Anti-Structure Preservation Effects in Optimality Theory*

T. A. Hall
University of Leipzig
hall@rz.uni-leipzig.de

Abstract

The present study examines a particular kind of rule blockage – referred to below as an 'anti-structure-preservation effect'. An anti-structure-preservation effect occurs if some language has a process which is preempted from going into effect if some sequence of sounds [XY] would occur on the surface, even though other words in the language have [XY] sequences (which are underlyingly /XY/). It will be argued below that anti-structure-preservation effects can be captured in Optimality Theory in terms of a general ranking involving FAITH and MARKEDNESS constraints and that individual languages invoke a specific instantiation of this ranking. A significant point made below is that while anti-structure-preservation effects can be handled straightforwardly in terms of constraint rankings they typically require ad hoc rule-specific conditions in rule-based approaches.

1 Introduction

In many languages one can observe regular phonological processes which fail to go into effect in some well-defined context – a situation which is usually referred to in the literature as a *blocking effect*. What is typically the case with blocking effects is that the process does not apply if some structure would be created which does not exist at all in that particular language. Thus, if a phonological rule introduces the sound [X] in a language L_1 and if the rule is blocked in words in which [Y] would surface in the neighborhood of the sound [X], then the usual assumption is that the blocking effect occurs because there are no surface sequences of [XY] (or [YX]) in L_1.

In this article I discuss blocking effects which are similar to the one described above for L_1 with the sole exception that the language which has the blocking effect (L_2) has at least some words which contain the surface sequence [XY] (which corresponds to /XY/). In other words, the process introducing [X] is blocked in L_2 in some environment not *because* L_2 does not allow [XY], but instead it is blocked *even though* L_2 has some [XY] sequences. Thus, the [XY] sequences in L_2 can be thought of as being 'anti-structures', since these are precisely the sequences which are penalized by the constraint which is responsible for the blocking effects. For this reason the kind of blocking effect described above for L_2 is an example of what will be referred to below as an *anti-structure preservation effect*.

In this article I present several examples of anti-structure preservation effects and argue that they all fall out in an Optimality Theoretic (henceforth OT; Prince & Smolensky 1993) analysis given a general ranking scheme involving certain FAITH and MARKEDNESS constraints. It will be emphasized repeatedly below that many anti-structure preservation effects are problematic for rule based theories because they typically require *ad hoc*, rule-specific conditions.

This article is organized in the following way. In §2 I present a formal account of how blocking effects are captured in the OT model. In §3 I show that there is a general ranking for anti-structure preservation effects which can be derived by a simple permutation of two

* Thanks are due to Stuart Davis, Silke Hamann, Evan Mellander and Marzena Zygis for comments on an earlier version of this article. All disclaimers apply.

constraints in the general scheme for blocking effects. The remainder of that section is devoted to a series of case studies in which the general ranking for anti-structure preservation effects is instantiated with specific FAITH and MARKEDNESS constraints. §4 concludes.

2 Blocking effects

Many languages have regular processes which are blocked from applying if the output would contain some illicit structure. In this section I summarize briefly how such blocking effects are accounted for in the OT model (see McCarthy 2002: 26-29 for recent discussion, as well as Prince & Smolensky 1993: 33ff.).

In OT the change from some input to an output which is distinct is typically captured with the general ranking MARKEDNESS » FAITH. Thus, consider a language in which vowel-initial syllables are avoided on the surface by the epenthesis of a glottal stop, e.g. a sequence /apa/ surfaces as [ʔapa]. From a formal point of view these facts are captured by ranking the FAITH constraint DEP-C below the MARKEDNESS constraint ONSET: ONSET » DEP-C.

The blocking effects referred to above come about if the output of a particular process would violate a second constraint, which belongs either to the MARKEDNESS or to the FAITH family (e.g. a POSITIONAL FAITH constraint). Since the examples I discuss in this article all involve the domination of one MARKEDNESS constraint by another one, I restrict my discussion of blocking effects to the case of MARKEDNESS A » MARKEDNESS B, as opposed to FAITH » MARKEDNESS B. This general constraint schema for blocking effects is presented in (1). Here and below MARKEDNESS and FAITH are abbreviated as M and F respectively.

(1) General ranking for blocking effects (first version):

M_A » M_B » F_B

'F_B' is understood to be a collective term describing FAITH constraints which have the function of militating against the alternation of an input so that it would satisfy M_B.

An example of a blocking effect from Dutch illustrates the general ranking in (1) (see McCarthy 2002: 26-27, who cites Booij 1995). Dutch requires the ranking ONSET » DEP-C to capture formally the epenthesis of a glottal stop at the beginning of syllables which would be vowel-initial, as described in the hypothetical language above, e.g. Dutch /aorta/ 'aorta' surfaces as [ʔa.ˈʔor.ta]. The blocking effect can be observed in unstressed non-word-initial syllables, e.g. /farao/ 'Pharaoh' surfaces as [ˈfa.ra.o] and not as [ˈfa.ra.ʔo]. This blocking effect is captured by ranking ONSET below a MARKEDNESS constraint which prohibits [ʔ] from serving as the onset of an unstressed non-word-initial syllable (*ʔV).

The analysis described above is captured in the following two tableaus for [ʔa.ˈʔor.ta] and [ˈfa.ra.o]. These specific examples illustrate the general ranking in (1): M_A (*ʔV) » M_B (ONSET) » F_B (DEP-C).

(2)	/aorta/	*ʔV	ONSET	DEP-C
a.	[ʔa.ˈor.ta]		*!	*
b.	☞ [ʔa.ˈʔor.ta]			**

(3)

	/farao/	*ʔV	Onset	DEP-C
a.	☞ [ˈfa.ra.o]		*	
b.	[ˈfa.ra.ʔo]	*!		*

In the first tableau the form in (2b) is optimal because (2a) violates ONSET. In (3) candidate (3a) is correct because (3b) does not satisfy *ʔV.[1]

The blocking effects discussed above are usually assumed to be *pervasive* in the sense that the structure prohibited by M_A does not exist anywhere in the language at all. This tacit assumption is captured by ranking M_A ahead of FAITH constraints which militate against altering an input sequence so that it would satisfy M_A – FAITH constraints which I refer to below collectively as ‘F_A’. The role of F_A with respect to the Dutch example can be illustrated by considering a hypothetical word with a sequence of unstressed (word-internal) [ʔV], say in a loanword of the form /ˈtaraʔo/. In this case an example of an F_A constraint would be IDENT-IO, since the change of the [ʔ] in the input /ˈtaraʔo/ to some other consonant would cause the output to be in line with *ʔV. e.g. /ˈtaraʔo/ → [ˈta.ra.ko]. Consider now the tableau in (4), in which the output form is one without the glottal stop:

(4)

	/ˈta.ra.ʔo/	*ʔV	IDENT-IO	Onset	DEP-C
a.	[ˈta.ra.ʔo]	*!			
b.	☞ [ˈta.ra.ko]		*		

In this tableau we can observe that the winner in (4b) is selected over the form which violates *ʔV (i.e. 4a) because of the ranking *ʔV » IDENT-IO (or more generally M_A » F_A). Note that F_A could be some other constraint which has the same function as IDENT-IO, i.e. a constraint which militates against a change which would bring the sequence into conformity with *ʔV, e.g. DEP-V, or MAX-C. (Note that in my analysis it is not crucial whether or not the correct output form is [ˈta.ra.ko], as in (4), or some other one, e.g. [ˈta.ra.o]).

The general ranking for blocking effects (taking now into consideration the pervasiveness of M_A) can now be stated in (5).

(5) a. General ranking for blocking effects:

M_A » M_B » F_B

b. General ranking capturing the pervasiveness of M_A:

M_A » F_A

An examination of the ranking required for Dutch in (2-4) reveals that this is a language-specific instantiation of the general ranking in (5a-b).

3 Anti-structure preservation effects

Imagine that there is some language L_1 like Dutch, in which blocking effects can be observed. From a formal point of view we would say that L_1 has the ranking in (5a-b). Imagine now a second language L_2, in which a blocking effect requires the ranking in (5a), but that in contrast to L_1, there are surface structures in L_2 which violate M_A. From a formal point of view L_2 does not have the ranking in (5b), but instead the one in (6). For reasons to be made

[1] Other FAITH constraints (e.g. MAX-V) and the candidates that violate them have been omitted from the tableaux in (2) and (3) so as not to detract from my goal of illustrating the ranking in (1).

clear below I refer to the situation captured with the ranking in (6) as an ‘anti-structure preservation effect’.

(6) General ranking for anti-structure preservation effects:

$F_A \gg M_A \gg M_B \gg F_B$

A hypothetical example of L_2 would be a language like Dutch, with the only difference being that in L_2 there are words like the one in (4) which surface faithfully, i.e. (4a) is the correct output form and not (4c).

The ranking in (6) is referred to as an ‘anti-structure preservation effect’ because the blocking effects which can be observed (in a certain set of words) are contradicted by the existence of ‘anti-structures’ (in a different set of words), where ‘anti-structures’ are defined as those structures prohibited by M_A. Thus, the ranking scheme in (6) (in particular $F_A \gg M_A$) has the function of preserving the anti-structures. The effects of the ranking in (6) are summarized in (7):

(7)

RANKING:	EFFECT:
a. $M_B \gg F_B$:	A process P of the form /Z/ $\rightarrow$ [X] / __ [Q] goes into effect. M_B penalizes [ZQ]. F_B penalizes the change from /Z/ to [X].
b. $M_A \gg M_B$:	A blocking effect: Process P does not go into effect if the output would consist of a sequence of sounds [XY] (or [YX]). M_A penalizes surface sequence [XY] (or [YX]).
c. $F_A \gg M_A$:	An input /XY/ (or /YX/) (the anti-structure) surfaces as [XY] (or [YX]). F_A penalizes any change which prevents /XY/ from surfacing as such.

Put differently, anti-structure preservation effects come about if a language has a regular phonological process which is blocked from applying in a certain set of examples, even though the output would create a sequence of sounds which already exists in the language. It should be noted here that no claim is being made here concerning the number of words which have anti-structures; in some of the examples discussed below there seem to be several dozen, while other examples only appear to have a handful. The important point is that the ranking $F_A \gg M_A$ ensures that these anti-structures surface as such.

It should be emphasized that the existence of anti-structure preservation effects should come as no surprise at all given the OT analysis of blocking effects in (5). Since the OT model predicts that any given ranking can show permutations in other languages it would actually come as a surprise if there were no examples of anti-structure preservation effects.

An important point I make below is that while the OT model captures all anti-structure preservation effects in a unified manner (i.e. as specific instantiations of the general ranking in 6), rule-based approaches cannot do so. Some of the examples discussed in this article can only be captured in a rule-based analysis with *ad hoc*, rule-specific conditions. Other examples require no such stipulations, instead the contrast between [XY] sequences banned by M_A and the [XY] anti-structures are accounted for representationally. The advantage of the present approach is that all examples of anti-structure preservation effects are captured the same way and that no rule-specific conditions nor contrastive phonological representations are necessary.

In the remainder of this section I discuss four sets of examples of anti-structure preservation effects. In §3.1-§3.2 I present examples from German and Gujarati respectively of segmental processes illustrating the necessity of the general ranking in (6). In §3.3-3.4 I show that two languages are attested in which anti-structure preservation effects can be observed with respect to processes involving the formation of glides from the corresponding high vowels, namely German and French. Finally, I show in §3.5 that the 'anti-gemination' effects in Afar (McCarthy 1986) are also a subcase of anti-structure preservation effects. In §4 I conclude.

3.1 German assibilation

In German a /t/ assibilates to [ts] before the palatal glide [j] but the process is consistently blocked after a sibilant. In this section I demonstrate that this is an example of an anti-structure-preservation effect (since German allows for sequences of adjacent sibilants) and that the most insightful analysis of the data requires a specific version of the general constraint ranking in (6). It will also be shown that the present treatment is superior to any conceivable rule-based one because rule-based treatments require an *ad hoc* rule-specific condition to account for the blocking effect after sibilants. The examples below have been drawn from Drosdowski *et al.* (1990) and the analysis has been adapted from Hall (2003a).

The following examples illustrate an alternation between the stop [t] and the affricate [ts]. In the first column we can observe the alternant with the affricate and in the corresponding line of the second column the alternant with [t]. These examples illustrate that the affricate [ts] surfaces consistently before suffixes beginning with the palatal glide [j], namely *–ion*, *–iös*, *–iell*, *–ial*, *–ium*, *–ien* and *–ius*:[2]

(8) Alternations between [t] and [ts] before [j]:

Negation	[negaˈtsjoːn]	'negation'	negativ	[ˈneːgatiːf]	'negative'
infektiös	[ɪnfɛkˈtsjøːs]	'infectious'	Infekt	[ɪnˈfɛkt]	'infection'
existentiell	[ɛksɪstɛnˈtsjɛl]	'existential'	existent	[ɛksɪˈstɛnt]	'existent'
exponential	[ɛksponɛnˈtsjaːl]	'exponential'	Exponent	[ɛkspoˈnɛnt]	'exponent'
Konsortium	[kɔnˈzɔɐtsjʊm]	'syndicate'	Konsorten	[kɔnˈzɔɐtən]	'gang'
Kroatien	[kʀoˈaːtsjən]	'Croatia'	Kroate	[kʀoˈaːtə]	'Croat'
Mauritius	[maʊˈʀiːtsjʊs]	'Mauritius'	mauritisch	[maʊˈʀiːtɪʃ]	'mauritian'

The generalization that can be gleaned from (8) is that /t/ assibilates to [ts] before the palatal glide [j].[3] I analyze this as an operation that alters the value of the feature [strident] (see Hall 2003a, who follows Clements 1999 and Kim 2001 for assibilations in other languages); thus the nonstrident sound /t/ becomes the corresponding affricate [ts] (=[+strident]) before /j/.

---

[2] In Standard German (see Drosdowski *et al.* 1990) there are said to be two phonetically distinct *j* sounds, namely a glide (sometimes transcribed as [i̯]) and the voiced palatal fricative (=IPA [ʝ]). According to Hall (1992) and Wiese (1996), who both base their analyses on Drosdowski *et al.* (1990), [ʝ] surfaces in absolute syllable-initial position (e.g. *Jahr* [ʝaːɐ] 'year'), and the glide as the second member of an onset cluster (e.g. *Union* [u.ni̯oːn] 'year') and as the second member of the diphthong [aɪ̯], e.g. *Zeit* [tsaɪ̯t] 'time'. In this article I transcribe all '*j* sounds' consistently as [j] because the alleged distinction between [ʝ] and [ɪ̯] is irrelevant.

[3] In the literature on German phonology it is usually assumed that the palatal glide in words like the ones in (8) is derived from a short high unrounded vowel by a rule of Glide Formation (see Wurzel 1970, Kloeke 1982, Hall 1992, Yu 1992 and Wiese 1996; see also Trubetzkoy 1939 and Moulton 1962). In the remainder of this section I abstract away from the analysis with /i/ for simplicity and therefore assume that all glides are underlyingly /j/. My assumption concerning the underlying form does not affect my analysis. In §3.3 below I show how [j] derives from /i/ and that this process of glide formation exhibits yet another example of an anti-structure preservation effect.

This analysis follows from the fact that the creation of sibilants from stops has its phonetic origin in the brief period of turbulence which occurs at the release of a stop into the tongue position required for a high vocoid (see Clements 1999 and Kim 2001).

One important point regarding the process of assibilation is that the change from /t/ to [ts] before [j] is not restricted to a derived environment (see Hall 2003a for discussion). Although there are few examples of tautomorphemic /tj/ sequences which could potentially convert to [tsj], many speakers do assibilate in these examples (e.g. recent loanwords like *Patio* and *Pentium* surface as [patsjo] and [pɛntsjʊm] respectively for many speakers). What is more, in nonce words /t/ assibilates to [ts] for many speakers even when there would be no reason for assuming a morpheme boundary between /t/ and /j/, e.g. *fetiolisch*, which can surface as [feˈtsjoːlɪʃ].[4]

The first component of my analysis is the general MARKEDNESS constraint in (9), which penalizes the surface sequence [tj].

(9) MARKEDNESS constraint:
*tj: [tj] is prohibited

The MARKEDNESS constraint in (9) probably has an explanation grounded in perception. For example, Flemming (1995: 120ff.), following earlier work by H. Kawasaki, which I have not seen, argues that the sequence coronal plus palatal glide is marked from a cross-linguistic point of view and that the explanation for the dispreference for such sequences in natural languages is grounded in perception. At present I have no explanation for why /tj/ should be singled out in German from the other coronal plus /j/ sequences, but I assume that there is some kind of explanation grounded in perception.

The MARKEDNESS constraint in (9) conflicts with the FAITH constraint which has the function of preventing /t/ from converting into the affricate [ts]. As noted above, I assume following several authors (e.g. Jakobson *et al.* 1952, LaCharité 1993, Rubach 1994, Clements 1999, Kim 2001, Kehrein 2002) that stops differ from the corresponding affricates in terms of the feature [strident]. Thus, according to this view a stop like /t/ is [–strident] and an affricate like /ts/ is [+strident]. The general FAITH constraint militating against a change in the feature [strident] is presented in (10a). As I argue below, the German facts can only be accounted for if reference is made in the constraint hierarchy for German to the two specific constraints in (10b) and (10c), which refer to the positive and negative values of [strident]. The former one penalizes an intput /t/ that surfaces as [ts] and the latter militates against the change from /ts/ to [t].

(10) FAITH constraints:
a. IDENT (±STRID): If an input segment is [□strident] then the corresponding output segment is [□strident].
b. IDENT (–STRID): If an input segment is [–strident] then the corresponding output segment is [–strident].
c. IDENT (+STRID): If an input segment is [+strident] then the corresponding output segment is [+strident].

[4] Assibilation is regularly blocked across a compound juncture and in personal names (e.g. *Katja* [katja]). See Hall (2003a) for discussion.

The evidence for splitting up the general IDENT constraint in (10a) into the specific constraints referring to the positive and negative values of [strident] is that the latter two occupy different positions in the language-specific constraint hierarchy for German (see below).

Given the language-specific ranking *tj » IDENT (–STRID), an input sequence /tj/ is correctly predicted to assibilate to [tsj]. This point is illustrated in the tableau in (11) for the word *Negation*, which is representative of the general pattern in (8).

(11)

	/negatjoːn/	* tj	IDENT (–STRID)
a.	[negatjoːn]	*!	
b.	☞ [negatsjoːn]		*

In (11) we can see that the assibilation of /t/ to [ts] before [j] is analyzed as a conflict between MARKEDNESS and FAITH. The fully faithful candidate (11a) is not optimal because it violates the high ranking MARKEDNESS constraint banning [tj] sequences. Candidate (11b), although unfaithful to its input, emerges as optimal because it satisfies the MARKEDNESS constraint *tj.

The following words contain a [tj] sequence which is preceded by a sibilant (=[s]).[5] As indicated in the phonetic transcription, no assibilation occurs. Note that the words in (12) contain some of the suffixes in (8) which regularly trigger the general assibilation rule, i.e. *-ion*, *-ial*, *-ium*.

(12) No assibilation after sibilants:

Bastion	[basˈtjoːn]	‘bastion’
Bestie	[ˈbɛstjə]	‘beast’
bestialisch	[bɛsˈtjaːlɪʃ]	‘bestial’
Indigestion	[ɪndigɛsˈtjoːn]	‘indigestion’
Autosuggestion	[ˈaʊtozʊgɛstjoːn]	‘autosuggestion’
Ostium	[ˈɔstjʊm]	‘ostium’

By contrast, assibilation is not blocked if any other consonant precedes, cf. the examples *infektiös, existentiell, Konsortium* in (8). There apparently are no examples of a [tj] sequence which is preceded by a nonsibilant fricative (i.e. [f] or [ç]) or lateral. I assume that these gaps are accidental. Significantly, assibilation in the examples in (12) is blocked even though German allows underlying [sts] sequences. Examples of German words with underlying [sts] are presented in (13). In (13a) we see the [sts] sequence between two vowels and in (13b) between a consonant and a vowel.

(13) Underlying tautomorphemic /sts/ sequences:

a.	Disziplin	[dɪstsiˈpliːn]	‘discipline’
	Faszination	[fastsinaˈtsjoːn]	‘fascination’
	Aszendent	[astsɛnˈdɛnt]	‘ascendant’
	Oszillograph	[ɔstsɪloˈgʀaf]	‘oscillograph’
b.	obszön	[ɔpˈstsøːn]	‘obscene’
	exzentrisch	[ɛkˈstsɛntʀɪʃ]	‘excentic’
	excellent	[ɛkstsɛˈlɛnt]	‘excellent’

[5] Apparently the only sibilant which can precede a [tj] sequence in German is [s].

exzessiv	[ɛkstsɛˈsiːf]	‘excessive’
Inszenierung	[ɪnstseˈniːʀʊŋ]	‘production’
transzendental	[tʀanstsɛndɛnˈtaːl]	‘transcedental’

[sts] also occurs word-initially in *Szene* [ˈstseːnə] ‘scene’. Underlying [stsj] sequences are difficult to come by. One example listed in Drosdowski *et al.* (1990) is *Faszie* [fastsjə] ‘fascia, bandage’.

In the analysis that follows I account for the fact that assibilation is blocked from operating after a sibilant even though other words in the language contain adjacent sibilants. The first constraint required is the specific FAITH constraint in (10c), which militates against a change from strident to nonstrident (e.g. /ts/ to [t]). The second component constraint is the MARKEDNESS constraint in (14), which prohibits a sequence of two adjacent sibilants. The same constraint is also posited by Russell (1997: 122) and Gussenhoven & Jacobs (1998) on the basis of English data.

(14) A MARKEDNESS constraint:
*SIBSIB: A sequence of two sibilants is prohibited

The seven sibilants of German are [s z ʃ ʒ ts tʃ dʒ], the only segments in the language I analyze as [CORONAL, +strident]; the one [+strident] sound which is not coronal is the affricate [pf]. I assume that the MARKEDNESS constraint in (14) is OCP-based in the sense that it refers to a sequence of two [CORONAL, +strident] segments.

Given the language-specific ranking in (15), all of the data presented in this section can be accounted for. Here we see that the first two constraints are ranked IDENT (+STRID) » *SIBSIB and the lower two *▯[tj » IDENT (–STRID). Recall from (9) that the latter ranking is necessary to account for the change from /t/ to [ts].

(15) IDENT (+STRID) » *SIBSIB » *tj » IDENT (–STRID)

The ranking in (15) – to be illustrated below with specific examples – is a specific instantiation of the general ranking schema in (6) for anti-structure preservation effects.

That *SIBSIB outranks *tj is shown in the tableau in (16) for the word *Bastion*, which is representative of the words in (12).

(16)

	/bastjoːn/	IDENT (+STRID)	*SIBSIB	*tj	IDENT (–STRID)
a.	[bastsjoːn]		*!		*
b.	☞ [bastjoːn]			*	

In this tableau we can observe that candidate (16b), although violating the otherwise pervasive MARKEDNESS constraint *tj, is better than candidate (16a) because the latter form is not in line with the higher ranking MARKEDNESS constraint *SIBSIB. What this means is that /t/ assibilates to [ts] unless the /t/ is preceded by a sibilant, in which case it surfaces as [t].

The reason for the ranking IDENT (+STRID) » *SIBSIB can be seen when we consider the following tableau for *Disziplin*, which is representative of the data in (13). Here it is illustrated that this ranking is necessary to allow for underlying [sts] sequences – the anti-structures – to surface as such:

(17)	[dɪstsipliːn]	IDENT (+STRID)	*SIBSIB	*tj	IDENT (–STRID)
a.	[dɪstipliːn]	*!			
b.	☞ [dɪstsipliːn]		*		

In this tableau the nonoptimal candidate (17a), although satisfying both MARKEDNESS constraints, loses out to (17b) because the change from /ts/ to [t] violates the high ranking FAITH constraint IDENT (+STRID).[6]

It should be emphasized that it would be difficult for a rule-based analysis to account for the nonassibilation of /t/ in the examples in (12) without unmotivated stipulations. One possible treatment would require an assibilation rule of the form /t/ → [ts] / __ j and a negative filter barring adjacent sibilants (to explain the data in 12). One would consequently have to situate both the rule and the filter at the same stratum in the lexicon to capture the fact that the rule is blocked when the output violates the filter. The problem with this analysis is that it cannot account for the existence of words like *Disziplin* in (13), since they would also be ruled out by the filter. One might alternatively argue, contrary to what was stated above, that assibilation is a true derived environment rule, in which case its application would be blocked in (13) because these are nonderived words. This analysis is weak because it cannot capture the fact that there is no assibilation in (13) for a *phonological* reason, namely because an /s/ precedes /t/.

In terms of rule-based phonology the only analysis which might work technically is one which encodes a rule-specific condition into assibilation. In this case the condition would simply say that this particular rule does not apply if the target is preceded by a sibilant, and since this condition is a part of the rule itself, it would not have the power to filter out the words in (13). While this analysis might work technically it requires a stipulation in the structural description of a rule. By contrast, the OT analysis presented above has the advantage that it requires no rule-specific condition and that all facts presented above are captured with the interaction of four universal constraints, namely the two FAITH constraints posited in (10b-c), which penalize outputs which change the underlying value of stridency and two MARKEDNESS constraints.[7]

1.2 Sibilant neutralization in Gujarati

In the historical development from Sanskrit to Gujarati we can observe a general process which neutralized nonanterior sibilants to [s]. It will be shown below that this process is an example of an anti-structure-preservation effect which is captured with a specific version of the general ranking in (6). The data in this section are drawn from Pandit (1954). An earlier rule-based analysis is presented in Hall (1996).

Sanskrit had three sibilant phonemes presented in the first column in (16) with the traditional symbols which I use below. In the second column I list the corresponding IPA symbols and in the third column the corresponding features.

6 Recall from (6) that M_A (=*SIBSIB in 17) is dominated by F_A, i.e. all other FAITH constraints militating against the sequence banned by M_A. In the present case two additional examples of F_A are DEP-IO and MAX-IO. The ranking DEP-IO, MAX-IO » *SIBSIB accounts for the fact that the anti-structure input sequence /sts/ surfaces as [sts] and not as [səts] (DEP-IO violation) or [ts] (MAX-IO violation).

7 See McCarthy (1997), who analyzes a rule-specific condition in the Southern Palestinian dialect of Arabic in an OT analysis. However, McCarthy's OT analysis does not require the same kind of interaction between FAITH and MARKEDNESS constraints as my own.

(18) *Symbol:* *IPA Symbol* *Features:*

s	s	[CORONAL, +anterior]
ś	ʃ or ç	[CORONAL, –anterior, +distributed]
ṣ̥	ʂ	[CORONAL, –anterior, –distributed]

I assume that as the only anterior sibilant, [s] is not marked for [distributed], but nothing in my analysis crucially hinges on this.

The two nonanaterior sibilants in (18) neutralized to [s] in most Middle Indo-Aryan dialects (Pandit 1954; Misra 1967: 124-126; Masica 1991: 168). In the Gujarati examples in (19) we can also observe the effects of this general process of sibilant neutralization. In the first four examples the nonanaterior sibilant was [ś] and in the final one it was [ṣ̥]:

(19)

Sanskrit	*Gujarati*	
śaṭ̥ati	saṛ̥vũ	'to rot'
śuṇ̥ḍ̥ā	sũḍ̥lo	'basket'
ādarśaḥ̥	ārso	'mirror'
śvāsaḥ̥	sās	'breath'
māṣ̥a	māso	'measure of weight'

The change from Sanskrit [ś ṣ̥] to Gujarati [s] can be seen as the result of a conflict between the MARKEDNESS constraint in (20) which penalizes nonanterior sibilants and a FAITH constraint which had the function of preventing the change from [–anterior] to [+anterior]. The former constraint is presented in (20):

(20) A MARKEDNESS constraint:
*NONANTSIB: No nonanterior sibilants (i.e. *[CORONAL, –anterior, –strident])

The constraint *NONANTSIB is motivated by typological evidence. since the unmarked sibilant inventory contains /s/ (as opposed to /s/ and a nonanterior sibilant like /ʃ/) (see Maddieson 1984).

The general FAITH constraint referring to both values of [anterior] is presented in (21a) and the specific one required for the data in (19) in (21b).

(21) FAITH constraints:
a. IDENT(±ANT): If an input segment is [αanterior] then the corresponding output segment is [αanterior].
b. IDENT(–ANT): If an input segment is [–anterior] then the output segment is [–anterior].
c. IDENT(+ANT): If an input segment is [+anterior] then the output segment is [+anterior].

In (22) I show by way of the hypothetical example /śa/ how this form surfaces as [sa] in Gujarati. In (22) and below the input is taken to be the acoustic input from Sanskrit and the output forms are the ones which surface in Gujarati.

(22)

	/ śa/	*NONANTSIB	IDENT(–ANT):
a.	[śa]	*!	
b.	☞ [sa]		*

In this tableau it can be observed that the correct form in (22b) is better than the fully faithful one in (22a) because the latter form violates the high ranked MARKEDNESS constraint which penalizes nonanaterior sounds.

In all of the examples in (19) sibilant neutralization takes place before a back vowel. The additional data in (23) illustrate that the neutralization of [ś] to [s] did not take place before front vowels but that in this context Sanskrit [ś] stays [ś] in Gujarati.[8]

(23)	*Sanskrit*	*Gujarati*	
	śikṣā	śīkh	‘advice’
	śītakālah	śiyāḷo	‘winter’
	śīrṣam	śīś	‘head’

What the examples in (23) show is that the neutralization of nonanterior sibilants to [s] is suspended before front vocoids; thus, Sanskrit did not allow sequences like [si] and [se] to arise by way of sibilant neutralization. I capture this generalization with the sequential MARKEDNESS constraint in (24), which penalizes a sequence of anterior sibilant plus front vocoid:

(24) A MARKEDNESS constraint:
*si: No sequence of anterior sibilant plus front vocoid.

If the constraint *si is ranked ahead of the MARKEDNESS constraint *[COR, –ANT] then the correct output for the data in (23) is obtained. This is illustrated in the tableau in (25):

(25)	/śi/	IDENT (+ANT)	*si	*NONANTSIB	IDENT (–ANT)
a.	[si]		*!		*
b.	☞ [śi]			*	

In (25) we can observe that an input /śi/ surfaces optimally as [śi] and not as [si] because only the former form satisfies the high ranked MARKEDNESS constraint *si.

The additional examples in (26) illustrate that Sanskrit [s] surfaces as [s] in Gujarati, even if a front vocoid follows:

(26)	*Sanskrit*	*Gujarati*	
	samvarate	sāvarṇī	‘broom stick’
	sinduram	sindur	‘red lead powder’
	sedbati	sidhāvvũ	‘to depart’
	vāsita	vāsī	‘stale’

The significance of the examples in (26) is that they show that Gujarati allows for [si] sequences only if these [si] sequences had /si/ as the input and not /śi/.

---

8 Pandit (1954) shows that Sanskrit [ṣ] surfaced in Gujarati as [ś] before a front vowel or front glide. I ignore these examples here because they require an added complication (namely the markedness constraint *ṣi) which is peripheral to the present discussion.

That an original [s] surfaces in Gujarati as [s] falls out from the rankings presented in (25) above with the addition of the FAITH constraint in (21c), which penalizes the change from [+anterior] to [–anterior]. If this IDENT constraint occupies the highest niche in the constraint hierarchy for Gujarati then the present analysis correctly predicts that input /si/ – the anti-structure – will consistently map onto surface [si]:

(27)

	/si/	IDENT (+ANT)	*si	*NONANTSIB	IDENT (–ANT)
a.	[śi]	*!		*	
b.	☞ [si]		*		

In contrast to the example discussed in §3.1, it is possible to account for the Gujarati facts in a rule-based model (see Hall 1996, whose analysis I summarize here). Assuming that the feature [distr] is a daughter of [CORONAL] and that [ant] in turn is dominated by [distr] the change from /śa/ to [sa] can be expressed as the delinking of a line of association, as in (28a). (The [s] that results from this operation receives the feature [+anterior] by default). If a sequence like [śi] shares the feature [+distr] (see 28b), then the blockage of sibilant neutralization to this structure follows from representational accounts for the inalterability of linked structures (e.g. Hayes 1986).

(28) a.

```
   ś          a
[CORONAL] [DORSAL]
    ǂ
 [+distr]
    |
  [–ant]
```

b.

```
     ś            i
[CORONAL]   [CORONAL]
       \     /
       [+distr]
```

Although the analysis in (28) works technically I claim that the true explanation for the rule blockage in [śi] is due to constraint rankings and not nonlinear representations. The reason I adopt the constraint ranking approach is that the same kind of anti-structure preservation effects can be observed in other languages, in which a possible analysis in terms of nonlinear representations is not possible even in theory (e.g. German assibilation in §3.1 and German glide formation in §3.3).[9]

1.3 German glide formation

Following earlier work on German phonology (recall note 3), I hold that [j] in that language derives from an underlying vowel /i/ because [i] and [j] stand in complementary distribution (see Wurzel 1970, Kloeke 1982, Hall 1992, Yu 1992 and Wiese 1996; see also Trubetzkoy 1939 and Moulton 1962, who make a similar assumption in pre-generative frameworks).[10] It will be argued that German glide formation provides a clear example of an anti-structure-preservation effect because the process is blocked from going into effect if the output would be [ji], even though the language as a whole allows for [ji] sequences.

The examples in (29) illustrate that [j] surfaces in onset position, i.e. either in absolute syllable-initial position (in 29a), or as the second member of an onset cluster (in 29b). By

[9] This does not mean that one should reject nonlinear rperesentations like the ones in (28) altogether; the point is that an explanation for the Gujarati examples does not *require* nonlinear representations.

[10] Hall (1992) and Wiese (1996) argue that [j] is derived from /ɪ/ (and not /i/). The difference between the two analyses is very subtle and does not affect the analysis presented above.

contrast, (unstressed) [i] (or its allophone [iː], which surfaces in stressed position) only occurs in the nucleus.

(29) The distribution of German [j]:

a.	Jahr	[jaːɐ]	‘year’
	Boje	[boːjə]	‘buoy’
b.	prinzipiell	[pʀɪn.tsi.pjɛl]	‘in principle’
	Nation	[na.tsjon]	‘nation’
	Studium	[ʃtuː.djʊm]	‘studies (sg.)’

Evidence that the Cj sequences in (29b) are parsed as V.CjV and not as VC.jV is that the C portion does not undergo (syllable) Final Devoicing if it is a voiced obstruent. See Hall (2003a) for discussion and an OT analysis of the syllabification of Cj sequences.

Following earlier work by Rosenthall (1994) on glide formation in OT, I hold that the phonetic forms in (29) falls out from the interaction between ONSET (see 30a) and MAX-μ (see 30b).The language-specific ranking is presented in (30c):

(30) a. A MARKEDNESS constraint:
ONSET: Syllables are not vowel initial

b. Two FAITH constraints:
MAX-μ: A mora in the input corresonds to a mora in the output.
DEP-μ: A mora in the output corresonds to a mora in the input.

c. ONSET » MAX-μ

The constraint MAX-μ militates against the change from a vowel (i.e. /i/) to a glide (i.e. [j]). Thus, if the moraic segment /i/ becomes the (nonmoraic) [j] then what is involved is the deletion of an underlying mora in order to satisfy ONSET. The tableau in (31) shows how the optimal form with a glide is selected for the word *Studium*, which is representative of the words in (30):

(31)

	/ʃtuː.diʊm/	ONSET	MAX-μ
a.	[ʃtuː.di.ʊm]	*!	
b.	☞ [ʃtuː.djʊm]		*

In this tableau we can observe that the nonoptimal candidate (31a) loses out to the winner in (31b) because it violates the highest ranked constraint ONSET.[11]

The following data show that glide formation as in (29) is blocked when [iː] follows. This point is illustrated in the first column of (32), in which the root ends in [i] and the suffix begins with [iː]. An examination of the examples in the second column reveals that the root-final [i] in the corresonding morphemes in the first column surfaces as [j] if a vowel other than [iː] follows.[12] For clarity morpheme boundaries in (32) have been indicated in the

[11] German permits ONSET violations in words with vowels in hiatus in which the first vowel is not /i/, e.g. *naiv* [na.iːf] ‘naive’. I assume here that a form like [na.iːf] is selected as optimal due to other constraints which are not relevant for the present analysis. See Rosenthall (1994) for discussion of this issue with respect to languages other than German.

[12] The examples in (32) have been drawn from Drosdowski *et al.* (1990). Some informants can pronounce the [j] in the words in the second column as [j] or as [i], suggesting the glide formation in certain words is optional, e.g. [ˈliːnjə] or [ˈliːniə]. Importantly, there is no optionality regarding the pronunciation of [iiː] in the words in the first column in (32), i.e. all informants categorically reject the pronunciation [jiː].

orthographic form with a dash. There are no suffixes beginning with a vowel other than [iː] which could attach to the root in the final form in (32).

(32) No glide formation before [iː]:

lini-ieren	[liniˈiːʀən]	'rule'	Lini-e	[ˈliːnjə]	'line'
Alli-ierten	[aliˈiːɐtən]	'allies'	Alli-anz	[aˈljants]	'alliance'
Initi-ierung	[initsiˈiːʀʊŋ]	'initiation'	initi-al	[iniˈtsjaːl]	'initial'
vari-ieren	[vaʀiˈiːʀən]	'vary'	Vari-etät	[vaʀjeˈtɛːt]	'variety'
assozi-ieren	[asotsiˈiːʀən]	'associate'	assozi-ativ	[asotsjaˈtif]	'associative'
substanti-ieren	[zʊpstantsiˈiːʀən]	'substantiate'	substanti-ell	[zʊpstanˈtsjɛl]	'substantial'
li-iert	[liˈiːɐt]	'be on intimate terms with someone'			

The only tautomorphemic [iiː] sequences to my knowledge occurs in the word *Schiit* [ʃiiːt] 'Shiite'. As in the examples in (32), no glide formation occurs in this word.

I argue that the blockage of glide formation in the examples in the first column of (32) falls out from the MARKEDNESS constraint in (33), which, as I demonstrate below, must be ranked ahead of ONSET:

(33) A MARKEDNESS constraint:
*ji

The OCP motivated constraint in (33) has been proposed by several linguists (e.g. Kawasaki 1982, which I have not seen) and has been argued to be motivated by speech perception.[13]

The ranking *ji » ONSET is illustrated in the following tableau for the word *liniieren*, which is representative of the words in the first column of (32):

(34)

	/lini-iːʀən/	*ji	ONSET	MAX-□
a.	□ [li.ni.iː.ʀən]		*	
b.	[li.njiː.ʀən]	*!		*

In this tableau it can be observed that the incorrect form in (34b) violates the high ranked constraint *ji and therefore loses out to the form in (34a).

The following words illustrate that German permits the anti-structure (i.e. [ji] sequences) on the surface:

(35)

injizieren	[ɪnjiˈtsiːʀən]	'inject'
projizieren	[pʀojiˈtsiːʀən]	'project'
konjizieren	[kənjiˈtsiːʀən]	'conjecture'

There are no German words beginning with /ji/, but this sequence is not difficult to pronounce (either in word-initial position or word-internally) and therefore there is no tendency at all to repair /ji/ sequences from other languages when they enter German as loanwords, e.g. Czech *Jičin*, German [jitʃiːn]. Note that the /j/ in the words in (35) must be analyzed as underlyingly

A glottal stop surfaces before the stressed vowel in words like *liniieren* in (32) – an epenthesis that is motivated to avoid an ONSET violation, as in Dutch (recall the example in 2, which is the same as in German).

13 The [ji] gap in other languages is sometimes assumed to be attributed to the OCP if /j/ has the same features as /i/. This treatment will not work for the German examples because sequences of two /i/'s are grammatical (recall the first column in 30).

/j/ and not /i/. The underlying glide is necessary here because there are word pairs in which [i] and [j] contrast, e.g. [ɪnjiˈtsiːʀən] 'inject' vs. [liniˈiːʀən] 'rule' in which [i] and [j] occur in the context C__i.

That the [ji] sequences in (35) are the optimal forms (as opposed to ones containing [ii]) falls out given the ranking of the three constraints in (34) and the Faith constraint Dep-μ (from 30b), which prohibits the insertion of a mora. That Dep-μ outranks *ji is illustrated in the tableau in (36) for the word *injizieren*, which is representative of words containing an underlying /ji/.

(36)

	/ɪnjitsiːʀən/	Dep-μ	*ji	Onset	Max-μ
a.	☞ [ɪn.ji.tsiː.ʀən]		*		
b.	[ɪ.ni.i.tsiː.ʀən]	*!		*	

It can be observed in (36) that the constraint Dep-μ plays a crucial role in my analysis by preventing the form in (36b) from being selected as optimal.

The complete ranking for German is presented in (37):

(37) Dep-μ » *ji » Onset » Max-μ

Note that this specific ranking matches the general ranking presented in (6) above for anti-structure preservation effects. What crucially differentiates the ranking in (37) from the kind of blocking effects as described in §2 is the partial ranking Dep-μ » *ji, which ensures that the anti-structure (i.e. /ji/) surfaces faithfully.

Note that my analysis crucially requires that vowels be underlyingly moraic and that glide formation in (29) (and the data in 32) be captured with the faith constraints Max-μ and Dep-μ. An alternative analysis of glide formation, which I reject below, analyzes the change from /i/ to [j] (and from /j/ to [i]) by constraints penalizing [i] if it occurs as a peak or a margin (i.e. *P/i and *M/i respectively; see Prince & Smolensky 1993 and Baertsch 2002). According to this approach one could analyze glide formation (i.e. the change from /i/ to [j] before a vowel) by ranking Onset over *M/i, as in (38).

(38)

	/ʃtuː.diʊm/	Onset	*M/i
a.	[ʃtuː.di.ʊm]	*!	
b.	☞ [ʃtuː.djʊm]		*

The reason one cannot substitute Max-μ and Dep-μ with *M/i and *P/i respectively is that no ranking between these constraints will select the correct winner for the *liniieren* and *injizieren* examples, as illustrated in (39) and (40):

(39)

	/lini-iːʀən/	*P/i	*ji	Onset	*M/i
a.	[li.ni.iː.ʀən]	***!		*	
b.	☞ [li.njiː.ʀən]	**	*		*

(40)

	/ɪnjitsiːʀən/	*P/i	*ji	Onset	*M/i
a.	☞ [ɪn.ji.tsiː.ʀən]	**	*		
b.	[ɪ.ni.i.tsiː.ʀən]	***!		*	

Although the correct output form is selected in (40), in (39) we can observe that (39b) is incorrectly selected as optimal (symbolized above as '□ ').

In conclusion, it needs to be stressed that any rule-based analysis will not be able to account for all of the German data presented above without *ad hoc* stipulations. In order to account for glide formation a rule would need to be posited of the form /i/ □ [j] / __ V. In order to account for the blockage of this process before [i] a filter would be necessary of the form *ji, but it remains unclear how the examples in (32) can be made exempt from the filter. By contrast, the OT analysis presented above accounts for the anti-structure preservation effect with a simple ranking involving four universal constraints.

1.4 French glide formation

In French there is a process of glide formation which converts the high vowels /i u y/ into the corresponding glides [j w ɥ] in pre-vocalic position. This rule has been discussed extensively by a number of authors (e.g. Kaye & Lowenstamm 1984, Tranel 1987: 115ff., Kaye 1989: 112ff., Noske 1993: 221ff., Rialland 1994), primarily from the perspective of nonlinear representations. The French glide formation data provide two clear examples of anti-structure-preservation effects. First, the general rule of glide formation is blocked if it is preceded by a consonant+liquid (CL) cluster, but there are other words in the language which have consonant-liquid-glide sequences in the onset (see §3.4.1). In the second case (described by Tranel 1987) glide formation is blocked for many speakers after /r/, even though for these speakers there are other words which contain [rj] sequences (see §3.4.2).

1.4.1 Glide formation blocked by preceding CL clusters

The process of glide formation is illustrated with the data in (41) (from Tranel 1987). In the first column I have listed words ending in one of the three high vowels [i u y]. In the second column we can observe that these high vowels surface as the corresponding glides [j w ɥ] before vowel-initial suffixes.

(41) French glide formation (Tranel 1987: 119):

scie	[si]	'saw'	scier	[sje]	'to saw'
défi	[defi]	'challenge'	défier	[defje]	'to challenge'
tue	[ty]	'kills'	tuer	[tɥe]	'to kill'
mue	[my]	'shedding'	mue	[mɥe]	'to shed'
secoue	[sœku]	'shakes'	secouer	[sœkwe]	'to shake'
loue	[lu]	'rents'	louer	[lwe]	'to rent'

Additional data (from Noske 1993: 222) suggest that the process of glide formation is not restricted to a derived environment, but instead that it affects any pre-vocalic high vowel e.g. *nuage* [nɥaʒ] 'cloud' (from /nyaʒ/).[14]

I capture glide formation in French with the ranking ONSET » MAX-□ (recall the analysis in §3 for German). This ranking is ilustrated with the tableau in (42) for the word [lwe]:

[14] Noske (1993) and Rialland (1994) describe glide formation as an optional process. For example, the latter author lists [nwe] and [nue] as possible pronunciations for the word *nouer* 'to tie' (p. 137). The analysis I present below is not intended to capture the optionality of glide formation, since this is an independent issue.
Glide formation is systematically blocked from applying to a high vowel in three contexts (see Tranel 1987: 119): (i) across a prefix+stem juncture, (ii) across a compound juncture, and (iii) across words. See Hannahs (1995) for an analysis of French glide formation in which the contexts in (i)-(iii) are discussed. In my analysis I assume that the restrictions fall out from various ALIGN constraints.

(42)

/lu-e/	ONSET	Max-μ
a. [lu.e]	*!	
b. ☞ [lwe]		*

In this tableau we can see that the faithful candidate in (42a) is not optimal because it violates the high ranking constraint ONSET.

The data in (43) illustrate that glide formation is blocked after a consonant + liquid (henceforth CL) cluster. This is illustrated in the second column, where it can be observed that the stem-final high vowel does not surface as the corresponding glide:[15]

(43) Glide formation blocked after CL clusters (Tranel 1987: 120):

plie	[pli]	'fold'	plier	[plije]	'to fold'
ennui	[ɑ̃nɥi]	'boredom'	ennuyer	[ɑ̃nɥije]	'to bore'
glu	[gly]	'birdlime'	gluant	[glyɑ̃]	'sticky'
clou	[klu]	'nail'	clouer	[klue]	'to nail'

Rialland (1994: 138) presents examples of words in which glide formation occurs after word-initial CC sequences, where the C's are both obstruents, e.g. *skier* [skje] 'to ski' (from /skie/), and in less frequent words, e.g. *psiadie* [psjadi] 'psiadie' (from /psiadi/). These additional examples are important because they tell us that glide formation is blocked after CL clusters and not after any CC sequence.

The blockage of glide formation in (43) can be understood in terms of the MARKEDNESS constraint in (44), which bans syllables beginning with three segments. I assume that $*_{\sigma}$[CCC is a specific instantiation of the constraint NOCOMPLEXONSET (Prince & Smolensky 1993).

(44) A MARKEDNESS constraint:
$*_{\sigma}$[CCC: No syllable begins with a sequence of three nonsyllabic segments.

If the constraint $*_{\sigma}$[CCC outranks ONSET then the correct prediction is made that glide formation is blocked in the examples in (43). This point is illustrated in the tableau in (45) for the word [klue]:

(45)

/klu-e/	$*_{\sigma}$[CCC	ONSET	Max-μ
a. ☞ [klu.e]		*	
b. [klwe]	*!		*

In this tableau we can see that the optimal form is (45a), since the sequence CCj in (45b) violates the high ranked MARKEDNESS constraint $*_{\sigma}$[CCC.[16]

[15] In French phonology it is usually assumed that there is a palatal glide between the [i] and following vowel, e.g. [plije] and not [plie]. By contrast, no glide is posited after [u ɥ]. I leave open here what a formal analysis of why examples like [plije] are better than ones like [plie] would look like. One also might want to consider analyzing the palatal glide in the context i__V to be purely the consequence of coarticulation or perception and that it should not be accounted for in a phonological analysis.

[16] The analysis in (45) brings up the question of how glide formation can be applied successfully after word-initial CC clusters, e.g. *skier* [skje] 'skier' (recall the discussion after 43). Surface forms like [skje] can be selected as optimal by either positing that the first of two word-initial obstruents is extrasyllabic (see Rialland 1994 who defends this option), or by conjoining the constraint $*_{\sigma}$[CCC with one that bans liquids in the

My analysis in (45) is very different from the one that is traditionally assumed in French phonology (see the references cited above). According to that view glide formation is blocked in examples like (43) because if it were to apply then there would be a sequence of three consonants within the subsyllabic constituent onset, which is said to be banned by an exceptionless constraint. By contrast, in my treatment the constraint $*_{□}$[CCC does not crucially require the subsyllabic constituent onset, but instead it refers simply to a sequence of three nonsyllabic segments situated in syllable-initial position. A second difference between the traditional analysis and my own is that my constraint $*_{□}$[CCC is violable. This point is illustrated when we consider the examples in (46), which contain the anti-structures (i.e. underlying $*_{□}$[CCG sequences). Note that the glide in these examples contrasts with the corresponding high vowel (cf. 47). In the literature on French phonology it is assumed that the glide in these words is situated in the nucleus (and not in the onset) and that this is the explanation for why these examples do not violate the filter referred to above which bans a CL sequence in the subsyllabic constituent onset.

(46) Underlying CLw and CLɥ sequences (Tranel 1987: 116):

a.	trois	[trwɑ]	'three'
	cloison	[klwazõ]	'partition'
b.	bruit	[brɥi]	'noise'
	fluide	[flɥid]	'fluid'

(47) Underlying CLu and CLy (Tranel 1987: 116)

a.	clouer	[klue]	'to nail'
	prouesse	[pruɛs]	'prowess'
b.	cruauté	[kryote]	'cruelty'
	fluet	[flyɛ]	'slim'

Apparently there are no examples of French words like the ones in (46), in which the glide portion of the onset is [j].

In the present analysis the examples in (46) and (47) can be captured by ranking the FAITH constraint DEP-□ ahead of $*_{□}$[CCC. This ranking is illustrated in the two tableaux in (48) and (49) for [trwɑ] and [klue] respectively.

(48)

	/ trwɑ/	DEP-□	$*_{□}$[CCC	ONSET	Max-□
a.	[tru.ɑ]	*!		*	
b.	□ [trwɑ]		*		

(49)

	/ klue /	DEP-□	$*_{□}$[CCC	ONSET	Max-□
a.	[klwe]		*!		*
b.	□ [klu.e]			*	

In (48) we see that the incorrect form in (48a) loses out to the winner because the change from /w/ to [u] is disallowed by the high ranking constraint DEP-□. In the second tableau the form in (49b) surfaces as optimal even though this form exhibits an ONSET violation because the

onset. Since my analysis of the French facts as anti-structure preservation effects does not crucially hinge on either option I leave this question open for further study.

change from /u/ to [w] in (49a) violates the higher ranked MARKEDNESS constraint *□[CCC.[17] [18]

1.1.2 Glide formation blocked by preceding /r/

Tranel (1987: 121) presents some additional data involving glide formation in French which I see as another example of an anti-structure preservation effect in that language. Tranel notes that in French the vowel [i] rarely turns into the corresponding glide [j] after the rhotic [r].[19] Illustrating this point with the verb *rire* 'to laugh', he notes that the pronunciations in (50a) are much more common than the ones which glide formation has applied (e.g. [rjɑ̃]). He writes "...while no speaker will find the first set impossible (e.g. [rijɑ̃], T. A. H.), many speakers will find the second set (e.g. [rjɑ̃], T. A. H.) odd". Interestingly, Tranel adds that [rj] sequences in nonderived words are possible, citing the place name *Riom* in (50b) as an example. The data in (50a) contrast with the ones in (50c), in which [l] precedes the high vocoid (these examples consist of derivatives of the verb *lier* 'to link'). Tranel notes that in contrast to the examples in (50a) in (50c) it is the pronunciations with [lj] which are "probably more generally accepted than the first (i.e. [li], T. A. H.)."

(50) Li and Lj sequences in French (Tranel 1987: 121)

a.	[rijɑ̃]	'cheerful'
	[rijœr]	'merry'
	[rijõ]	'(we) laugh'
b.	[rjõ]	'Riom'
c.	[ljɑ̃]	'sociable'
	[ljœr]	'binder'
	[ljõ]	'(we) link'

Tranel concludes that "the consonant [l] more readily accepts gliding next to it than does the consonant [r]."

I account for the blockage of glide formation in (50a) with the sonority-based MARKEDNESS constraint in (51) (from Hall 2003b):

(51) A MARKEDNESS constraint:
*rj

The constraint in (51) penalizes a sequence of rhotic (regardless of manner and/or place) plus palatal glide. Hall (2000, 2003b) shows that the constraint *rj derives motivation (when the /r/ is coronal) from articulatory phonetics in the sense that it would require a tongue tip plus concave tongue posture be altered to a blade plus convex posture. Hall (2000, 2003b) also notes that a phonetic (i.e. articulatory) explanation for (51) holds when /r/ is uvular as well,

[17] Recall that there are no examples of words like the ones in (46) in which the glide is [j]. What this suggests is that only the blocking effects which involve a change from /u y/ to [w ɥ] are anti-structure preservation effects, whereas the blockage of /i/ to [j] in the first two examples in (43) display blocking effects.

[18] One question I have not addressed in my analysis of French is how glides are represented phonologically. As I noted above the general assumption in the literature is that the glide in words like [trwa] (in 46) are in the nucleus, whereas the same segment in words like [lwe] (in 41) is in the onset. In my treatment the distinction between onset glides and nuclear glides is not important, and hence both sounds could, in principle, be represented the same way.

[19] The place of articulation for French /r/ is uvular (see Tranel 1987: 142ff., who refers to French /r/ as 'back'). The manner of articulation varies from a trill to a tap.

since it is difficult to move the tongue from the position required for a uvular constriction to [j]. (This derives support from the extreme rarity from the cross-linguistic perspective of palatalized uvular sounds).

The data in (50) require the ranking in (52), a specific instantiation of the general constraint schema in (5) for anti-structure preservation effects:

(52) DEP-□ » *rj » ONSET » MAX-□

The ranking in (52) differs minimally from the one posited above in (48-49) for the additional French data and for the German data in §3.3.

The ranking in (52) is illustrated in the following three tableaus for the words [.ljõ.] (from 50c), [.ri.ã.] (from 50a) and [.rjõ.] (the anti-structure, from 50b).

(53)	/li+õ/	DEP-□	*rj	ONSET	Max-□
a.	[.li.õ.]			*!	
b.	□ [.ljõ.]				*

(54)	/ri+ã/	DEP-□	*rj	ONSET	Max-□
a.	□ [.ri.ã.]			*	
b.	[.rjã.]		*!		*

(55)	/rjõ/	DEP-□	*rj	ONSET	Max-□
a.	[.ri.õ]	*!		*	
b.	□ [.rjõ.]		*		

The general glide formation example is represented by tableau (53). As in (42) glide formation in (53) is captured with the ranking ONSET » MAX-□. The blockage of glide formation after a rhotic is illustrated in (54). Here we can observe that (54b) is not optimal because it violates the high ranked MARKEDNESS constraint *rj. The final tableau shows that the antistructures (i.e. underlying /rj/ sequences) surface as such and that the faithful candidate wins due to the ranking DEP-□ » *rj.

1.5 ‘Anti-gemination’ effects in Afar

An excellent example of an anti-structure preservation effect is the phenomenon referred to as ‘anti-gemination’ in the Lowland East Cushitic language Afar (McCarthy 1986). We will see below that vowel syncope in this language is blocked if it would create a geminate but that this language has underlying tautomorphemic and heteromorphemic geminates.

In Afar (described by Bliese 1981: 214-217, and analyzed by McCarthy 1986 in a rule-based approach) there is a rule of syncope that deletes an unstressed vowel in a peninitial two-sided open syllable. The effects of this process can be observed in the Afar words in the second column of (55). A comparison of these forms with the corresponding ones in the first column reveal that there are vowel-zero alternations.

(55) Afar Syncope (Bliese 1981: 215):

[digib-ˈt-e]	‘she married’	[digˈb-e]	‘I married’
[wager-ˈn-e]	‘we reconciled’	[wagˈr-e]	‘he reconciled’
[xawal-ˈt-e]	‘she tired’	[xawˈlele]	‘she will tire’

Following Rose (2000: 134), I employ the informal constraint DELETE, which penalizes fully faithful forms without deletion. I assume that DELETE is a MARKEDNESS constraint which penalizes forms which are metrically nonoptimal (see Zawaydeh 1997, who assumes that it involves a ban on adjacent light open syllables). Given the ranking DELETE » MAX-V (proposed by Rose 2000) my analysis correctly selects the syncopated candidate:

(56)

/digib-e/	DELETE	Max-V
a. [digibe]	*!	
b. ☞ [digbe]		*

The following examples illustrate that syncope is blocked from going into effect if the consonants flanking the unstressed vowel are identical. This example of rule blockage is referred to as anti-gemination in the literature because the output of syncope is blocked if it would be a geminate consonant.

(57) Anti-gemination effects (Bliese 1981: 215):

[danaˈn-e]	'I/he was hurt'
[xaraˈr-e]	'I/he burned'
[modoˈd-e]	'I/he collected animals to bring home'

In my analysis (which follows closely the one proposed by Rose 2000: 104-105) the blockage of syncope in (57) is the predicted result if the constraint DELETE in (56) is dominated by a MARKEDNESS constraint banning geminate consonants (i.e. NOGEM). This ranking is illustrated in the following tableau for the first example in (57):

(58)

/danan-e/	NOGEM	DELETE	Max-V
a. [danne]	*!		*
b. ☞ [danane]		*	

The constraint NOGEM is only violated by 'true' geminates, i.e. geminates with a single root node. The form in (58a) violates this constraint because [nn] is understood to be such a geminate.[20] Given the ranking NOGEM » DELETE the correct form in (58) is correctly predicted to be the one without deletion, i.e. (58b).

As pointed out by McCarthy (1986: 221) (who attributes this observation to Bliese 1981: 215) the condition on rule blockage described above is rather unexpected because Afar otherwise shows no aversion to geminate consonants (which would surface if syncope would apply in 57). Thus, Afar has both tautomorphemic and heteromorphemic geminates in underlying and surface representations, e.g. [yalˈli-h] 'God-gen' (Bliese 1981: 212; [y] = IPA [j]). In the present analysis the underlying tautomorphemic geminates are the anti-structures which surface as such because the MARKEDNESS constraint NOGEM is domainted by the FAITH constraint which militates against the structure banned by that MARKEDNESS constraint, i.e. geminates.

Following Keer (1998), I assume that input (tautomorphemic) geminates always consist of a single segment (i.e. root node). Given this assumption concerning the input the

[20] There is also a candidate [danne] (not seen in 58) with a 'fake' geminate, i.e. [nn] is represented with two separate identical segments. This form is ruled out if the constraint OCP (which it violates) dominates DELETE. Rose (2000: 104) assumes without argument the reverse ranking but nothing in her analysis would be affected by this proposed ranking.

only FAITH constraint violated by the simplification of a tautomorphemic geminate is MAX-CONS-μ. (I am assuming that the first part of a tautomorphemic geminate is underlyingly moraic; the constraint only penalizes a consonantal mora for reasons to be described below). Underlying geminates are now correctly predicted to surface as such if the MARKEDNESS constraint NOGEM is dominated by the FAITH constraint MAX-CONS-μ. This ranking is illustrated in the following tableau for the word /yalli-h/ 'God-gen':

(59)	/yalli-h/	MAX-CONS-μ	NOGEM	DELETE	Max-V
a.	[ya.lih]	*!			
b.	☞ [yal.lih]		*		

In this tableau we can observe that (59a) loses out to the form in which the anti-structure is preserved, namely (59b), because it violates MAX-CONS-μ.[21] The reason the highest ranking constraint in (59) is the specific FAITH constraint MAX-CONS-μ rather than a general one, i.e. MAX-μ, is that the general constraint would incorrectly predict that candidate (56a) be selected over (56b). Note, however, that the specific constraint MAX-CONS-μ does not effect the outcome in (56) because the mora that is deleted is vocalic and not consonantal.

A comparison of the language-specific ranking in (60) with the general one in (6) reveals that Afar is yet another example of a language with anti-structure preservation effects. This being said, it needs to be emphasized here that not all cases of anti-gemination exhibit anti-structure preservation effects. For example, in the Coahuiltecan language Tonkawa, spoken in Texas, a syncope rule applies similar to the one in Afar (see McCarthy 1986: 223ff.). As in Afar, syncope in Tonkawa is blocked if the output would be a geminate, but in contrast to Afar, Tonkawa has no underlying geminates. Thus, Tonkawa syncope is an example of a language with a blocking effect (since there are no anti-structures in the language) which would be captured with the general ranking in (5).

4 Conclusion

In the preceding paragraphs I have examined a number of case studies from several languages illustrating anti-structure-preservation effects and have demonstrated that all of these examples require a language-specific instantiation of the general ranking in (6). The most important aspect of this ranking is F_A » M_A, since this is what allows the (underlying) anti-structures to surface faithfully.

What needs to be stressed is that while underlying anti-structures are preserved in the phonetic form by the ranking F_A » M_A, *derived* anti-structures are not allowed to surface in the present analysis. Thus, consider a hypothetical language like German with a process of glide formation of the form /i/ → [j] / __ V, which is blocked before /i/. A derived anti-structure would be some word, e.g. /aki-in/, which surfaces exceptionally as [akjin]. An example like [akjin] from /aki-in/ in this hypothetical language could not surface in the present treatment because the ranking F_A » M_A only allows for underlying anti-structures /ji/ to be preserved in the output as [ji]. In rule-based approaches one would presumably analyze derived anti-structure preservation effects either as idiosyncratic exceptions to the filter banning [ji], or in terms of level ordering. For example, a form like [akjin] from /aki-in/ might

[21] McCarthy (1986: 222) points out that syncope in Afar is not blocked if the unstressed vowel is flanked by adjacent identical consonants which are heteromorphemic. I follow Rose (2000), who proposes that the asymetrical behavior of true and fake geminates is to be expected if the OCP is limited to certain morphological domains. Since this issue is peripheral to the analysis made above I do not pursue the details here.

be regular in the sense that the [ji] filter is violated consistently before the suffix *–in*, which can be shown on independent grounds to belong to a later stratum than the [i]-initial suffixes which block glide formation.

One topic of research one might want to pursue in the future is to investigate such derived anti-structure-preservation effects. Thus, one would need to determine whether or not there are indeed such cases and if so to establish the general ranking for this phenomenon and to show how this general ranking is related to the one proposed in (6) for (underlying) anti-structure preservation effects.

References

Baertsch, K. 2002. *An Optimality Theoretic Approach to Syllable Structure: The Split Margin Hierarchy*. Ph.D. Dissertation: Indiana University.

Bliese, L. 1981. *A Generative Grammar of Afar*. Arlington, Texas: Summer Institute of Linguistics.

Booij, G. 1995. *The Phonology of Dutch*. Oxford: Clarendon Press.

Clements, G. N. 1999. Affricates as noncontoured stops. In: O. Fujimura et al. (eds.) *Item, Order in Language and Speech*. Prague: Charles University Press.

Drosdowski, G. et al. 1990. *Duden. Das Aussprachewörterbuch. Wörterbuch der deutschen Standard-aussprache*. Mannheim: Dudenverlag.

Flemming, E. 1995. *Auditory Representations in Phonology*. New York: Garland.

Gussenhoven, C. & H. Jacobs 1998. *Understanding Phonology*. London: Arnold.

Hall, T. A. 1992. *Syllable Structure and Syllable Related Processes in German.* Tübingen: Niemeyer.

Hall, T. A. 1996. Inalterability and sibilant neutralization in Gujarati. *Lingua* 98: 11-20.

Hall, T. A. 2000. Typological generalizations concerning secondary palatalization. *Lingua* 110: 1-25.

Hall, T. A. 2003a. Assibilation in Modern German. To appear in *Lingua.*

Hall, T. A. 2003b. On the nongemination of /r/ in West Germanic twenty years later. Ms. University of Leipzig.

Hannahs, S. J. 1995. The phonological word in French. *Linguistics* 33: 1125-1144.

Hayes, B. 1986. Inalterablity in CV phonology. *Language* 62: 321-351.

Jakobson, R., G. Fant and M. Halle. 1952. *Preliminaries to Speech Analysis: The Distinctive Features and their Correlates*. Cambridge: MIT Press.

Kawasaki, H. 1982. *An Acoustical Basis for Universal Constraints on Sound Sequences*. Ph.D. Dissertation. University of California at berkeley.

Kaye, J. 1989. *Phonology. A Cognitive View*. Hillsdale, New Jersey: Lawrence Erlbaum.

Kaye, J. & J. Lowenstamm 1984. De la syllabicité. In: F. Dell, D. Hirst & J.-R. Vergnaud (eds.) *Forme sonore du langage. Structure des représentations en phonologie*. Paris: Hermann. 123-159.

Keer, E. 1998. Spirantization and geminate inalterability. *Working Papers from Rutgers University* 1: 147-167.

Kehrein 2002. *Phonological Representation and Phonetic Phrasing: Affricates and Laryngeals*. Tübingen: Niemeyer.

Kim, H. 2001. A phonetically based account of phonological stop assibilation. *Phonology* 18: 81-108.

Kloeke, W. U. S. van Lessen 1982. *Deutsche Phonologie und Morphologie. Merkmale und Markiertheit*. Tübingen: Neimeyer.

LaCharité, D. 1993. *The Internal Structure of Affricates*. Ph.D. dissertation. University of Ottawa.

Maddieson, I. 1984. *Patterns of Sounds*. Cambridge: Cambridge University Press.

Masica, C. 1991. *The Indo-Aryan Languages*. Cambridge: Cambridge University Press.

McCarthy, J. 1986. OCP effects: gemination and antigemination. *Linguistic Inquiry* 17: 207-263.

McCarthy, J. 1997. Process-specific constraints in Optimality Theory. *Linguistic Inquiry* 28: 231-251.

McCarthy, J. 2002. *A Thematic Guide to Optimality Theory*. Cambridge: Cambridge University Press.

Misra, B. G. 1967. *Historical Phonology of Modern Standard Hindi*. Ph.D. Dissertation: Cornell University.

Moulton, W. 1962. *The Sounds of English and German*. Chicago: Chicago University Press.

Noske, R. 1993. *A Theory of Syllabification and Segmental Alternation. With Studies on the Phonology of French, German, Tonkawa and Yawelmani*. Tübingen: Niemeyer.

Pandit, P. B. 1954. Indo-Aryan sibilants in Gujarati. *Indian Linguistics* 14: 503-511.

Prince, A. & P. Smolensky 1993. Optimality Theory. Rutgers University and University of Colorado.

Rialland, A. 1994. The phonology and phonetics of extrasyllabicity in French. In: P. A. Keating (ed.) *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology* III. Cambridge: Cambridge University Press. 136-159.

Rose, S. 2000. Rethinking geminates, long-distance geminates and the OCP. *Linguistic Inquiry* 31: 85-122.

Rosenthall, S. 1994. *Vowel/Glide Alternation in a Theory of Constraint Interaction*. Ph.D. Dissertation: University of Massachusetts at Amherst.

Rubach, J. 1994. Affricates as strident stops in Polish. *Linguistic Inquiry* 25: 119-143.

Russell, K. 1997. Optimality theory and morphology. In: D. Archangeli & D. T. Langendoen (eds.) *Optimality Theory. An Overview.* Oxford: Blackwell. 102-133.

Tranel, B. 1987. *The Sounds of French*. Cambridge: Cambridge University Press.

Trubetzkoy, N. 1939. *Grundzüge der Phonologie*. Göttingen. Vandenhoeck & Ruprecht.

Wiese, R. 1996. *The Phonology of German*. Oxford: Clarendon Press.

Wurzel, W. U. 1970. *Studien zur deutschen Lautstruktur*. Berlin: Akademieverlag.

Yu, S.-T. 1992. *Unterspezifikation in der Phonologie des Deutschen.* Tübingen: Niemeyer.

Zawaydeh, B. A. 1997. On an optimality-theoretic account of epenthesis and syncope in Arabic dialects. In: Eid, M. & R. R. Ratcliffe (eds.) *Perspectives on Arabic Linguistics*. Amsterdam: Benjamins. 191-213.