

OPTIMALITY THEORY AND PHONOLOGICAL CHANGE

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1. Introduction

In generative phonology it has been, since Kiparsky (1968), a standard practice to account for sound change by means of rule addition, rule simplification, rule reordering and rule loss. Given that the phonological rule as such no longer exists in recently proposed constraint-based theories of phonology, such as Optimality Theory (cf. Prince and Smolensky (1993), McCarthy and Prince (1993a and b), the question arises how sound change can be accounted for in these theories.

In this paper¹ we will address this issue. It will be claimed, as is to be expected, that in Optimality Theory, sound change can straightforwardly be accounted for by constraint reranking². This will be illustrated by an example of sound change in the historical phonology of French. It involves the loss of the possibility to phonologically encliticize an unstressed object pronoun to a preceding stressed element (phonological enclisis). The formal account of this change relies on a reordering of Alignment constraints.

This paper purports to show not only that sound change can be analyzed as constraint-reranking (as already mentioned an expected result), but also that the analyses proposed are not thwarted by the same drawbacks of previous derivational nonlinear accounts. Finally, we will raise the issue of how to account for markedness and unmarkedness in sound change.

This study is organized as follows. In section 2, we will discuss the first example, the loss of phonological enclisis. We will point out some of the problematic aspects of previous phonological and syntactic accounts. Section 3 presents an OT-analysis making use of Alignment constraints. It will be argued that this sound change can be more adequately accounted for by a constraint-reranking. More importantly, the proposed analysis will be shown to have some attractive consequences for syntactic accounts of similar phenomena. Finally, in section 4, we will summarize and discuss the main results of the proposed analyses.

¹ **This is a slightly revised and expanded version of a paper presented at the ABRALIN1 conference which is going to appear in the proceedings of that conference. During my stay as a Gastwissenschaftler at the Zentrum für Allgemeine Sprachwissenschaft in Berlin I had the opportunity to discuss the facts and analyses presented here in a very stimulating academic environment. I would like to thank the ZAS for inviting me, and, in particular, T.A. Hall, Ursula Kleinhenz, Sylvia Löhken, and Gustav Wurzel for their warmhearted hospitality.**

² **Löhken (1996) presents a very detailed account of sound change and Optimality Theory in the historical phonology of German.**

2. The loss of phonological enclisis in French

In Old French, monosyllabic unstressed function words could be pronounced either as part of the word that preceded them (enclisis³; for instance, *jol vi* 'I saw him') or as part of the word that followed them (proclisis; for instance, *jo l'aim* 'I love him/her'). In the evolution from Gallo-Romance to Old French, the possibility of encliticizing disappeared⁴. Traditional scholars such as Kukenheim (1971) have argued that the loss of enclisis was caused by a change in the rhythmic structure of the language. Classical Latin had initial stress and a descending rhythm, which was replaced by an ascending rhythm and final stress in the evolution from Gallo-Romance to Old French. The idea of a relation between phonological enclisis and strong initial stress has been advanced more recently by Adams (1987) in her study of null-subjects and Verb-second effects in Old French. Adams (1987) not only attributes the loss of enclisis to the above-mentioned change, but also considers this change to have been the cause for the cliticization of subject pronouns and the loss of Verb-second phenomena.

Neither Kukenheim nor Adams formalized their insights. Adams states that "the loss of enclisis was part of a process by which all elements in the phrase gave up their individual accent to that of the final tonic syllable; it thus points to a fundamental change in accentuation. As long as *je*, for example, in *jes avrai* remained an independent form with its own accent, *les* could cliticize to it." Adams (1987:165) presents the two grammars, repeated below as (1a) and (1b), for Gallo-Romance and Old French in order to clarify the difference in constituent structure.

(1a)

Jé	les	avrái
Jé+les		avrái
Jés		avrái

(1b)

Je	les	avrái
Je	les +	avrái
Je +	les +	avrái

³ Enclisis was optional in Old French. In Modern French only a few lexicalized remnants can be observed, such as, the contraction of *de + le* > *du*, *de + les* > *des*, *à + le* > *au* and *à + les* > *aux*. These forms can be analyzed along the lines of Zwicky (1987) as syntactic allomorphy or along the lines of Hayes (1990) as precompiled phrasal allomorphy. The optional character of Old French enclisis seems to exclude such an analysis. The reader is referred to Jacobs (1993) for a more detailed account and to Evers (1994) for a partially lexicalized approach.

⁴ Clitics are considered following Garde (1968:70-72) as basically stressless and therefore have to be integrated into prosodic words. A distinction has to be made between phonological and syntactical proclisis and enclisis. An unstressed object pronoun in preverbal position can syntactically be proclitic on the verb, but phonologically be enclitic on a preceding stressed element. This is most clearly shown by cases such as Old French *jot vi* 'I saw you', where the phonological enclisis is clear by the reduction and integration of the object pronoun into the preceding stressed subject pronoun, but where syntactically the object pronoun is proclitic on the verb.

Recent research on prosodic phonology has led to the development of a number of prosodic theories which all postulate a level of representation that is not necessarily isomorphic with syntactic structure and that mediates between the phonological and syntactic components of a grammar. These theories make it possible to give a more formal expression of the insights provided by scholars such as Kukenheim and Adams. Moreover, as will be shown, they not only do that, but also can add to our understanding of why the changes took place in the way they did. This section is organized as follows: in section 2.1, we will concentrate mainly on the prosodic conditions, that is the domain of application of enclisis and proclisis, and, on the evolutionary change from enclisis to proclisis. We will first discuss the prosodic theories of Selkirk and Shen (1990) and Nespor and Vogel (1986) which both allow for a more formal account of enclisis and proclisis as well as for the above-mentioned evolutionary change. Next, we will examine in section 2.2 the predictions made by and the problematical aspects of both theories by looking at Brazilian and European Portuguese. After that, section 2.3 briefly discusses how syntactic theories try to explain partially the same phenomena as prosodic theories.

2.1 Prosodic theories

Selkirk and Shen's (1990) Edge-based theory of the syntax-phonology mapping allows for the construction of two prosodic constituents: the Prosodic Word (PW) and the Major Phrase. The mapping of syntactic structure to prosodic structure is defined by the algorithm in (2).

(2) Syntax-Phonology Mapping (Selkirk and Shen, 1990:319)

For each category C_n of the prosodic structure of a language
there is a two-part parameter of the form

$C_n: \{\text{RIGHT/LEFT}; X_m\}$

Where X_m is a category type in X-bar theory

For each language it must be specified whether the right- or the left-edge of syntactic categories in the syntax-phonology mapping is used. For the Gallo-Romance syntax-phonology mapping rule constructing Prosodic Words, the choice of the left-edge of syntactic categories yields domains in which the preverbal clitic object pronoun is separated from the verb although syntactically being dependent on it. The object pronoun is thus phonologically enclitic, but syntactically proclitic.

Furthermore, if for Old French the parameter is reset to right-edges, one obtains a domain in which the preverbal clitic object pronoun is no longer separated from the verb, but together with a preceding non-lexical item incorporated within the same domain as the verb. The Gallo-Romance and Old French Prosodic Word rules can be stated as in (3).

(3) a) Gallo-Romance Prosodic Word rule

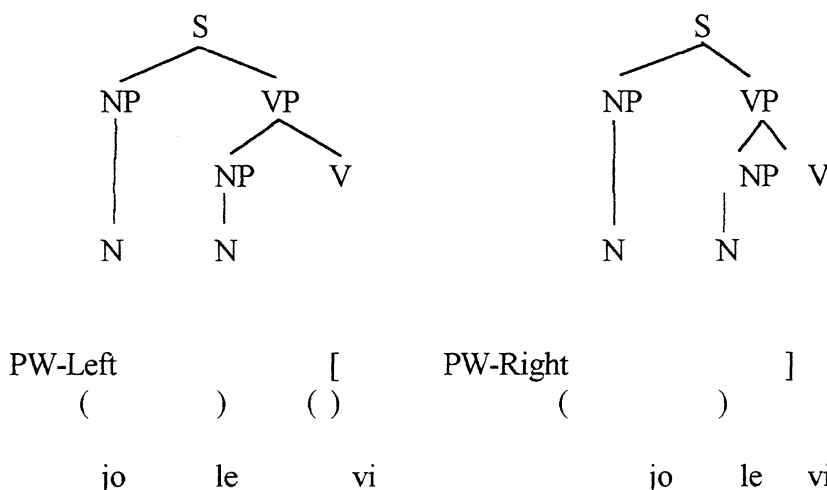
Prosodic Word: $\{\text{Left}, \text{Lex}_0\}$

b) Old French Prosodic Word rule

Prosodic Word: $\{\text{Right}, \text{Lex}_0\}$

The different prosodic constituent structures made possible by the different parameter settings in (3) are listed in (4), and, are entirely consistent with the different constituent structures assumed by Adams (1987) in (1) above.

(4a) Parameter 2 is set to LEFT (4b) Parameter 2 is set to RIGHT



In (4a) the left-edge is used for the syntax-phonology mapping and in (4b) the right-edge. The syntactic representation in (4) is greatly simplified for ease of exposition. Both subject and object pronouns have been represented as NP's. The exact syntactic nature, however, does not crucially alter the prosodic constituent structure. Selkirk and Shen (1990) allow a variation in (2) according to which all syntactic categories or only lexical syntactic categories count for purposes of domain construction. Given that pronouns are functional and not lexical instances of syntactic categories whatever their label, the same prosodic constituents as in (4) will obtain as long as we specify that lexical X0's are chosen for the PW-rules.

It is clear that the evolution from enclisis to proclisis can straightforwardly be described as a change in the edge-parameter setting for the construction of Prosodic Words from (3a) to (3b). In (4a), the parameter setting LEFT automatically induces a PW boundary at the beginning of the utterance, hence the domains (*jo le*) and (*vi*). *Jo* and *vi* being the heads of different PW's both receive stress and, therefore, *le* is able to encliticize on the preceding stressed subject pronoun. Given that stress is final in structure (4b), the subject pronoun is no longer stressed and consequently a following clitic (unstressed) object pronoun can no longer cliticize onto it. Furthermore, the cliticization of subject pronouns themselves also follows quite naturally from the change in the edge-parameter setting.

Moreover, given that the edges that are relevant for the syntax-phonology mapping correspond to the location of word and phrasal stress (final in Old and Modern French; initial in Classical Latin), it seems logical to try and connect these facts in a more principled way. Jacobs (1993) has proposed the principle in (5).

- (5) The syntax-phonology mapping parameter is set to RIGHT in a language with final and to LEFT in a language with initial stress.

The edge-based theory of the syntax-phonology mapping thus seems to provide a straightforward explanation for the loss of enclisis. The change from a descending rhythm to an ascending rhythm (from Classical Latin phrase initial stress to Gallo-Romance and Old French phrase final stress) can formally be described as a change in the edge-parameter setting for the construction of Prosodic Words. The different prosodic constituent structure that resulted from this switch can be claimed to be responsible for the loss of enclisis (cf. Jacobs 1993, for a more detailed account).

There is, however, another way of accounting for the facts which is based on the prosodic theory of Nespor and Vogel (1986) and which makes different empirical predictions. In the prosodic theory advocated by Nespor and Vogel a constituent is proposed which mediates between the phonological word and the phonological phrase and which, at first sight, seems to be the ideal candidate for defining the domain of application of clitic phonology: the clitic group. The construction of the clitic group (C) groups together a host and its clitics according to the algorithm in (6).

(6) Clitic group formation

I C-domain

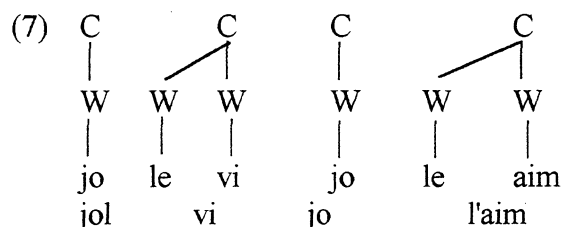
The domain of C consists of a W (Phonological Word) containing an independent (i.e. a nonclitic) word plus any adjacent W's containing

- a. a DCL, or
- b. a CL such that there is no possible host with which it shares more category memberships.

II C-construction

Join into an n-ary branching C all W's included in a string delimited by the definition of the domain of C

Nespor and Vogel distinguish between directional clitics (DCL), such as, for instance, the Greek possessives (Nespor and Vogel 1986:153) which always attach to a host in one specific direction regardless of the syntactic configuration and clitics *tout court* which attach to that host with which they share most syntactic category memberships.⁵ Given that object pronouns can attach to a host on the right as well as on the left (compare *jol vi* and *jo l'aim*), they must not be considered DCL's, but CL's. However, given that the object pronoun will always share more syntactic category membership with the following verb, and, given that *jo*-being able to occur in isolation and being able to be separated from the verb by an adverb- is not a clitic itself, but an independent word, the algorithm in (6) will yield for the proclisis and enclisis examples above the same C-domain division. This is illustrated in (7).



It should also be noticed that, because *jo* is not a clitic, it is not possible either to have one single clitic group consisting of *jo* + object pronoun + verb. Besides the clitic group, which is not able to define the proper domain for the application of proclisis and enclisis, Nespor and Vogel's theory contains the phonological phrase, which, as will be shown, can serve as the correct

⁵ **Syntactic category membership can be defined as follows: X and Y share category membership in Z if Z dominates both X and Y.**

characterization of the domain of application of enclisis and proclisis.
The definition of the phonological phrase is given in (8) (cf. Nespor and Vogel, 1986).

(8) Phonological Phrase (PP)

Join into a PP any lexical head (X) with all items on its non-recursive side
within the maximal projection and with any other non lexical items on the
same side.

Given that the word order in the evolution of French has changed from basically OV to VO (a change that took place at about the same time as the loss of enclisis⁶), the construction of PP's must have changed also according to (8). In the OV-period, the object pronoun will be separated from the verb (hence liable to encliticize onto a preceding stressed host), whereas in the VO period it will be grouped together with the verb into one single PP (hence liable to procliticize onto the verb). Enclisis and proclisis could then be thought of as ways of licensing clitics by incorporating them into the prosodic hierarchy, and, the loss of enclisis would follow as a natural consequence of the change in the PP-domain triggered by the syntactic word order (that is, please recall fn.6, head-initial to head-final) change.

In this section, we have discussed how the prosodic theories of Nespor and Vogel (1986) and of Selkirk and Shen (1990) allow for a description of the Old French clisis processes. In the next section, we will discuss the problematical aspects and empirical predictions of these theories.

2.2 Problems and predictions

There are a number of problematical aspects with both analyses presented in the previous section. We will only discuss the more important ones and refer for a more detailed account to Evers (1994).

First of all, both the Edge-based account and the PP-account seem to imply that proclisis was not possible until the edge-parameter was reset from LEFT to RIGHT or until the word order changed from OV to VO. This is so because the Gallo-Romance parameter setting (3a) ({Lex0,Left}) will always induce a word boundary between a proclitic word and a following lexical X0. Therefore, the intermediate stage of the language where both enclisis and proclisis are possible (an example of this is given in (9) cf. Evers, 1994:15) is hard to describe.

(9) Enclisis and proclisis in Old French (12th century *Chanson de Roland*)

Fors s'en eissirent li Sarrazins dedenz
Sis cumbatirent al bon vassal Rolant

The Sarrazins who were inside went outside
and fought with the good knight Roland

⁶ It is more accurate to say that syntactic structures have changed from head-initial to head-final, thus from having the recursive side on the left of the head (Latin, Gallo-Romance) to having the recursive side on the right of the head (Old French, Modern French). For a more detailed account the reader is referred to Bichakjian (1988) and Bauer (1992).

One either has to assume in the edge-based theory account that the two different rules of prosodic word construction (3a) and (3b) coexisted for some time or that after the switch from LEFT to RIGHT ((3a) to (3b)), initial stress subsisted for some time (cf. Jacobs, 1993). Given that this period must have lasted four centuries, since enclisis and proclisis coexisted from the earliest Old French documents on, neither assumption is very attractive. *Mutatis mutandis*, the same holds for the PP-construction in the OV-period. In conclusion, both prosodic theories to some extent provide a possible account for the evolutionary change from enclisis to proclisis, but face similar problems in defining the correct domains for the application of proclisis and enclisis in the Old French period.

Second, the two theories make different empirical predictions. Whereas the analysis casted in the edge-based theory predicts that enclisis can occur in languages that have initial stress, but cannot occur in languages that have final stress, the analysis presented in the Nespor and Vogel theory predicts enclisis to be possible in OV-languages, but not in VO-languages.

Let us briefly examine these predictions. One of the differences between European Portuguese (EP) and Brazilian Portuguese has been claimed to be the preference for enclisis in EP and for proclisis in BP. Brandão de Carvalho (1989) argues that EP object pronouns are always enclitic⁷, whereas BP object pronouns are always proclitic. Some examples are given in (10).

- (10a)EP Eu vi-te ontem 'I saw you yesterday'
 Ele disse-te que.. 'He told you that...'
 O gato apanhou-o 'The cat caught him'

- (10b)BP Eu te vi ontem
 Ele te disse que...
 O gato o apanhou

The cases in (10) are cases where pronominal placement is theoretically free, that is in independent or root clauses with an overt subject and no initial adverbial complement. According to Brandão de Carvalho (1989:407) the utterances in (10a) are "perfectly possible in Brazil; however, they are perceived as European and/or quite normative in BP speech." The same holds for the possibility of (10b) in EP, which "will generally be felt as 'Brazilianlike' or somewhat 'literary' in normal styles." Given that the basic word order in both varieties is identical, the predictions of the Nespor and Vogel account are not borne out by the facts. Moreover, the fact that both (10a) and (10b) are possible in both varieties makes a **strong** link between either initial stress or OV-word order and the existence of enclisis in a language hard to sustain. This does not mean of course that stress does not play a role in clisis processes. The function of stress can quite clearly be observed in the EP and BP contrastive examples in (11).

- (11a)EP Diga-me (11b) BP Me diga
 De-me Me de

⁷ Brandão de Carvalho (1989:409) also considers EP cases where the pronoun figures obligatory in preverbal position (subordinates, interrogative sentences, and utterances with an initial adverbial complement) as being phonologically enclitic. Thus, for instance, in cases such as '*Não te vi*' 'I didn't see you', or '*Já te dou*' 'I'll give (it) to you now', the object pronoun although in preverbal position is considered to be enclitic on the preceding stressed element. In BP, the object pronoun is considered to be syntactically as well as phonologically proclitic to the verb.

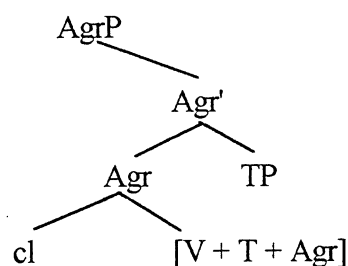
Brandão de Carvalho states that no EP utterance can begin with an unstressed pronoun⁸, hence the enclitic forms in (11a). Given the absence of such a constraint in BP, the proclitic forms in (11b) which do have an unstressed pronoun in utterance initial position are only possible in BP. In this subsection, we have discussed the problematical aspects and empirical predictions of the edge-based and Nespor and Vogel-based accounts of enclisis and proclisis. It has been argued that both analyses face problems in accounting for the Old French period in which both enclisis and proclisis were possible, and, that the predictions they make are not borne out by the facts of Brazilian and European Portuguese. In the next section, we will briefly discuss how syntactic proposals try to account for partially the same phenomena as phonological accounts.

2.3 Syntactic accounts

An overview of the literature on clitic placement in syntax cannot be but incomplete. We will therefore only briefly discuss a recent proposal by Madeira (1993). After discussing Kayne's (1991) account of clitic placement in Italian and Spanish, where the position of the clitic is related to the tensed/untensed nature of clauses (compare Italian *la guardano* 'they look at her' versus *guardar-la* 'to look at her'), Madeira examines EP where the position of the clitic in tensed clauses is not always preverbal.

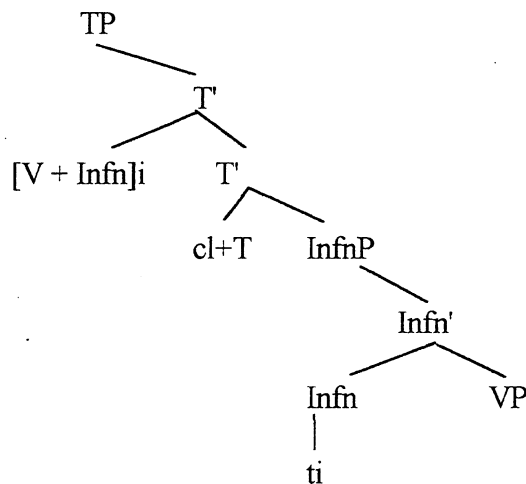
Clitics are assumed to be base-generated as the head of a DP subcategorized for by the verb. The surface position is reached by movement into a higher functional head. For Italian and Spanish tensed clauses, the clitic is assumed to left-adjoin to the functional head where the verbal complex is found: AGR. In infinitival clauses, the clitic is moved to an "abstract T-node and movement of the verbal complex is past it to a position adjoined to T". Schematically this can be represented as in (12) (taken from Madeira (1993:157)).

(12) a) Italian and Spanish tensed clauses



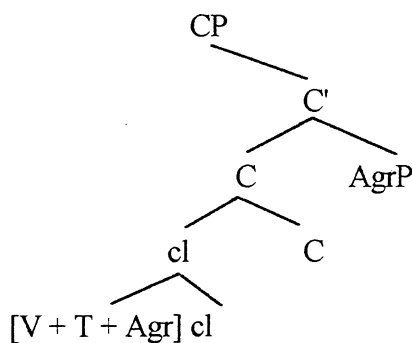
⁸ This constraint is traditionally known as the Tobler-Mussafia Law.

b) Italian and Spanish infinitival clauses



Languages with a verb-clitic root order thus pose a problem for the account along the lines of (12). Madeira suggests that the clitic in these cases is moved into an empty C-node in root clauses. The verb also moves into C and is left-adjoined to the clitic, resulting in the order verb-clitic. This is illustrated in (13).

(13) Enclisis in root clauses



Movement of the verb into C is motivated by the fact that the clitic must syntactically be incorporated by the verb presumably in order to check case features. We will not discuss this matter in detail here. The reader is referred to Madeira (1993:161-162; especially fn.6). Madeira then generalizes her account to Italian, Spanish and European Portuguese by assuming that clitics move to the highest functional head with the restriction that movement to empty C is only possible in EP, but not in Italian and Spanish.

Movement of the clitic to the empty C in root clauses is taken to be the explanation for the fact that in EP clitics cannot occur in sentence-initial position. This is illustrated in (14).

(14) Telefonou-lhe o Paulo

*lhe telefonou o Paulo

Madeira (1993:173) explains this as follows. If the clitic is moved to the highest available functional head (the empty C) then "in order to satisfy the incorporation requirement, the verbal complex must move up, left-adjoining to the clitic in C." If the verbal complex does not attach to the clitic, the representation is ruled out. However, if we recall the contrastive pairs in (11a) and (11b), it becomes clear that the ban on clitic-first is to some extent independent of syntactic incorporation requirements. Rather, it seems to be the case that the verbal complex adjoins to the LEFT in EP, but to the RIGHT in BP. Moreover, in Madeira's analysis of EP, the clitic surfaces to the left in clitic-verb sequences (where the verb is taken to be the head (12a)), but to the right in verb-clitic sequences (where the clitic is taken to be the head (13)). No syntactic motivation is given to support this asymmetry (cf. Madeira, 1993:162, fn.7).

In this section, we have briefly discussed a recent syntactic proposal for clitic placement. We have tried to demonstrate that contrasts such as the ones in (11) can observationally be described in terms of different directions of adjunction, but that no motivation for such a state of affairs can be provided. This of course does not mean that syntactic considerations do not play a role in clitic placement, but only that not all facts concerning clitic placement can adequately be handled syntactically⁹.

In the next section we will present the outlines of an optimality-theoretic approach to proclisis and enclisis which is not thwarted by the same problems as the prosodic theories discussed above, and, which can also account for the aspects that were shown to be syntactically problematical.

3. An optimality approach

In Optimality theory (Prince and Smolensky 1993) phonology is thought of as a universal set of constraints which are hierarchically ranked on a language-specific basis. The relation between input and output is accounted for by two functions, GEN and H-EVAL, which respectively generate for each input all possible outputs and evaluate which output is optimal (cf. Prince and Smolensky 1993 for a more detailed account). Thus in Optimality theory the phonological rule as such no longer exists. Rather, starting from an input **all** possible outputs are generated and evaluated against the constraint-ranking of the language until the optimal output is found. The candidate which best satisfies the constraint hierarchy is evaluated as the optimal one. The role of phonological rules has thus been entirely subsumed by the constraint hierarchy (for more details see Prince and Smolensky 1993). In Optimality theory, constraints may be violated, depending on the ranking of other constraints. This then is a crucial difference between the way constraints have hitherto been conceived of and Optimality theory. The following example, taken from Prince and Smolensky (1993:29) should make this clear. Speaking in derivationalist terms, languages normally do not allow heavy syllables to be split by foot-construction rules. A principle of Syllabic Integrity, stating that foot-parsing may not dissect syllables, (cf. Prince (1976)) is

⁹ Another phenomenon which is quite difficult to handle syntactically is the so-called *mesoclis* in EP, as in, for instance, *visitar-te-emos* 'we will visit you' (cf. Madeira (1993:157) and van der Leeuw (1994) for an elegant account in Optimality theory).

assumed to guarantee this. It is therefore, that in Classical Latin, for instance, moraic trochee construction skips a light penultimate syllable, if the antepenultimate syllable is heavy. Now, in Tongan main stress falls on the penultimate mora of a word. However, unlike in Classical Latin, for instance, in a sequence /-CVVCV/, the VV sequence is split in two, yielding CV.(V.CV). Compare *húu* 'go in' (monosyllabic) versus *hu.ú.fi* 'open officially' (trisyllabic). In a rule-based approach, a rule of foot construction then necessarily has to violate a constraint (Syllabic Integrity) assumed to be universal.

Optimality theory offers a solution in terms of constraint domination. Two constraints are invoked by Prince and Smolensky (1993:28-29). One is EDGEMOST which states that the most prominent foot in the word is at the right edge, and the other one is ONS which states that every syllable has an onset. If the constraint EDGEMOST dominates ONS, the facts of Tongan will obtain. In (15) this is illustrated in a so-called constraint tableau. The F points to the optimal candidate, the * means a violation of a constraint, and the ! points to crucial constraint satisfaction failure.

(15) Candidates	Edgemost	ONS
F hu.(ú.fi)		*
(húu).fi	s!	

In (15) only candidates that are properly bracketed are considered. Other ill-parsed possible candidates will be ruled out by other constraints (cf. Prince and Smolensky (1993) for a more detailed account). If constraints in a rule-based theory can be conceived of as a sort of 'phonological customs inspection' (Kenstowicz (1994:531), where a violation is fatal, the constraints in Optimality theory are less rigid, where candidates are allowed to violate constraints, as long as they better satisfy higher-ranked constraints than other candidates.

McCarthy and Prince (1993 a and b) propose a unified theory (called Generalized Alignment) to account for the different ways in which constituent-edges are referred to in phonology and morphology. Basically a Generalized Alignment requirement means that an edge (R/L) of a prosodic or morphological constituent must coincide with an edge (R/L) of another prosodic or morphological constituent according to the general schema in (16).

(16) General schema for ALIGN

In ALIGN (GCat, GEdge, PCat, PEdge), the GEdge of any GCat must coincide with PEdge of some PCat, where

GCat = Grammatical category, among which are the morphological categories

MCat = Root, Stem, Morphological Word, Prefix, Suffix, etc.

PCat = Prosodic Category = μ , s, Ft, PrWd, PhPhrase, etc.

GEdge, PEdge = Left, Right

The general schema for Alignment can be understood, according to McCarthy and Prince (1993b:32) as "extending to word-internal constituency the edge-based theory of the syntax/phonology interface." The Alignment schema in (16) can thus be understood as defining part of the Morphology-Phonology interface.

Conversely, the syntax-phonology mapping parameter from (2) above can be defined in terms of Generalized Alignment, which allows for a definition of the Syntax-Phonology interface in a similar way as the Morphology-Phonology interface.

For Gallo-Romance, we reformulate the Prosodic Word rule (3a) as the alignment instruction (17).

(17) Align-Lex0-LEFT: Align (Lex0, L, PrWd, L)

According to the constraint in (17) any left-edge of a Lex0 should coincide with the left-edge of a Prosodic Word. The problems that both the prosodic theories discussed in section 2 were confronted with (accounting for both enclisis and proclisis at the same time) can now easily be solved. As a constraint (17) can be violated depending on the ranking of other constraints. The cases where it is violated in Old French are precisely the cases where we have proclisis.

Now in order to enforce proclisis, we need a constraint ranking that in the case of a vowel hiatus, will ensure the non-surfacing of the first vowel rather than the insertion of an epenthetic consonant. The constraints needed to guarantee this are motivated in Prince and Smolensky (1993:85-96). The constraints involved are ONS (syllables must have onsets), PARSE (underlying segments must be parsed) and FILL (syllable positions must be filled with underlying segments). In order to illustrate these constraints, let us consider an input string /V/. If ONS dominates the other two constraints, the relative ranking of PARSE and FILL yields the results in (18a) and (18b), where a dot represents a syllable boundary, an angled bracket unparsed material and " an empty node.

(18a) /V/	ONS	PARSE	FILL
. V .	*!		
<V>		*!	
F . " V .			*

(18b) /V/	ONS	FILL	PARSE
. V .	*!		
F <V>			*
" V .		*!	

In (18a), where PARSE dominates FILL, the non-syllabification of input /V/ is less optimal than adding extra material (the epenthetic consonant represented by "). In other words, PARSE demands fully syllabified candidates, regardless of whether they contain extra material, whereas, FILL demands non-epenthetic forms, even if they contain unparsed material.

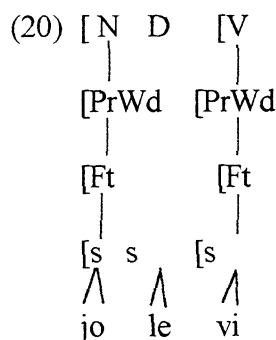
For Gallo-Romance and Old French proclisis, we need underparsing (deletion) of V's, hence the constraint order ONS>>FILL>>PARSE. In order to be effective these constraints must dominate the constraint in (17). The constraint ranking assumed thus far is given in (19).

(19) ONS>>FILL>>PARSE>>ALIGN(Lex0).¹⁰

¹⁰ It should be noticed that proclisis did not apply to any V#V sequence. It only applied to a specific set of unstressed function words (articles, object pronouns, possessives and

Let us now return to enclisis. Two issues will be addressed here. One, why is it that the object pronoun occurs in preverbal position? Is this something that can be accounted for by the constraint hierarchy or is this an aspect that should be accounted for in terms of syntactic movement rules, and, thus should be handled in another component of the grammar? Two, how does the phonological enclisis (reduction of the unstressed object pronoun and enclisis onto the preceding stressed element) translate into Optimality theory?

Let us start with the second issue. In order to facilitate the discussion, let us first consider (20).



In (20) we have given a partial representation where according to the constraint in (17), the left-edges of a Lex0 have been left-aligned with a PrWd. Also, in (20) we have partially represented in terms of alignment, the Prosodic Hierarchy Hypothesis (cf. among others, Selkirk (1980), Nespor and Vogel (1986)). The analysis that will be given depends on the underlying representation of the articles and object pronouns that were liable to encliticize in Old French (*le*, *les*, (articles and pronouns) and, occasionally, the unstressed pronouns *me*, *te*, *se*, and *en*). If it is assumed that in underlying representation these function words do not have a vowel nucleus (cf. Evers (1994)), the possible outputs *jol vi* and *jo le vi* can be accounted for by assuming that both forms are incorporated into the preceding word (the syllable to the preceding foot in the case of *jo le* and the segment *l* to the preceding syllable in the case of *jol*) in order to satisfy the constraint FtBIN (according to which feet must be binary under syllabic or moraic analysis, cf. Prince and Smolensky (1993) and McCarthy and Prince (1993b)). The choice between either *jol* or *jo le* can be made on the basis of an optional reranking of the relevant syllable-structure constraints (cf. Prince and Smolensky, 1993:85-96). For *jol*, the constraint -COD (syllables must not have a coda) must be dominated by PARSE, which in turn must dominate FILL^{nuc} (a nucleus node must be filled with underlying segments). For *jo le*, the constraint ranking must be the following: -COD >> PARSE >> FILL^{nuc}. This is illustrated in (21). The input is /jol/.

(21a) Candidates	PARSE	FILL ^{nuc}	-COD
F .jol.			*
jo<l>.	*!		
.jo.l~		*!	

particles (cf. Einhorn, 1974:12). We will not work this out in more detail nor provide constraint tableaux motivating the ranking assumed.

(21b) Candidates	-COD	PARSE	FILL ^{nuc}
.jol.	*!		
.jo<l>.		*!	
F .jo.l'			*

The constraint FILL^{nuc} must be interpreted as follows. Given our assumption that the object pronoun *le* in underlying representation does not have a nucleus, providing one by GEN as in the last candidate in both (21a) and (21b) is a violation of Fill^{nuc}. If this form is the actual output, as it is in (21b), then that empty nucleus is interpreted as a schwa in the output (cf. Prince and Smolensky, 1993:50-51 for related discussion).

Summarizing thus far, we have presented the outlines of an optimality analysis of Gallo-Romance and Old French proclisis and enclisis. It has been argued that the problem of earlier prosodic theories to define the domains of application for enclisis and proclisis can be solved in Optimality theory, precisely because the syntax/phonology mapping defined in terms of alignment is less rigid in the sense that the constraints defining it can be violated by higher-ranked constraints, viz. the syllable structure constraints in the case of Old French. Furthermore, the predictions made by the two theories discussed in section 2 which were shown to be problematic are no longer made by the present Optimality-theoretic analysis.

Let us now address the question as to whether enclisis and proclisis in the syntactic sense of preverbal and postverbal position can also be handled along the lines of the Alignment-based syntax/phonology interface or should be left to the syntactic component. It should be made clear at the outset that this is a question which can not be answered easily and that a lot more research in this respect is needed.

In section 2.3, we have discussed Madeira's (1993) proposal to account for the ban on clitic-first in EP. We have argued that given the contrastive pairs in (11), the ban on clitic-first is very likely to be independent of syntactic incorporation requirements. Rather, it seemed that the verbal complex adjoins to the LEFT of a clitic in C in EP, but to the RIGHT in BP. What we would like to propose in order to account for the difference between EP and BP is that the clitic and the verb are adjoined to the relevant syntactic node by syntactic movement rules, but that the order in which they surface follows as a consequence of the Alignment instruction for the syntax/phonology mapping. We then no longer need to have unmotivated left- or right adjunction of the verbal complex in C, but can make the surface position of the clitic follow as a rather straightforward result of the syntax/phonology mapping.

In order to account for the contrastive EP and BP pairs in (11), we assume for EP a high-ranked constraint that demands a left-alignment of Lex0's with PrWd's (ALIGN-Lex0-L), whereas for BP the opposite ranking is assumed: a high-ranked constraint is assumed that demands right-alignment of Lex0's with PrWd's (ALIGN-Lex0-R), as informally represented in (22). This is in general, what seems to be required to motivate a constraint: adduce examples of other languages where the same constraint or exactly the opposite constraint ranking is necessary.

(22) EP ALIGN-Lex0-L >> ALIGN-Lex0-R

BP ALIGN-Lex0-R >> ALIGN-Lex0-L

To further strengthen this idea, let us first try to work out some more EP examples. Following Brandão de Carvalho (1989), we assume the forms in (23) to represent the unmarked state of affairs with respect to pronoun-placement in EP. Brandão de Carvalho (1989:407) distinguishes between cases where pronoun placement is theoretically free (23a-d), but where EP "shows a greater propensity to 'enclisis', that is to postverbal position" and cases (23e-g) where pronoun placement is not free (please recall fn.7).

- (23) unmarked a) Eu vi-te ontem "I saw you yesterday"
 marked b) Eu-te vi ontem id.
- unmarked c) O gato apanhou-o "The cat caught him"
 marked d) O gato o apanhou id.
- obligatory e) Diga-me "Tell me"
 position f) Não te vi "I did not see you"
 g) Quem me vê? "Who sees me?"

As far as syntactic movement is concerned, we follow the analysis of Kayne (1991) from (12a) and (12b) above, in which it is assumed that clitics are adjoined to the functional head where the verbal complex is found. Now, if we want to get the position of the clitic with respect to the verbal complex for free as a result of alignment, then, besides the constraints demanding left-alignment and right-alignment of Lex0 with PrWd's in EP, one more alignment constraint is needed that demands that a PrWd must begin with a foot: ALIGN-PrWd (PrWd, L, Ft, L). This constraint has been extensively motivated in OT-literature (cf. among others Prince and McCarthy (1993)).

It should be recalled from the discussion of Madeira's proposal that the order verb-clitic only occurs when the C-position is empty. When the C-position is filled the order is clitic-verb (interrogative sentences (23g) and utterances with an initial adverbial complement (23f)). If it is assumed now that in these cases the filled C-position does not constitute a lexical category (that is non-lexical items occur in it), then in, for instance, in (23f) the pre-position of *te* offers two prosodic grouping possibilities. Either it is grouped with the verb in a PrWd or it is grouped in a PrWd with the preceding *não*. Grouping it together with the verb as (*não*) (*te vi*) would both violate the constraint ALIGN-Lex0-L (*te* not being a lexical category) and the constraint ALIGN-PrWd (the second PrWd (*te vi*) does not begin with a foot). The grouping of *te* with preceding *não*, as (*não te*)(*vi*), would neither violate ALIGN-Lex0-L nor ALIGN-PrWd (as a matter of fact both *não* and *vi* are stressed, cf. fn.7), but only a violation of ALIGN-Lex0-R. In this way we can provide an account for the obligatory preposition and obligatory phonological enclisis in EP in cases like (23f-g). This is illustrated in tableau (24) for (23f).

(24) <i>não te vi</i>	AL-Lex0-L	AL-PrWd	AL-Lex0-R
F (<i>não te</i>)(<i>vi</i>)			*
(<i>não</i>) (<i>te vi</i>)	*!	*	
(<i>não</i>) (<i>te</i>)(<i>vi</i>)		*!	*

In order to further determine the correct hierarchical ranking of the Alignment constraints, let us consider (23e). In (23e), the preposition of *me* would yield only one possibility: grouping it together with the verb. This grouping would violate both Align-PrWd and Align-Lex0-L. Both constraints must therefore in EP dominate Align-Lex0-R, in order to account for the obligatory postposition in (23e). Please recall that, as mentioned above, for BP a high-ranked constraint ALIGN-Lex0-R is assumed. This will account for the obligatory preposition in *me diga* cases in BP.

The postposition of *te* or *o* as in (23a and c) violates ALIGN-Lex0-R, but does not violate the higher-ranked constraints ALIGN-Lex0-L and ALIGN-PrWd. Preposing it, again, gives two possibilities. If the pronoun is grouped together with the verb (phonological proclisis, that is, as *(Eu)(te vi)* and *(O gato)(o apanhou)*), this entails a violation of ALIGN-Lex0-L and Align-PrWd. However, the grouping of the pronoun together with the preceding subject (phonological enclisis, that is, as *(Eu te)(vi)* and *(O gato o)(apanhou)*) would only violate ALIGN-Lex0-R, and, because Align-PrWd and Align-Lex0-L dominate Align-Lex0-R, is the optimal output when the pronoun occurs in preverbal position. It thus follows straightforwardly from the constraints and the constraint ranking assumed that pronouns in EP, whether they appear pre- or postverbally, are always phonologically enclitic. It should be observed, however, that the marked status of (23b) and (23d) in EP does not follow directly from the constraint hierarchy. A possible way to account for it, might be to assume that, all else being equal, grouping takes place preferably with the head from which it receives case.

In conclusion, the fact that both (23a/b) and (23c/d) are possible in EP, but **only** if they are phonologically enclitic, follows thus straightforwardly from the constraint ranking. The analysis presented here thus nicely captures the different surface order of the verb and the clitic in BP, which was shown to be problematical in a syntactic account. Moreover, it also straightforwardly formalizes, as mentioned, Brandão de Carvalho's insight that pronouns in EP, whether they appear pre- or postverbally, are always phonologically enclitic.

Conversely, because ALIGN-Lex0-R is high-ranked in BP, the preferred groupings for BP are the ones involving phonological proclisis: *(Eu)(te vi)* and *(O gato)(o apanhou)*. In this section we have presented the outlines of an analysis in Optimality theory of enclisis and proclisis. It has been argued that Optimality theory is better equipped to handle the domain aspects of the enclisis and proclisis phenomena discussed here. The problem of identifying the correct domains for the application of enclisis and proclisis which the prosodic theories discussed in section 2 were confronted with, has vanished in the present analysis. Furthermore, no empirically unmotivated predictions are made. Finally, we have argued that extending the Generalized Alignment theory to the syntax/phonology mapping, opens up a new perspective to account for phenomena that hitherto have proven reluctant to a purely syntactic account.

4. Summary and discussion: sound change and markedness

In this paper, we have discussed an example of sound change in the historical phonology of French, where we have shown not only that Optimality Theory by constraint reranking can adequately account for sound change, but also that the proposed analyses are not thwarted by drawbacks of previous nonlinear derivational accounts.

There is, however, one aspect that needs to be briefly discussed. In section 2, in the discussion of the edge-based analysis of the loss of enclisis, we briefly discussed the tentative principle (7), in which a link was made between the edge relevant for the edge-parameter and the edge where

phrasal stress is located. For the sake of the argumentation, we will side-step for the moment the empirical adequacy of the principle in (7), and concentrate on the role of principles such as these in Optimality Theory. Until the advent of constraint-based theories, such as Optimality Theory, it has been a common practice among phonologists to add to the Theory of Markedness by formulating principles such as the one in (7). The obvious question that arises now, of course, is how such principles can translate into Optimality Theory. In other words, does Optimality Theory allow for a Theory of Markedness based on similar principles, or should the unmarked state of affairs in one way or another follow as a natural result from the hierarchy? The latter position seems unmotivated as there is nothing inherent in the formalism of constraint-hierarchies that would prefer one ranking above the other. Also, each constraint itself, because it is considered to be part of Universal Grammar, is already in a sense a statement about markedness. Nevertheless, one would like to be able to express more formally that some rankings are more natural or less marked than others. Therefore, for the case at hand, we could, if the first position is adopted, and, assuming that phrase-initial and phrase-final stress can be accounted for by edge-aligning feet with Prosodic Words, propose a principle like (24).

- (24) *If, in a language, the constraint ALIGN (PrWd, L, Ft, L) is higher ranked than the constraint ALIGN (PrWd, R, Ft, R), then, the constraint ALIGN (LEX0, L, PrWd, L) is, in the unmarked case, higher ranked than the constraint ALIGN (LEX0, R, PrWd, R).*

It is, however, easy to see that this way of dealing with markedness can easily become very complicated. For instance, if we want to express the generalization (cf. Hayes (1993)) that certain languages (that is those that have iambic stress rules) tend to have quantitative rules such as rhythmic vowel lengthening, consonant gemination, vowel reduction and vowel deletion, whereas other languages (those having trochaic stress rules) do not, this would become, if expressed in a similar way as (24), very intricate. It is clear that especially in this area a lot of future research is needed.

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