ending the section, it must be pointed out that the Sonority Constraint does not apply at stratum II, e.g. loot-de ‘to wash’, hul-ra ‘fear’, moa-de ‘to swallow’, dis-n-u-de ‘to make someone hang something’, which are all words
derived at stratum II. It has been shown in Paradis (1986a,b,c;1987b) that this limitation of the Sonority Constraint to stratum I is essential for the understanding of marker behavior in Fula.

2.4. The Constraint against the Unrounded Velar Glide *y in Fula

The following discussion bears on a segmental constraint in Fula, which prevents an underlying segment y from surfacing. It is an excerpt of a more complete analysis presented in Paradis (1986a,b,c;1987a), which accounts for irregular consonantal alternations at the beginning of nominal stems in Fula, a classical problem in African linguistics (cf. Arnott (1971), Anderson (1976), Skousen (1972), among others). The discussion will bring further evidence for V-3, i.e. violations following from inherently ill-formed material.

To understand the treatment given to the *y-constraint in Fula, we must conceive part of the human language faculty as a place where all segmental features are stored. The fact that some combinations are universally impossible (e.g. [+low], [+high]) hinges on principles, while the fact that other combinations are disallowed only in certain languages depends on parameter settings. Along these lines, I will claim that the impossibility in Fula of a continuant unrounded voiced consonant with a velar articulation must be expressed by the following negative parameter.

\begin{equation}
\text{Parameter: velar: [+continuant] [+voiced] [-round] (off)}
\end{equation}

Type: segmental
Domain: the whole phonological component except the morphemic level.

This means that h is permitted in Fula but not the velar glide y, which is disallowed everywhere within the phonological component except at the morphemic level. However, although y never shows up, I argue that it exists underlingly and it is responsible for irregular consonantal alternations.

First, consider the regular patterns given in (36).
A Theory of Constraint Violations

(36) **Stems with regular patterns** (stratum 1)

<table>
<thead>
<tr>
<th>stems</th>
<th>regular patterns</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>wecc</td>
<td>wecc-o becc-e</td>
<td>rib</td>
</tr>
<tr>
<td>wibj</td>
<td>wibj-o bibj-e</td>
<td>wing</td>
</tr>
<tr>
<td>woj</td>
<td>woj-ere boj-e</td>
<td>hare</td>
</tr>
<tr>
<td>wukk</td>
<td>wukk-uru bukk-i</td>
<td>pompom</td>
</tr>
<tr>
<td>waad</td>
<td>waad-ere bead-e</td>
<td>drop</td>
</tr>
<tr>
<td>ye6</td>
<td>ye6-re j6-re</td>
<td>seed (kind of)</td>
</tr>
<tr>
<td>ylim</td>
<td>ylim-re j6m-re</td>
<td>poem</td>
</tr>
<tr>
<td>yont</td>
<td>yont-ere jont-e</td>
<td>week</td>
</tr>
<tr>
<td>yun</td>
<td>yun-de jul-de</td>
<td>strainer</td>
</tr>
<tr>
<td>yaa6</td>
<td>yaa6-re jaa6-e</td>
<td>jujube</td>
</tr>
<tr>
<td>en</td>
<td>en-du en-di</td>
<td>breast</td>
</tr>
<tr>
<td>in</td>
<td>in-de in-d'e</td>
<td>name</td>
</tr>
<tr>
<td>oorr</td>
<td>oorr-de oor-d'e</td>
<td>herd</td>
</tr>
<tr>
<td>af</td>
<td>af-be af-o</td>
<td>elder</td>
</tr>
<tr>
<td>uulln</td>
<td>uulln-du ullu-d'l</td>
<td>cat</td>
</tr>
</tbody>
</table>

It can be observed that w, y alternate with b, l respectively, in front of any vowel quality. It can also be observed that stem-initial vowels do not alternate. Note that alternations are triggered by suffix-class markers through parasynthetic constructions which are irrelevant here.

Now consider the following patterns.

(37) **Stems with problematic alternations** (stratum 1)

<table>
<thead>
<tr>
<th>stems</th>
<th>irregular alterations</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>yor</td>
<td>wor-be gor-ko *bor-ko</td>
<td>man</td>
</tr>
<tr>
<td>yur</td>
<td>wur-o gur-e *bur-e</td>
<td>village</td>
</tr>
<tr>
<td>yit</td>
<td>yit-ere git-e *jir-e</td>
<td>eye</td>
</tr>
<tr>
<td>yer</td>
<td>yer-t-ere gert-e *jert-e</td>
<td>peanut</td>
</tr>
<tr>
<td>yabb</td>
<td>abb-ere gabb-e *abb-e</td>
<td>seed</td>
</tr>
</tbody>
</table>

Not only does w alternate with g instead of b, but the glide y and the stem-initial vowel a also alternate with this consonant. Moreover, the w/g alternation only occurs in front of high back vowels, whereas the y/g alternation is restricted to high front vowels. And the sole vowel to alternate with g is typically the low
vowel a. This problematic triple alternation with g, which seems totally opaque, can be handled if we assume that the stems in (37) actually have the initial segment γ. This will be explained below.

2.4.1. Effects of the parameter in (35).

Stems with an initial γ are detected as a violation of the constraint in (35) as soon as they leave the dictionary to enter the lexicon. I argue that these γ-3 are repaired through the delinking of γ from its prosodic slot (hereforth γ-Delinking). However, as a skeletal slot must be licensed (cf. (1b)), the empty slot cannot remain segmentally unlinked. Two repair strategies are available: segmental spreading from the nucleus or skeletal deletion; it will be shown that both actually apply. Insertion (epenthesis) is ruled out, since there is no syllabic purpose (cf. (2)) and, in any case, there is no default consonant in Fula which could fill an onset position. Change α, another alternative, is also ruled out since the constraint bears on a whole bundle of features and not on one in particular (cf. (2)).

Segmental spreading following from γ-Delinking. As mentioned above, the first four irregular stems in (37) are remarkable in that the glide at the beginning of the stems in the second column always agrees with the articulatory position of the next vowel (viz. wo, wu, ye, yi); alternations such as *we/ ge, *wi/ qi, *yo/ go, *yu/ gu) are never encountered. I claim that this is not an accident but, on the contrary, that it results from the fact that the vowel and the glide within these sequences are actually one single segment. More precisely, I argue that the vowel spreads from the nucleus to the floating slot in the onset, as shown in (36).

(36) Derivations

\[
\begin{array}{llllllll}
a. \text{Delinking} & \text{O} & \text{N} & \text{O} & \text{N} \\
\text{x} & \text{x} & \text{x} & \text{x} \\
\text{γ} & \text{I} & \text{I} & \text{I} \\
\text{γ} \{u\} & \text{γ} \{i\} & \{o\} & \{e\} \\
b. \text{Spreading} & \text{O} & \text{N} & \text{O} & \text{N} \\
\text{I} & \text{I} & \text{I} & \text{I} \\
\text{x} & \text{x} & \text{x} & \text{x} \\
\text{γ} \{u\} & \text{γ} \{i\} & \{o\} & \{e\} \\
\end{array}
\]

Skeleton deletion following from γ-Delinking. This repair strategy applies when no segment can fill the floating slot generated by γ-Delinking. This happens with the
vowel \(a\), which cannot spread in an onset position in Fula because of its feature [+low]. In this case, the floating slot is merely deleted, as shown in (39).

(39) Derivation [\(a\)bb-\(a\)re]

a. \(\gamma\)-Delinking \(O\ N\)  
\(X\ X\)  
\(\gamma\ a\)  

b. No voc. \(O\ N\)  
spreading \(\emptyset\ X\)  
\(\gamma\ a\ [a]\)  

This accounts for some of the forms in (37), namely the continuant ones. But what about the non-continuant forms, the ones with an initial \(g\) given in the third column in (37)? First, it must be mentioned that consonantal alternations at the beginnings of stems in Fula are caused by the prefixation of an empty slot (cf. Paradis (1966a)), which is triggered itself by the suffixation of a nominal marker, irrelevant here. Second, we must recall that continuant geminates are not permitted, and, third, that onsets cannot branch (cf. 2.3 and 3.3). These stipulations enable us to understand the following derivation.

(40) Derivation: [\(gur\)-\(e\)]

a. Const. conflict: \(O\ N\)  
1) no float. slot: \(X\ X\)  
\(\gamma\gamma\) (occlusivization) \(X\ X\)  
2) no cont. gem. \(\gamma\) \(u\)  
PLH \(\rightarrow\) spread. (\(V\-I\)) \(\gamma\) \(u\)  

b. Repairing \(O\ N\)  
\(X\ X\)  
\(\gamma\gamma\) (following from the prefixation of a floating slot), which is changed into \([\text{-continuant}]\) in (40b), according to the focus of the constraint against continuant geminates (cf. 2.3, 3.3). The formation of ill-formed geminates is due to a constraint conflict (described earlier in (29)), which is solved by the PLH. The PLH also determines that the constraint against floating slots (a skeletal constraint), which triggers spreading in (40a), has precedence over the constraint against \(\gamma\) (a segmental constraint). In other words, spreading occurs before \(\gamma\)-Delinking applies. Then, occlusivization repairs the ill-formed geminate, bleeding \(\gamma\)-Delinking. The geminate consonant is finally degeminated, since onsets cannot branch in Fula and since vocalic ephenthesis never applies at the beginning of words, and above all never at stratum I.
Obviously this analysis with V-3s resorts to what is traditionally called an "abstract segment" (γ never shows up). The main objection against this type of proposal is usually based on "learnability grounds". How can a child learn such a segment? I maintain that it can be learned by deduction: all voiced stops in Fula have a proper continuant counterpart except g. However, though learnable, such a segment does encounter learnability problems. This is reflected by what we find in other Fula dialects. The only unstable alternations are the ones where γ is posited in the Fula of Fouta Toro, i.e. the dialect studied here; e.g. yertere in (37) has been reanalyzed either as ertere or as gertere in Fula Kunda and woroore 'kola nut' (which patterns with gorooge), as oroore in Fula Kunda and as goroore in Massinankoore.

Thus not only does *γ explain irregular alternations but it also accounts for the learnability problems manifested as unstable alternations among Fula dialects. The only alternative would be to memorize all the alternations. However, this would totally fail to capture the important vocalic regularities discussed above, as well as the fact that g is the only voiced stop without a proper continuant counterpart.

2.5. Constraint on Nuclear Sequences in Fula (cf. Paradis (1986; 1987b))

The constraint discussed in this section prohibits nuclear sequences in Fula. As in 2.2, it is an effect of the OCP, but activated this time on the nuclear tier.

(41) Principle: OCP *N N

Identity: nuclear level

Domain: the whole phonological component

2.5.1. Effects of the constraint in (41).

This constraint can have two effects: it can block the Shortening Rule for markers, or it can cause the delinking of a nucleus.

Blocking of the Shortening Rule for markers. It was said in the course of the discussion on rV markers in 2.3 that the Shortening Rule applies to all nominal class markers at stratum I, except when the application of the rule leads to a constraint violation. This rule, introduced in (25), deletes the first slot of a marker, rendering the attached consonant unpronounceable. The examples in (42) constitute another case where the Shortening Rule is blocked in order to prevent a V-1, namely a violation of the OCP on nucleus sequences.
a. Final vowel
   a\text{\textipa{66u}}-go
   gallaa-\text{\textipa{d\text{"i}}}i
   kippoo-\text{\textipa{d\text{"e}}}e
   *a\text{\textipa{66u}}-o
   *gallaa-\text{\textipa{i}}
   *kippoo-\text{\textipa{e}}
   cheek
   horns
   cap

b. Final diphthong
   kin-\text{\textipa{d\text{"e}}}
   por-go
   dew-gal
   *kin-e
   *por-o
   *dew-al
   parts
   tops
   marriage

The examples in (42b) show that the constraint is not concerned only with vocalic sequences. Indeed, the Shortening Rule is blocked even though the stems end with a consonant. What matters for the constraint in (41) is not the nature of the segment but the fact that it belongs to a diphthong, i.e. a nucleus. Note that nuclei are syllabified before the application of any morphological or phonological rule and that diphthongs are inherently syllabified in Fula (cf. Paradis (1986a;1987b)). This ensures the identification of nuclei before the Shortening Rule applies.

Delinking. This repair strategy applies in the case of a V-2. As morphological operations (affixation) never respect phonological constraints, unlike phonological rules and processes, they are not expected to be blocked in order to avoid a violation. They generate a violation, as in (43), and then a repair strategy applies, which is, here, the delinking of a nucleus. Insertion cannot be selected since there is no default consonant in Fula; cf. also Prunet (1986) for the examples below.

(43) /\text{\textipa{k\circ- a/}}\rightarrow\text{\textipa{k\text{\textipa{a}}}} \quad \text{it is you}...
     /\text{\textipa{m\text{\textipa{b\text{\textipa{e\text{\textipa{l}- a/}}}}}}\rightarrow\text{\textipa{m\text{\textipa{b\text{\textipa{e\text{\textipa{l}- a/}}}}}} \quad \text{are you}...$

As oo and ee are not permissible diphthongs (cf. the Sonority constraint in 2.3), one of the vowels must be deleted, viz. the first one; it was pointed out in the case of the *\text{\textipa{nl}} sequences in 2.3 that Delinking applies to the first segment in default cases. From this delinking follows a compensatory vocalic lengthening, which is produced by the spreading of the second vowel to the preceding floating slot, as illustrated in (44).

(44) Derivation: [\text{\textipa{k\text{\textipa{a}}}]}

a. Suff. $\rightarrow$ N N
   V-2 $\mid$ $\mid$

b. Nucl. del. N N
   & voc. del. $\not\rightarrow$ $\mid$
   X X $\rightarrow$ spread. X X
   $\mid$ $\mid$
   k o a
   k o a
2.6. Sub-Conclusion

Section 2 was devoted to demonstrating that:

a. Morphological operations do not respect phonological constraints. They apply even when they generate a violation (viz. a V-2); e.g.
   i. The pronoun suffixation in Guere (cf. (12) and (19)).
   ii. The -ii suffixation in Fula (cf. (32), (33)).
   iii. The pronoun suffixation in Fula (cf. (43), (44)).

b. By contrast, phonological rules and processes do respect phonological constraints. They are blocked if their application leads to a constraint violation (a V-1); e.g.
   i. The Sonority Constraint in Fula blocks the Shortening Rule for markers in (28) and (31) in order to prevent ill-formed homorganic sequences; cf. dV and VrV variants for rV markers.
   ii. The expected compensatory lengthening of l in poofaili is blocked in (32b) and (34) because consonantal geminates are not permitted in this position (*poofailii).
   iii. The low vowel â in Fula does not spread to the preceding onset in (3), from which y was delinked, because it is not allowed in this position.
   iv. The OCP at the nuclear level in Fula (*NN; cf. (41)) also blocks the Shortening Rule for suffix markers in words such as e66u-gø (*e66-o) in (42), because stems end with a nuclear segment.

c. Constraint violations following from phonological rules or processes (viz. V-1) only occur in case of constraint conflicts (cf. (21) for the derivation *wâ-e (*âe) → *wâ-ë (*wê) → gâe in Guere and (29) for the formation of the disallowed continuant geminate *rr in Fula). It must be noted that these violations, as well as the V-2 listed in (a), occur at the lexical level, and thus infringe the Structure Preservation Principle. Recall that this principle aims at preventing rules or processes of the lexical phonology from creating structures, segments or sequences that are not used distinctively as part of lexical entries.

d. Intra-morphemic constraint violations can be of the V-3 type (cf. (22) for underlying rounded sequences such as * kýu, * gûo, * ñûu in Guere and (36) for the underlying segment *y in Fula), or of the V-1 type (cf. (29) for the formation of a disallowed *rr sequence at the beginning of rV markers; recall that these markers have three skeletal slots). As pointed out in 1.4, intra-morphemic violations cannot be accounted for by the notion of
“invisibility” following from the Morphemic Tier Hypothesis, since this notion refers to distinct morphemes and the violations discussed here occur within a single morpheme. These violations are, however, easily explained in the framework developed in this paper, namely with the notion of constraint domain and the distinction made between the different types of violation, i.e. V-1, V-2, V-3.

e. Constraints, along with phonological rules and processes, have domains, which can be:

i. A lexical stratum; the Sonority Constraint in Fula holds at stratum 1 but not at stratum II.

ii. The lexicon; the constraint on non-high vowel sequences in Guere (cf. (10b)) does not hold at the syntactic level.

iii. The whole phonological component except the morphemic level; the OCP on the labial tier in Guere (cf. (16)) and the constraint against *\(y\) in Fula (cf. (35)) are not activated in the dictionary, i.e. before stems enter the first lexical stratum, but hold everywhere in the phonological component.

iv. The whole phonological component including the morphemic level (cf. section 3).

It is important to note that domains are always continuous. Along with A & P, I claim that discontinuous domains are impossible. However, my position constrasts with theirs (cf. A & P, 35) in that I maintain that a constraint can be activated at a particular stratum (e.g. The Sonority Constraint at stratum I) without holding in the whole lexicon.

f. A single constraint can have several effects.

i. The constraint against non-high vowel sequences in Guere (cf. (10b)) accounts for:
   - Underlying representations in (11);
   - The raising of non-high vowels in (12);
   - The delinking of the low vowel \(a\) in (14).

ii. The OCP on the labial tier in Guere (cf. (16)) accounts for:
   - The delabialization of the rounded glide \(w\) in (19); cf. *\(\text{wo} \rightarrow \text{go}\);
   - The delinking of the rounded glide \(w\) within complex segments in (22); cf. *\(\text{kwu} \rightarrow \text{ku}\).

iii. The Sonority Constraint accounts for:
- Underlying representations;
- The blocking of the Shortening Rule with \( r^\gamma \) markers in (28) and in (30), where ill-formed homorganic sequences would be formed;
- The delinking of \( n \) in *\( n-1 \) sequences in (32).

iv. The constraint against \( *\gamma \) (cf. (35)) indirectly accounts for:
- The glide at the beginning of problematic stems such as \( wor\theta e / \)
- The absence of a glide when the stem begins with the low vowel \( a \) as in \( ab\beta\theta e / gabb\beta \) in (39).

v. Finally, the constraint against nuclear sequences in Fula (cf. (41)) provides an explanation for:
- The blocking of the Shortening Rule when markers are preceded by stems with a final nuclear segment, as in \( \theta\theta\theta u-\theta q \) (*\( \theta\theta\theta u-0 \)) in (42)
- The vocalic delinking in (44), where a vowel pronoun is suffixed to stems with a final vowel; cf. \( k\omega \) (/ko-a/).

There is no way in which a 'rule approach' such as the one proposed in Chomsky & Halle (1968) can link all these effects. In such a framework, a specific context must be provided for each alternation. In addition, blocking effects are analyzed in most cases as exceptions or ad hoc facts because they cannot be related to a general trigger. In other words, the functional sameness of facts (cf. Kisseberth (1970) for this notion), which is easily captured in the framework proposed here, is completely ignored in a rule approach.

3. Configurational Constraints

In this section, we will examine three sets of configurational constraints in Fula and in Guere, i.e. constraints involving "branching". In 3.2 and 3.3, it will be shown that these constraints can have different focuses, on the basis of which the PLH determines precedence in the case of conflicting constraints.

3.1. Constraints on Syllabic Constituents in Fula

The parameters given in (45) all have a syllabic focus; they determine what types of syllables are permitted in Fula. As was pointed out in several places in Section 2, Fula allows branching nuclei but prohibits branching onsets and branching codas.
(45) Parameters: a. Syll. focus b. Syll. focus c. Syll. focus
    \N \C \O
    / \ / \ / \X X X X X X

Domain: the whole phonological component including the morphemic level.

3.1.1. Effect of the parameter in (45a).

The positive setting in (45a) allows long vowels (e.g. heal-de ‘to speak’, foof-de ‘to breath’) and diphthongs (e.g. ter-gal ‘limb’, lam-de ‘vagina’; cf. Paradis (1986a,c; to appear) for more details).

3.1.2. Effect of the parameter in (45b).

The negative setting in (45b) disallows branching codas. When a verbal stem (e.g. a word from stratum II) ends with two consonants, the default vowel \( u \) is inserted as in (46), and a new syllable is created.

(46) \[ /\text{moml}/ \rightarrow \text{moml}-u \quad /\text{majj}/ \rightarrow \text{majj}-u \]

3.1.3. Effects of the parameters in (45b,c).

The negative settings in (45b,c) can have three effects: they can trigger the insertion of the default vowel \( u \); they can block the Shortening Rule (cf. (25) for this rule); they can block a syllabification process.

**Insertion of the default \( u \)**: This repair strategy is triggered in (47) by both constraints in (45b,c). After marker suffixation has applied, a sequence of three consonants is formed. Since the middle consonant cannot attach to the preceding coda or the following onset, the default consonant \( u \) is inserted after the second consonant, which insertion is motivated by syllabic purposes as required in (2).

(47) \[ /\text{moml}-de/ \rightarrow \text{moml}-u-de \quad \text{to scrub} \quad /\text{majj}-de/ \rightarrow \text{majj}-u-de \quad \text{to ignore} \]

**Blocking of the Shortening Rule**: Both constraints also prevent the Shortening Rule from applying to \( rv \) markers (cf. 2.3 for these three-slot markers) when they are preceded by a stem with two final consonants, as in (48). The rule, which should apply to these examples derived at stratum I, is blocked because it would generate a sequence of three non-nuclear consonants. Thus, the floating slot at the beginning
of rV markers remains, to which slot the marker vowel spreads through the dorsal tier (cf. (31) for a similar derivation).

(48)  

<table>
<thead>
<tr>
<th>Word</th>
</tr>
</thead>
</table>
| abb-ere | *abb-re seed  
| talk-uru | *talk-ru amulet  
| lacc-iri | *lacc-ri couscous  

**Blocking on a syllabification process.** In (49), the constraint against branching onsets (cf. (45c)) blocks the syllabification of the onset.

(49)  

<table>
<thead>
<tr>
<th>Word</th>
</tr>
</thead>
</table>
| sof-ru | chick  
| cof-el | little chick  
|        | *ccof-el  

As illustrated in (40), consonantal alternations at the beginning of nouns in Fula are due to the prefixation of a floating slot, triggered by some suffix class markers through parasynthetic constructions (cf. Paradis (1986a)), to which floating slot the initial consonant of a stem spreads. Spreading is caused by the principle against floating slots in (1b); it repairs the V-2 generated by the prefixation in (50a). However, if the consonant which spreads is a continuant, a V-1 is simultaneously created, since continuant geminates are disallowed in Fula (cf. 3.3). Change α (occlusivization in this case) applies to repair the ill-formed geminate generated in the course of the constraint conflict described in (50b).

(50) **Derivation:** [cof-el]

\[
\begin{array}{c}
\text{a. Suff. \& pref. through} \\
\text{parasynthetic constructions} \\
\rightarrow V-2 \\
\end{array}
\]

\[
\begin{array}{c}
\text{b. Constraint conflict:} \\
1) \text{no empty slot, cf. (1b);} \\
2) \text{no cont. geminate, PLH} \\
\text{linking (V-1) and occlusivization} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]

\[
\begin{array}{c}
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\text{X - X X - X X} \\
\end{array}
\]
A Theory of Constraint Violations

c. Syllabification: coda
   (no branching onset)
   | O N O R |
   \ | | | | |
   X - X X - X X
   \ | | | |
   c o f e l

d. Segm. delinking and
   skeletal deletion
   | O - X X - X X |
   \ | | | |
   c o f e l

The onset syllabification process is blocked in (50c) because of the constraint against branching onsets in (45c). In (45d), the segment is delinked from the prefix slot, because this slot fails to be syllabified; I mentioned in 2.4 that Fula does not allow additional syllables at the beginning of stems, which implies that *u-cco(e) is ruled out. In any case, Insertion does not apply at stratum 1. Finally, the slot itself is deleted because of the principle in (1b) that prohibits floating slots.

3.2. Constraints on Light Diphthongs in Guere (cf. Paradis (1983a,b))

There is a general restriction concerning the content of diphthongs: they must always contain a high vowel or consonant, which, I claim, is the effect of a principle. What is parameterized is the position of the high vowel within diphthongs. In English, for example, diphthongs can either begin with a high vowel as in fuse [fyuz] or end with one as in how [həw], toy [toj] and while [həwij] (cf. Kenyon & Knott (1947) for the transcriptions). The same options are available in several French dialects from Quebec (cf. Dumas (1978)). This is not the case in all languages, however. In Guere, as indicated in (51b), a high vowel must make up the first part of a light diphthong. Note that light diphthongs, as opposed to heavy ones, only have one slot (cf. Kaye & Lowenstamm (1984)).

(51) Parameters:  a. Skeletal focus  b. Segm. focus  c. Metrical focus
   X (on)       X (off)       S2 (off)
   / \        / \        I
   V V        V V        X
   [-H]       / \        V V

Domain: the whole phonological component including the morphemic level.

The parameters presented in (51) have different focuses. The first one, which is positively set for diphthongs, focuses on the skeletal structure. The second one, which does not allow diphthongs to begin with a non-high vowel, has a segmental
focus. And the third one, which prohibits diphthongs outside the first syllable (words are maximally bisyllabic in Guere), has a metrical focus.

3.2.1. Effects of the parameters in (51a,b).

As shown in (52), the positive setting in (51a) accounts for diphthongs in Guere, even at the morphemic level. These, of course, always begin with a high vowel as required by the constraint in (51b).

(52)  zià to shake  sìc to go down  duò to take

3.2.2. Effects of the parameter in (51b)

The negative setting in (51b) can have two additional effects: it can trigger Change α (vocalic raising in this case) or the delinking of a vowel.

Change α (vocalic raising). This repair strategy, already discussed in 2.1, modifies the value of the feature [high] according to the constraint focus in (51b). The application of vocalic raising can be observed in (53), where the object pronouns ə, ɛ, ò, selected according to nominal class, form a disallowed diphthong (a V-2) with the last vowel of a nominal stem. Recall that these pronouns, like some other suffixes in Guere, do not have skeletal slots; they attach directly to the final slot of a stem.

(53)  /6iɛ-ɔ, ɛ, ə/ → 6iɔ, 6iɛ, 6iə, 6i → sing PRO
       /zɛɔ-ɔ, ɛ, ə/ → zɔɔ, zɔɛ, zɔə, zɔ → beg PRO

It is important to note that the difference between zɔɔ ‘beg PRO’ (the form with a diphthong) and zɔə ‘make PRO beg’ (the form without a diphthong) is clearly audible.

A derivation is given in (54), where the formation of an illicit diphthong and the subsequent application of vocalic raising are illustrated.

(54) Derivation: [zɔɛ]
    (*zə)    | | | \    | | | \  
               z r c - ɛ    z r o - ɛ
Delinking. Guere resorts to this repair strategy, as in (55), when vocalic raising cannot apply. This is the case with stems that contain the low vowel \( \ddot{a} \), a vowel which cannot be raised in Guere (cf. 2.1.2).

(55) \( \dddot{b}l\ddot{a} - \ddot{a}, \dddot{e}, \ddot{a}, \dddot{i} / \rightarrow \dddot{b}l\ddot{e}, \dddot{b}l\ddot{i}, \dddot{b}l\ddot{a}, \dddot{b}l\dddot{i} \) beat PRO

The derivation of \( \dddot{b}l\ddot{e} \) is given in (56).

(56) Derivation
   a. Suff. \( \rightarrow \ V-2 \) \( X \) \( X \) \( X \)    b. Delinking \( X \) \( X \) \( X \)
   \( (*\dddot{a}l) \) \( \mid \) \( \mid \) \( \mid \) \& deletion \( \mid \) \( \mid \) \( \# \) \( \)
   \( \dddot{b} l \ a - \dddot{e} \) \( \dddot{b} l \ O - \dddot{e} \)

Note that the examples in (53) and (55) differ from those presented in section 2.1 on vocalic sequences. It was shown in 2.1 that vocalic raising and delinking do not apply when the second vowel of a vocalic sequence is high (e.g. \( z\dddot{e} \) and \( b\dddot{a}l\dddot{a} \)) because the constraint in (10b) is only concerned with non-high vowel sequences. By contrast, repair strategies apply in (53) and (55) without consideration for the nature of the pronoun vowel, i.e. the last part of the diphthong. Furthermore, the fact that there is no compensatory lengthening after delinking has applied in (55) (cf. also \( b\dddot{l}l / b\dddot{e}l \) and \( z\dddot{e} \dddot{a} / z\dddot{e} \dddot{a} \dddot{a} / \) in (53)) constitutes another difference with the examples in 2.1. At the same time, it proves that pronouns do not have a skeletal slot (cf. the causative forms in (14) for examples displaying a compensatory lengthening in Guere).

3.2.3. Effect of the parameter in (51c).

The negative setting in (51c) disallows diphthongs which do not belong to the first syllable of a word. This can be observed in (57), where pronoun suffixation automatically triggers the delinking of the preceding vowel.

(57) \( / j\ddot{e}b\dddot{a} - \ddot{a}, \dddot{e}, \dddot{a}, \dddot{i} / \rightarrow j\dddot{e}b\dddot{a}, j\dddot{e}b\dddot{e}, j\dddot{e}b\dddot{a}, j\dddot{b}i \) know PRO
   *j\dddot{e}b\dddot{a} or *j\dddot{b}e

Delinking is caused by the fact that this preceding vowel is the final segment of a bisyllabic stem and would form a diphthong in an illicit position, as shown in (58). Since the constraint in (51c) is not concerned with the segmental content of diphthongs but with their metrical position, the application of Change \( \alpha \) would be useless. The first vowel of the sequence, i.e. the stem vowel, undergoes delinking because the second vowel belongs to the object pronouns, which are inalterable in Guere (cf. 2.1).
(58) Derivation

\[
\begin{array}{cccc}
N_1 & N_2 & N_1 & N_2 \\
\mid & \mid & \mid & \\
a. \text{Suff. } \rightarrow \text{V}-2 & X & X & X & \text{b. Delinking} & X & X & X & X \\
\text{(no diphthong)} & \mid & \mid & \mid & \& \text{deletion} & \mid & \mid & \mid \\
in N_2 & j & i & ë & o & \text{-} & \varepsilon & j & i & ë & ë & \text{-} & \varepsilon
\end{array}
\]

Obviously, the constraint in (51c) is metrically conditioned, since it is sensitive to the length of words; nevertheless, this will not be further discussed because of the limits of this paper. A similar constraint is displayed in the next section.

3.3. Constraints on Geminates in Fula (cf. Paradis (1986a; to appear))

Geminates are highly restricted cross-linguistically. In Ruhlen (1975), it is shown that out of 800 languages only 90 can have consonantal geminates, and only 30 can form geminates with all their consonants. Many languages can only form geminates with certain consonantal classes. This is the case in some French dialects, where geminates are restricted to sonorants, e.g. grammair /grammar/, allocation /allokasya/, pourrait /purrɛ/. Some other languages, such as Ardi and Orok, do not even have geminate natural classes. In this respect, Fula is no exception since it is also subject to restrictions. The first parameter in (59a) indicates that Fula allows geminates, whereas the second, (59b), shows that these are limited to the class of non-continuant consonants. The third parameter in (59c) disallows geminates whose initial part is not attached to the first syllable of a word.

(59) Parameters: a. Skeletal focus b. Segm. focus c. Metrical focus

\[
\begin{array}{ccc}
X & X & (on) \\
\backslash / & \backslash / & S_2-3 & (off) \\
C & C & X & X \\
{[+cont]} & \backslash / & C
\end{array}
\]

Domain: the whole phonological component including the morphemic level.

3.3.1. Effect of the parameters in (59a,b).

The positive setting in (59a) accounts for the presence of geminates in the Fula stems given in (60). These geminates, of course, are always non-continuant, as required by the constraint in (59b).
(60) d'ojj-u-de 'to cough' fett-u-de 'to kick' tikk-u-de 'to get mad'

3.3.2. Effect of the parameter $\alpha$ in (59b).

This constraint, referred to on several occasions in the preceding sections, triggers a sole repair strategy: Change $\alpha$, which modifies the value of the feature [+continuant] attached to ill-formed geminates, in order to make them conform to the constraint in (59b). Change $\alpha$ (occlusivization in this case) applies in the second column of the following examples because the suffix-class marker -i, which contains a floating slot, triggers the gemination of the stem's final continuant consonant.

(61)

| nof-ru  | nopp-i²  | ear |
| saw-ru  | cebb-i   | stick |
| wuy-6a  | gujj-o   | thief |
| kos-am  | kocc-e   | milk |

A derivation is given in (62), where it can be seen that gemination goes through a constraint conflict similar to the ones discussed in 2.4 and 3.1.

(62) Derivation: [noppj]

a. Suffixation $\rightarrow$ V-2.

| N | N |

Constraint conflict:

1) no floating slot; $XXX - XX$

2) no continuant gem. $| | | |$

b. PLH $\rightarrow$ linking (V-1) $XXX - XX$

& occlusiviz. (repairing) $| | | / |$

At first, one can think of three different strategies to solve the conflict which arises in (62a): 1) delete the floating skeletal slot; 2) link the marker vowel $i$ to the floating slot; 3) link the continuant consonant $\_i$ to the floating slot. Epenthesi is not available since there is no syllabic purpose involved and, furthermore, Fula does not have any default consonant. The first alternative is

² The diminutive forms are nof-el (sing.) and nof-on (plur.), saw-el and saw-on, etc.
ruled out because, according to the PLH, a slot cannot be deleted because of a segment except if there is no other way of repairing the violation. The onset slot is deleted in (39), because the vowel a of the following nucleus can absolutely not spread to an onset position, since it is low and it cannot be raised. The second alternative, where the marker vowel j links to the floating slot, is also ruled out. A nuclear segment does not spread to a non-nuclear position if a non-nuclear segment is available (cf. the priority for spreading in (1c)). Moreover, nouns cannot end with long vowels in Fula. The only possibility left is to link the continuant consonant and resort to Change α (occlusivization).

3.3.3. Effect of the parameter in (59c).

The negative setting in (59c) has the effect of blocking the coda syllabification process (cf. the derivation below), which results in consonantal degemination and, subsequently, vocalic compensatory lengthening, displayed in the second column of the following examples (cf. also poofaali *poofallii in (34)).

(63) sing (strat. I) plural (strat. II) diminutive gloss
martu martuu-j-i martu-y-el hammer
dag-ki dan̥kii-j-i dag-ki-y-el stool
duk-o dukoo-j-i duko-y-el argument

These examples are default forms (plural and diminutive) derived at stratum II from singular words derived themselves at stratum I. A suffix y is inserted between the singular forms and the final nominal class markers suffixed at stratum II. When the marker is -j, that is, the one with a floating slot, the suffix y must geminate and subsequently undergo occlusivization because of the constraint in (59b). This gemination, however, generates a potential violation of the constraint in (59c), which is detected when the metrical structure is finally erected. The strategy adopted in order to prevent this violation is, of course, blocking: geminates must not be syllabified in illicit positions. This causes the delinking of j <-y/ from its first skeletal slot (segments cannot remain attached to non-syllabified slots), and subsequently the compensatory lengthening of the preceding vowel as illustrated in (64).

(64) Derivation
   a. Suff. → V-2
      (no floating slot)                           O   N   C   O   N   N
                                |||||     |
                                XXXXX XXX-XXX
                                |||||     |
                                mar   t   u   y   i
b. Linking &
occlusive

\[ \begin{array}{cccccccc}
\text{O} & \text{N} & \text{C} & \text{O} & \text{N} & \text{N} \\
\text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{m} & \text{a} & \text{r} & \text{t} & \text{u} & \text{j} & \text{i} \\
\end{array} \]

\[ \text{c. Syllabification &} \]

\[ \begin{array}{cccccccc}
\text{O} & \text{N}_1 & \text{C} & \text{O} & \text{N}_2 & \text{O} & \text{N}_3 \\
\text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{m} & \text{a} & \text{r} & \text{t} & \text{u} & \text{j} & \text{i} \\
\end{array} \]

\[ \text{(no coda; cf. (59c))} \]

\[ \begin{array}{cccccccc}
\text{d. Cons. delinking} & \text{&} & \text{compens. lengthening} \\
\text{O} & \text{N}_1 & \text{C} & \text{O} & \text{N}_2 & \text{O} & \text{N}_3 \\
\text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} & \text{X} \\
\text{m} & \text{a} & \text{r} & \text{t} & \text{u} & \text{j} & \text{i} \\
\end{array} \]

This derivation shows clearly that Delinking and Deletion constitute different stages. The first slot of the disallowed geminate in (64d) is only delinked, not deleted, from its segment j; otherwise, no subsequent vocalic compensatory lengthening could be posited, which is not the case (*martuji). Another important conclusion can be drawn: a segment never recuperates its initial quality even when the conditioning for a change disappears. Indeed, j in (64d) does not retrieve its [+continuant] feature value, i.e. it does not turn into y again(*martuuyi), although it is no longer a geminate and no longer governed by the constraint in (59b). Guere adduces additional evidence. Consider \text{wōō} 'shout it', which went through a diphthong stage, viz. *wōō → wōō → wōō, where the first vowel of the sequence was raised because of the constraint on light diphthongs in (51b); this vowel does not retrieve its initial quality after the diphthong configuration was undone by the suffixation of an extra slot.

Along with the Guere constraint in (51c) that prohibits diphthongs which are not contained in the first syllable, the Fula constraint in (59c) restricts a configuration type, i.e. geminates, to the initial syllable of a word. Here again, I claim that this restriction is metrically conditioned, since it is sensitive to the length of words. However, I will not dwell here on this conditioning any more than in the preceding section. The negative setting in (59c) was mostly intended to show that constraints can have different focuses, which can be, as in this case, metrical.
4. Conclusion

This paper was intended to shed light on three crucial aspects of constraints, in addition to the ones discussed in the sub-conclusion in 2.6. The first is the many-to-many relation of constraints and repair strategies illustrated in (65).

\[
\begin{array}{ccc}
R.S.1 & R.S.2 & R.S.3 \\
\hline
\text{Cons.1} & \text{Cons.2} & \text{Cons.3}
\end{array}
\]

I came to the conclusion in 2.6 that a single constraint can have several effects and be preserved by several repair strategies. I want to point out now that the reverse is also true: a single repair strategy can preserve several constraints, as summarized in (66).

(66) **Repair Strategy Summary**

a. Delinking applies to:

i. a followed by a non-high vowel in Guere, e.g. (14).

ii. w within *w* sequences in Guere, e.g. (22).

iii. n within *n* sequences in Fula, e.g. (32).

iv. the segment *y* in Fula, e.g. (38).

v. a floating skeletal slot in an empty onset followed by a in Fula, e.g. (39).

vi. the first N in *NN* sequences in Fula, e.g. (43).

vii. a within a ligh diphthong in Guere, e.g. (55).

viii. geminates which are not attached to the first syllable of a word, e.g. Degemination in (57).

b. Change α applies to:

i. the first vowel of non-high vowel sequences in Guere; cf. vocalic raising in (12).

ii. *w* sequences in Guere; cf. delabialization (*w* → *go*) in (19).

iii. the initial non-high vowel of a light diphthong; cf. vocalic raising in (53).

iv. non-continuant geminates in Fula (cf. occlusivization in (61)).

The same repair strategy can apply in different languages but also for different purposes in a single language. This is the case with Guere, where Change α (vocalic raising) affects non-high vowel sequences in (12) as well as light diphthongs in (53). Moreover, Delinking repairs *aV* sequences in (14) in addition to *aV* diphthongs in (55). This multi-context application of repair strategies enables
us to reduce phonological alternations to a very small set of highly constrained processes, viz. Insert, Delete, Change $\alpha$, in addition to expurgating cumbersome "triggers" from process descriptions.

Another aspect which I have emphasized is that configurations are usually highly restricted. For example, few languages have geminates or complex segments, and, in most cases, only certain types are allowed (cf. Ruhlen (1975)). Configurations are also often metrically conditioned, i.e. they are limited to certain positions within a word (cf. 3.2 for light diphthongs in Guere and 3.3 for geminates in Fula). Thus there is nothing bizarre in analyzing an alternation as the result of a repair strategy triggered by a constraint in contrast with the more traditional conception of phonological rule, even when there is only one repair strategy to justify the constraint. For instance, given all the configurational restrictions found in languages, I argue that the despirantization of continuant geminates in Fula follows from a constraint, viz. the constraint in (59b), as opposed to an absolute neutralization rule, despite the fact that despirantization constitutes the unique effect of this constraint. In other words, although one of the most important advantages of the framework proposed here over a rule approach is to link numerous apparently unrelated facts in a single language as well as cross-linguistically (cf. the sub-conclusion in 2.6), one cannot expect all constraints to be preserved by several repair strategies (especially if we consider that failures in connecting facts are often due to our poor understanding of languages).

The notion of "constraint focus" is the last aspect to be underlined. This notion is crucial to configurational constraints, especially in a constraint conflict, since all configurations involve several phonological levels simultaneously. However, it was demonstrated in 3.2 and 3.3 that configurational constraints, in spite of involving several phonological levels, always refer to or focus on one level at a time. The PLH (the Phonological Level Hierarchy) resorts to this notion in order to determine precedence among conflicting constraints. The theoretical refinements represented by the notions of "constraint focus" and "constraint domain" (cf. 2.6), as well as the PLH itself, are quite inexpensive for UG in comparison with the important advantages they offer, especially as the notion of constraint domain parallels that of "process domain" proposed by several lexical theories (cf. Mohanan (1986), Kiparsky (1982; 1985)). As for the notion of "repair strategy", triggered by a constraint (a negative parameter or a principle), I have demonstrated in 2.6 that it clearly constitutes a simplification of UG in addition to capturing important generalizations.
References


Résumé

Les contraintes phonologiques ont beaucoup été utilisées au cours des dernières années, particulièrement pour résoudre des problèmes de "conspirations" (cf. Kenstowicz et Kisseberth (1977)). Toutefois, comme celles-ci n'ont jamais été intégrées dans un cadre formel, on peut se demander: où se situent-elles dans la grammaire universelle (UG)? Ce papier, en les analysant comme des paramètres négatifs, permet de les relier tout naturellement à UG. Cette proposition fournit aussi un cadre théorique approprié au traitement des violations de contraintes (leur systématisation) et permet de rendre compte de l'interaction de la composante morphologique avec les contraintes (par exemple, les domaines de contraintes et les violations issues des opérations morphologiques) ainsi que de la forme et de l'universalité des processus phonologiques. De manière générale, ce papier, par l'analyse de 6 contraintes en pulaar (iku) et en guéré, veut offrir une vue d'ensemble sur le fonctionnement des contraintes, les causes de leur violations et les processus qui les réparent, ceci tout en faisant ressortir les avantages certains des contraintes sur une approche par des règles de type SPE.