

Shattering Paradigms: An Attempt to Formalize Pressures within Subparadigms

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1. Introduction

Paradigmatic pressures do not work in a homogeneous or symmetric way. As already noted by many scholars, factors such as the degree of phonological similarity, the degree of semantic closeness, the degree of productivity between the members of a paradigm, or the number of grammatical properties which these members share are directly correlated with the degree of phonological pressure exerted between them. Optimality Theory has built up many proposals to account for surface similarities between the members of a paradigm but none explicitly deals with the problem of inclusion, that is, with those cases in which given the paradigm set $\langle A, B, C, D \rangle$, only a partial subset of the paradigm, say $\langle A, B \rangle$ or $\langle A, B, C \rangle$, is under paradigmatic pressure. This paper is an attempt to deal with the notion of inclusion within paradigms. We show how the Optimal Paradigms model (McCarthy [2001] 2005) and the Transderivational Correspondence Theory (Benua [1997] 2000) can be extended to apply not only within flat paradigms but also within paradigms with an internal uneven structure, in such a way that nominal morphological categories like Gender and Number, verbal morphological categories like Tense, Number, Person, etc., or the productivity of a given derivative process are explicit in the formal machinery of the theory. Due to space reasons, we illustrate our proposal by focusing on two Romance phenomena – overapplication of cluster reduction in Catalan and overapplication of diphthongization in Spanish – but it can be extended to many other phenomena which will be referred to briefly when necessary. Our account, on the other hand, consubstantially touches on (non-formally-biased) aspects such as the relation between the inflectional categories Gender and Number and their universal ranking and implications, or the relation between productive and non-productive derivation.

Paradigmatic pressures have traditionally been invoked to account for exceptions to sound laws, or, in more current terms, to account for cases of phonological opacity.¹ Two essential concepts when dealing with exceptions to sound laws, *i.e.* when dealing with cases of phonological opacity, are *overapplication* and *underapplication*. Overapplication refers to situations where a phonological process applies even though the conditions that make it applicable are not visible. Underapplication

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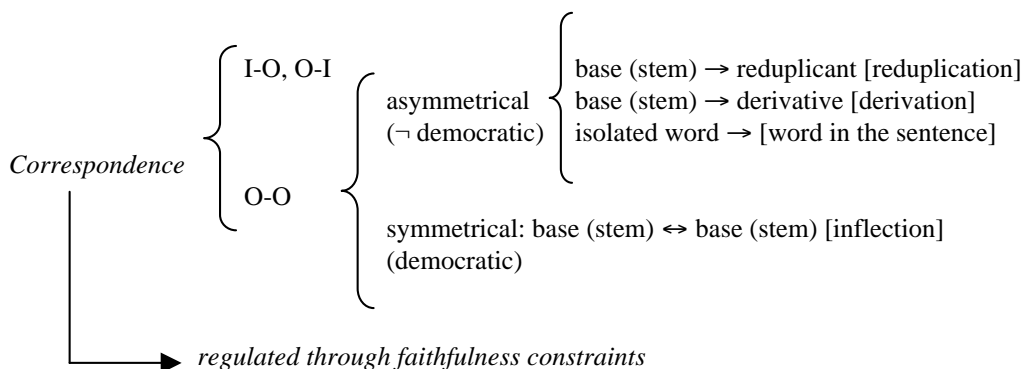
¹ Phonological opacity is a term coined by Kiparsky (1971, 1973) which refers to those cases in which a linguistic generalization is not surface-true (*i.e.* it fails to apply), and to those cases in which a linguistic generalization is not surface-apparent (*i.e.* it unexpectedly applies).

occurs when a (phonological) process does not apply even though the conditions that make it applicable are met. The phenomena dealt with in this paper are instances of overapplication of a process.

2. Paradigmatic pressures within Optimality Theory

Optimality Theory has developed a wide range of submodels, which, apart from the classic Input to Output and Output to Input correspondence, include *Output to Output correspondence*, namely, correspondence between surface forms. On the whole, as illustrated in (1), it is assumed that the surface correspondence relation between outputs is *asymmetrical* or *non-democratic* when dealing with reduplication, derivation or the occurrence of a word in the sentence, in that there is a base or isolated word which has priority over the others and to which the other members of the paradigm are faithful. And it is assumed that the correspondence relation between outputs is *symmetrical* or *democratic* when dealing with inflection, since in this particular case there is no single base which has priority: all the forms in the inflectional paradigm have the chance to exert pressure over all the others and also to undergo this pressure. In this paper, we corroborate this hypothesis, although this potential symmetrical and democratic relationship between the members of the paradigm is relativized, not by attributing a prominent status to one of the members of the paradigm, as proposed in some recent studies (see Albright 2005, Mascaró & Lloret 2007), but by splitting the inflectional paradigms into more cohesive sets, *i.e.*, into subparadigms. The pre-assumed asymmetrical relationship in derivation, on the other hand, is increased also by splitting the derivational paradigm into more cohesive paradigms, *i.e.* into subparadigms.

(1) *Asymmetrical and symmetrical paradigmatic pressures* (after McCarthy [2001] 2005, Pons 2002, Mascaró 2005, Albright 2005)



3. Paradigmatic pressures within inflection

3.1. The Optimal Paradigm model

The most influential OT-model designed thus far to account for paradigmatic pressures within the inflectional paradigm is the Optimal Paradigms model (McCarthy [2001] 2005; henceforth, OP model). This model is designed to account for paradigmatic pressures within the inflectional paradigm. According to this model, candidates consist of entire inflectional paradigms, whose individual members are all subjected to evaluation through the standard markedness and Input-Output faithfulness constraints. Emulating the standard Input-Output correspondence, the stem of each paradigm member stands in a surface correspondence with the stem in every other paradigm member; this correspondence is articulated by a set of Output-Output faithfulness constraints (labeled Optimal Paradigm faithfulness constraints, henceforth, OP faithfulness constraints). This model yields two interesting predictions. First, it predicts the already mentioned symmetrical status of the members of the inflectional paradigm in their potential to exert pressure over the rest of members. Second, it predicts that paradigmatic pressures are exclusively induced by phonological markedness, that is, what determines or governs the direction of the pressure is not a specific morphological status of a word but rather the need to respect

phonological markedness. Thus, the entire paradigm is attracted by an unmarked structure. Both predictions are corroborated in this paper, although the first one is relativized, as noted in § 2.

3.1.1. Refinement of the Optimal Paradigm model. Why and how?

3.1.1.1. Why?

We will illustrate the necessity of refining the OP model with a simple example drawn from Catalan. In most Catalan varieties, word-final clusters made up of a lateral or nasal followed by a homorganic stop are resolved through a process of cluster reduction which consists of the deletion of the stop consonant (2a). In some other varieties, these word-final clusters are maintained as such (2b). All varieties, however, reduce these final clusters when the plural morph *-s* follows (2c) and maintain the stop when the feminine morph *-a* follows (2d). The process of cluster simplification in word-final position never applies in heterorganic clusters (2e), nor in clusters with significant discrepancies of manner of articulation (2f). (Although not illustrated here, final sequences of a rhotic or alveolar sibilant followed by a homorganic stop can optionally be reduced when followed by a homorganic stop: *verd* [bér] ~ [bért] ‘green’; *gust* [gúst] ~ [gús] ‘taste’; and all varieties also delete the word-final stop consonant when followed by a word with an initial consonant: *més* [ál] *que jo* ‘taller than me’.)

(2) Cluster reduction in adjectival forms in Catalan varieties

a. <i>Some varieties</i>			b. <i>Some varieties</i>	
<i>alt</i>	[ál] ‘tall <i>masc. sing.</i> ’	≠	<i>alt</i>	[ált] ‘tall <i>masc. sing.</i> ’
<i>sant</i>	[sán] ‘saint <i>masc. sing.</i> ’	≠	<i>sant</i>	[sánt] ‘saint <i>masc. sing.</i> ’
c. <i>All varieties</i>			d. <i>All varieties</i>	
<i>alts</i>	[áls] ‘tall <i>masc. plur.</i> ’		<i>alta</i>	[áltə] ‘tall <i>fem. sing.</i> ’
<i>sants</i>	[sáns] ‘saint <i>masc. plur.</i> ’		<i>santa</i>	[sántə] ‘saint <i>fem. sing.</i> ’
			<i>altes</i>	[áltəs] ‘tall <i>fem. plur.</i> ’
			<i>santes</i>	[sántəs] ‘saint <i>fem. plur.</i> ’
e. <i>All varieties</i>			f. <i>All varieties</i>	
<i>remolc(s)</i>	[rəmólk(s)] ‘trailer <i>masc. sing. / plur.</i> ’		<i>cens</i>	[séns] ‘census <i>masc. sing.</i> ’
<i>calb(s)</i>	[kálp(s)] ‘bald <i>masc. sing. / plur.</i> ’		<i>ferm</i>	[férm] ‘firm <i>masc. sing.</i> ’
<i>parc(s)</i>	[párk(s)] ‘park <i>masc. sing. / plur.</i> ’		<i>carn</i>	[kárn] ‘meat <i>masc. sing.</i> ’

Different studies, framed formerly within autosegmental phonology and more recently within Optimality Theory, have tried to provide an explanation for this behaviour. Most of them adapt the hypothesis, originally developed in Mascaró (1976, 1984), that there is cluster simplification provided that it does not imply the loss of too much phonological information, either of point of articulation or manner of articulation. The causes of cluster simplification, however, vary from one author to another (see, in this respect, Morales 1992, 1995; Colina 1995; Jiménez 1997, 1999; Herrick 1999). Some other authors believe that the process of reduction applies due to the lack of perceptual prominence of the stop in this context or, more specifically, due to the lack of perceptual contrast between the stop and the preceding consonant (see, in this respect, Côté 2000, 2004a, b; Pons 2004, 2006, 2007; Wheeler 2005).

However, a careful look at the behavior of other Catalan dialects, which show preservation of the cluster in this context (2a) but simplification when the plural morph is added (2c), can lead to another explanation of the facts, namely that cluster simplification has its origin in the plural forms, a context in which the perceptual weakness of the stop is even more evident, in that it is flanked by two consonants (see Recasens 1993, Colomina 1996 for an analysis along these lines). This explains why simplification is triggered in *all* dialects in this context, and, due to paradigm uniformity (or analogy), the process has also been extended to word-final position, that is, to the singular forms. In fact, the same line of reasoning can be used when the behavior of other languages is analysed: whereas the process of cluster

simplification is almost systematic in the context C_C in many languages, it is not so common in the context C_## (where ## stands for word-final position). Thus we have here some consistent universal implications, according to which: *a)* If a language exhibits cluster simplification in tautosyllabic clusters of three segments, it will also exhibit cluster reduction in clusters of two segments. *b)* No language exhibits simplification in tautosyllabic clusters of two segments and preservation in tautosyllabic clusters of three segments. This implicational relation must have a consequence in the ranking of the contextual markedness constraints prohibiting homosyllabic consonant clusters, such as *CC]σ (3a) and *CCC]σ (3b). Given the above mentioned universal implications, the hierarchy in (4) is a fixed one, that is, it is universally constant and invariable.

(3) *Contextual markedness constraints against tautosyllabic consonant clusters*

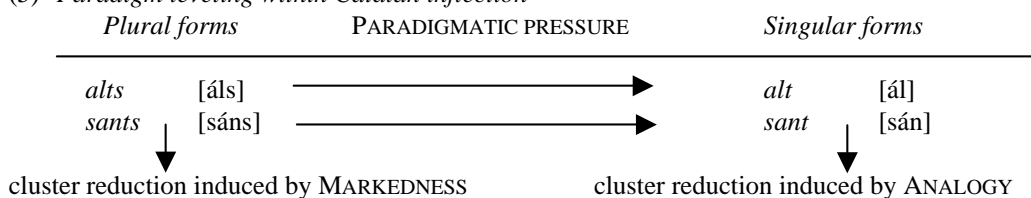
- a. *CC]σ: Assign one violation mark for every tautosyllabic cluster made up of two consonants.
- b. *CCC]σ: Assign one violation mark for every tautosyllabic cluster made up of three consonants.

(4) *Universal ranking of markedness constraints against tautosyllabic consonant clusters*

*CCC]σ >> *CC]σ

It can be interpreted, therefore, that the origin of this process is in the masculine plural forms, in which the process would be motivated by markedness reasons, in particular, to satisfy the high-ranked markedness constraint *CCC]σ (3b). And these plural reduced forms would exert their pressure over the singular forms in the varieties with cluster reduction but would not in the varieties with cluster preservation, a circumstance which is easily explained by a different constraint ranking. (See Pons 2004: 391-396; 2006: 183-213, for an extensive analysis.)

(5) *Paradigm leveling within Catalan inflection*



Within the OP model, this circumstance can be analyzed as follows. The markedness constraint *CCC]σ is the most relevant in the hierarchy: it determines both cluster reduction in the plural forms and the direction of paradigm leveling, in that it obstructs paradigm leveling from the singular to the plural forms (see candidate 7a in the tableau in 7). The constraints responsible for paradigm leveling are OP MAX-C (6a) and OP DEP-C (6b).

(6) *OP faithfulness constraints*

a. OP MAX-C (OP MAX-C): Within inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form (McCarthy [2001] 2005; Pons 2004, 2006 for Catalan).

b. OP DEP-C (OP DEP-C): Within inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form (McCarthy [2001] 2005; Pons 2004, 2006 for Catalan).²

As illustrated in (7), the paradigm candidate with alternations in the stem (7b) is discarded by these two

² Note that both constraints penalize the same unfaithful mappings because here we are dealing with a surface to surface relation (*i.e.* OUTPUT to OUTPUT), not directionally distinguishable as the INPUT to OUTPUT relation.

OP faithfulness constraints. Among the paradigm candidates with a uniform stem, the one selected as optimal is the one which satisfies the markedness constraint *CCC]σ: it is, indeed, a case of *overapplication* and *attraction to the unmarked*.

(7) *Paradigm leveling within Catalan Number inflection*³

/sant/, /sant+z/	*CCC]σ	OP MAX-C	OP DEP-C	MAX-IO
a. <sant, sants>	*!			
b. <sant, sans>		*	*!	*
☞ c. <san, sans>				**

So far so good. However, we have yet to explain why the feminine forms (both singular, *santa*, and plural, *santes*), with preservation of the final consonant of the stem, do not equally exert pressure over the masculine singular ones. These cases are problematic for the analysis proposed here because feminine singular and feminine plural forms, which contain the stop at the end of the stem, could wrongly override the pressure that the masculine plural forms exert over the masculine singular ones, and thus bring about the selection of a paradigm candidate of the type <sant, sant+ə, san+s, sant+ə+s>, which would be much more homogeneous than the actual one. This unwanted situation can be observed in the tableau in (8), where the paradigm candidate with the feminine forms as the attractors (8c) is wrongly selected as the optimal one.⁴

(8) *Wrong paradigm leveling within Catalan inflection (massive pressure from fem. forms)*

/sant/, /sant+z/, /sant+ə/, /sant+ə+z/	*CCC]σ	OP MAX-C	OP DEP-C	MAX-IO
a. <sant, santə, sants, santəs>	*!			
☹ b. <san, santə, sans, santəs>		****	****!	**
☛ c. <sant, santə, sans, santəs>		***	***	*

On the other hand, with this constraint ranking nothing prevents the masculine plural form from inducing overapplication of cluster reduction not only in the masculine singular forms, but also in the feminine forms, both singular and plural, as illustrated by the candidate (9d) in the following tableau.

(9) *Wrong paradigm leveling within Catalan inflection (massive pressure from masc. plur. forms)*

/sant/, /sant+z/, /sant+ə/, /sant+ə+z/	*CCC]σ	OP MAX-C	OP DEP-C	MAX-IO
a. <sant, santə, sants, santəs>	*!			
☹ b. <san, santə, sans, santəs>		****	****!	**
c. <sant, santə, sans, santəs>		***	***	*
☛ d. <san, sanə, sans, sanəs>				****

This last contradiction has a straightforward explanation. Overapplication of simplification in the feminine forms is not possible because it implies the deletion of a consonant segment followed by a vowel, a circumstance practically unknown in Catalan and many other languages, which is explained by the high degree of perceptibility of consonants placed in prevocalic position. The high ranking of a (positional) faithfulness constraint like MAX-C / __V (see 10) explains the lack of overapplication of cluster reduction in these cases – see candidate (11d) in the tableau in (11).

³ Following McCarthy's notation, the stems of the paradigms' members are underlined, because the stems are the elements under surface correspondence.

⁴ The sad face symbol ☹ appears before the actual candidate when it is not selected as optimal. The bomb symbol ☛ appears before a candidate which is wrongly selected as optimal.

(10) MAX-C [__V]: Assign one violation mark for every input consonant followed by a vowel which has no correspondent in the output (see Pons 2004, 2006, after Côté 2000).⁵

(11) *Wrong paradigm leveling within Catalan inflection (massive pressure from fem. forms)*

/sant/, /sant+z/, /sant+ə/, /sant+ə+z/	*CCC]σ	MAX-C / __V	OP MAX-C	OP DEP-C	MAX
a. <sant, santə, sants, santəs>	*!				
⊖ b. <san, santə, sans, santəs>			****	****!	**
☉ c. <sant, santə, sans, santəs>			***	***	*
d. <san, sanə, sans, sanəs>		**!			****

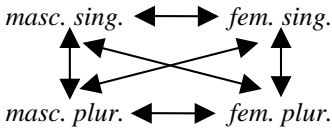
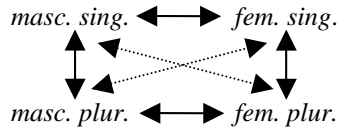
As seen in the preceding tableau, despite the introduction of this new constraint, the wrong paradigm candidate with no reduction in word final position is still selected as optimal (see 11c). The problem which arises in the preceding tableau is that the forms with a consonant at the right edge of the stem, justified by the positional faithfulness constraint MAX-C / __V, which can exert pressure over the masculine singular form, are much greater in number than those with no consonant at the right edge of the stem, justified by the markedness constraint *CCC]σ. That is, feminine forms end up having more paradigmatic power than the masculine plural form. And this is reflected in the number of violations of the OP MAX-C and OP DEP-C constraints, which is higher in the actual candidate (11b) than in the candidate without word-final simplification (11c). This is an instance of what is identified in McCarthy's paper as *majority-rules* effect, where the pattern that is most common in a paradigm acts as an attractor for others. This situation is a consequence of the fundamental architecture of the OP model. As originally articulated, indeed, the OP model predicts *flat paradigms* with no formal distinction between categories such as Gender, Number, Tense, Aspect, etc. The consequence of this architecture is that all the forms in a nominal or verbal paradigm have exactly the same potential of influence among themselves (see, as illustration, the diagram in 12a), regardless of the stronger connection which may exist between the members of a paradigm that *share more grammatical properties* (i.e. Gender, Number, Tense, etc.) (see Paul 1880), regardless of the stronger connection which may exist between the members of a paradigm that *share more phonetic and phonological properties* (see Paul 1880), and regardless of the looser connection which may exist between the members of a paradigm that have a *higher token frequency* (see Paul 1880) (see § 1).

3.1.1.2. How?

In order to solve these kinds of contradictions, the OP proposal can be refined in such a way that the predicted symmetrical influence illustrated in (12a) can be modified by giving more power of reciprocal influence to members which share more grammatical properties and less power of reciprocal influence to members which share fewer grammatical properties (12b). The formalization of these structured subparadigms is in fact a matter suggested but not explored in McCarthy's paper, and also highlighted as intriguing.⁶

⁵ In order for this constraint to affect heteromorphic consonant sequences, it is necessary to assume that morphs are ordered underlyingly, just as they are at the surface.

⁶ Some precedents for the proposal presented here but with a different perspective are the network model, found in Bybee 1996, among other works; lexical conservatism, found in Steriade 1997; and global distance and gradient attraction, found in Burzio 2002, 2005.

(12) *Refinement of the OP proposal*a. *Standard OP paradigmatic pressure*b. *Relativized OP paradigmatic pressure*3.1.1.2.1. *Relativizing OP faithfulness*

This is what is in fact found in Pons (2004: 391-396; 2006: 183-213), who proposes to relativize the OP faithfulness constraints according to the kind of inflection, that is, to invoke intraparadigmatic faithfulness constraints for *each type of inflection* (for instance, Gender and Number, in the case of nominal inflection) (see 13), thus offering the possibility of ranking each of them (see 14). As these constraints only affect a specific set or «subparadigm» within the paradigm, we have labeled them *Optimal Subparadigm* faithfulness constraints:

(13) *Optimal Subparadigm faithfulness constraints*

- OPTIMAL SUBPARADIGM NUMBER MAX-C (OSPN MAX-C): Within *Number* inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form (Pons 2004, 2006; after McCarthy [2001] 2005).
- OPTIMAL SUBPARADIGM GENDER MAX-C (OSPG MAX-C): Within *Gender* inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form (Pons 2004, 2006; after McCarthy [2001] 2005).
- OPTIMAL SUBPARADIGM NUMBER DEP-C (OSPN DEP-C): Within *Number* inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form (Pons 2004, 2006; after McCarthy [2001] 2005).
- OPTIMAL SUBPARADIGM GENDER DEP-C (OSPG DEP-C): Within *Gender* inflection, assign one violation mark for every consonant in the base (stem) of an inflected form which does not have a correspondent in the base (stem) of another inflected form. (Pons 2004, 2006; after McCarthy [2001] 2005).

(14) *Constraint hierarchy*

*CCC]σ >> OSPN DEP-C, OSPN MAX-C >> OSPG DEP-C, OSPG MAX-C >> MAX-IO

3.1.1.2.2. *Paradigm generation*

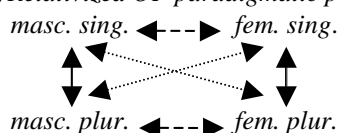
As seen in the tableau in (15), the proposal also entails a different system of candidate generation. For each input, apart from flat paradigms, GEN generates subparadigms, and the members in these subparadigms are those evaluated by the subparadigmatic faithfulness constraints. For instance, in a language like Catalan (with inflection for Gender and Number), for the input /sant/ ('saint'), four subparadigms are generated, two related by Gender (e.g. <sant, santa> <'saint' masc. sing., 'saint' fem. sing.>, <sants, santes> <'saint' masc. plur., 'saint' fem. plur.>) and two related by Number (<sant, sants> <'saint' masc. sing., 'saint' masc. plur.>, <santa, santes> <'saint' fem. sing., 'saint' fem. plur.>). The proposal, as articulated, predicts a higher pressure between members of the *same inflectional category* than between members of the same *inflectional paradigm*.

The effects of the hierarchy in (14) can be seen in the tableau in (16), where, thanks to the prominence of the intraparadigmatic faithfulness constraints related to Number with respect to those related to Gender, the paradigm candidate selected as optimal is that with deletion in the masculine forms and cluster preservation in the feminine forms (16d). (Due to expository reasons, standard OP faithfulness constraints are not included in the following tableau; because of stringency they are ranked below the OSP ones.)

This new architecture allows us to express, therefore, the closer connection that (may) exist between members depending on their kind of inflection (see § 3.1.1.2.4, for more evidence of this), and,

in this particular case, between members related by Number (see the new diagram in 15), which is reinforced by the higher formal (phonological) similarity between the members related by Number than between the members related by Gender.

(15) *Relativized OP paradigmatic pressure*



Pressure in NUMBER inflection
>
Pressure in GENDER inflection
>
Pressure in NOMINAL inflection

(16) *Overapplication of cluster reduction in Catalan within a relativized OP model*

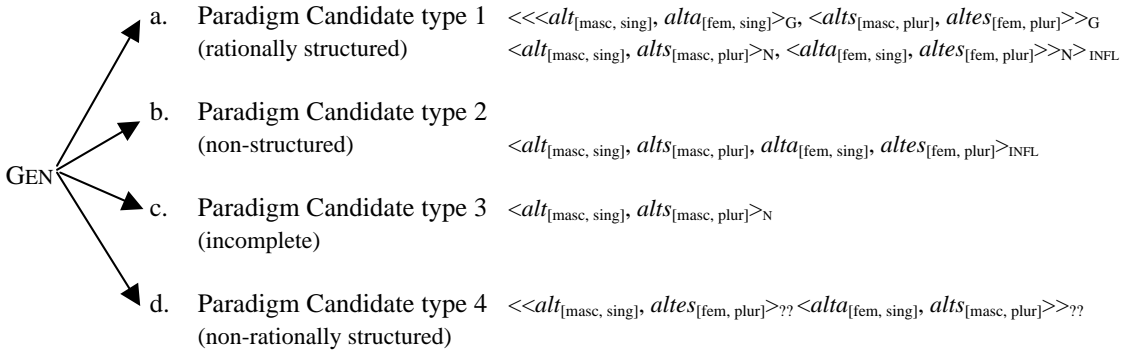
/sant/, /sant+s/, /sant+ə/, /sant+ə+s/	*CCC]σ	MAX-C [_ V]	OSPN DEP-C	OSPN MAX-C	OSPG DEP-C	OSPG MAX-C	MAX-IO
a. <<sant, sants> _N <sant, santə> _G <santə, santəs> _N <sants, santəs> _G > _{INFL} <i>fully faithful paradigm – uniform</i> → <i>underapplication</i>	*						
b. <<sant, sans> _N <sant, santə> _G <santə, santəs> _N <sans, santəs> _G > _{INFL} <i>non uniform paradigm</i> → <i>normal application</i>			*	*!		*	*
c. <<san, sans> _N <san, sanə> _G <sanə, sanəs> _N <sans, sanəs> _G > _{INFL} <i>fully unfaithful paradigm</i> <i>totally uniform</i> → <i>overapplication in the entire paradigm</i>		*					
d. <<san, sans> _N <san, santə> _G <santə, santəs> _N <sans, santəs> _G > _{INFL} <i>uniform paradigm for Number</i> <i>and not for Gender</i> → <i>overapplication in the Number subparadigm</i>					*	*	**

3.1.1.2.3. *Paradigm selection*

Given the condition of freedom of analysis, CON should contain some kind of morphological markedness constraints ruling out the generation of unnatural paradigms, such as those in (17c, d), which would be regulated by the morphological markedness constraints in (18a,b), respectively. The competition between the structured paradigm in (17a) and the unstructured paradigm in (17b) should also be regulated through morphological markedness constraints, and not through phonological

markedness constraints. This is why we propose an additional markedness constraint according to which all the members in a paradigm must share at least one inflectional property (of Gender or Number). Note that, whereas the constraints in (18a) and (18b) are highly ranked in all languages in that no language allows paradigms of the type (17c, d), the ranking of the constraint in (18c) is language-particular. For instance, in languages with or without uniformity in the whole inflectional paradigm, constraint (17c) is low-ranked.

(17) *Paradigm generation*



(18) *Paradigm selection*

- a. PARADIGM COMPLETENESS: Assign one violation mark for every paradigm candidate which does not have all the inflectional projections of a given base.
- b. PARADIGM COHERENCE: Assign one violation mark for every (sub)paradigm candidate in which none of the individual members share any grammatical properties.
- c. PARADIGM COHESION: Assign one violation mark for every paradigm member which does not share an inflectional feature (*i.e.* singular, plural, masculine, feminine) with some other member of the same paradigm.

3.1.1.2.4. *On Paradigmatic pressure in Number >> Paradigmatic pressure in Gender*

The closer connection observed in this paper between members related by Number with respect to members related by Gender is not language-particular, but can be considered universal. Greenberg (1966) already detected the asymmetry between these two categories, Number and Gender, with the former being less marked than the latter (*i.e.* Greenberg 1966: U32, U36), a circumstance which is corroborated by a set of well-known cross-linguistically recurrent factors: *a*) if a language has Gender distinction, it will also have Number distinction, but not viceversa (*i.e.* Spanish *vs.* English); *b*) all languages have Number distinction but not all languages have Gender distinction (*i.e.* Spanish *vs.* English); *c*) Number is more regular and automatic than Gender (in Catalan, for instance, the singular and the plural exponents are systematically \emptyset and $-s$, respectively, whereas masculine and feminine exponents are much more diverse (+ \emptyset , +[u], +[ə], +[i], for masculine; +[ə], +[\emptyset], +[u], +[i], for feminine) (see Mascaró 1986); *d*) Gender shows more syncretism than Number in all languages (in Catalan it is possible to find high invariability for Gender in adjectival forms whereas invariability for Number is reduced to a limited set of forms; see Mascaró 1986); it is also possible to find many instances of syncretism for Gender in the marked categories of many pronominal systems whereas no such syncretism is found for Number; *e*) Number has always an expression in verbal categories, but Gender not always; *f*) the unmarked member for Number is more unmarked than the unmarked member for Gender (*i.e.* Singular has zero expression in the majority of languages, whereas Masculine has some kind of expression in a significant number of languages; *g*) Gender appears closer to the base than Number, and *h*) Gender can change the semantics of the base to which it is attached whereas Number cannot (see § 4.1.1.2.4). In Romance languages, it is possible to find a substantial amount of evidence in the direction highlighted in this paper, *i.e.*, with uniformity in forms related by Number and no

observed (see § 2), in this case the relation between the words subject to uniformity is expected to be asymmetrical, since there is a *base* to which the derived forms are faithful: the opposite direction, that is, the pressure of the derived form over the base, is proscribed by resorting to a specific constraint, labeled BASE-PRIORITY). Precisely because of BASE-PRIORITY, both under- and overapplication are predicted by this submodel: only those forms which respect the base, whether they satisfy the relevant markedness constraint or not, will satisfy BASE-PRIORITY. There are many reasons, however, to treat the set of derived words from the same base as a paradigm, similar to the inflectional paradigm (see, among others, Bauer 1997, Booij 1997, and Stump 2002).

4.1.1. Refinement of the Transderivational Correspondence Theory. Why and how?

4.1.1.1. Why?

We will illustrate the need to refine the TCT model with a simple example, in this case drawn from Spanish. As exemplified in (20a, c), in Spanish, unstressed mid vowels [e] and [o] alternate with [jé] and [wé] in stressed position due to a process of diphthongization of the mid vowels in stressed position. Diphthongization, however, overapplies in diminutive words,⁷ where the very same vowels unexpectedly become [jé] and [wé] in unstressed position (20b).⁸

(20) Overapplication of diphthongization in productive derivation

a. Stressed stem	b. Unstressed stem (productive deriv.) → unexpected diphthong	c. Unstressed stem (non-productive deriv.) → expected monophthong
<i>f[jé]sta</i> ‘party’	<i>f[je]stecita/f[je]stita</i> ‘party dim.’	<i>f[e]stivo</i> ‘festive’
<i>v[jé]jo</i> ‘old man’	<i>v[je]jecito/v[je]jito</i> ‘old man dim.’	<i>v[e]jez</i> ‘old age’
<i>v[jé]nto</i> ‘wind’	<i>v[je]ntecito/v[je]ntito</i> ‘wind dim.’	<i>v[e]ntisca</i> ‘snowstorm’
<i>b[wé]no</i> ‘good’	<i>b[we]necito/b[we]nito</i> ‘good dim.’	<i>b[o]ndad</i> ‘goodness’
<i>c[wé]rpo</i> ‘body’	<i>c[we]rpecito/c[we]rpito</i> ‘body dim.’	<i>c[o]rporal</i> ‘corporal’
<i>n[wé]vo</i> ‘new’	<i>n[we]vecito/n[we]vito</i> ‘new dim.’	<i>n[o]vedad</i> ‘novelty’

This phenomenon is also present in verbal conjugation (e.g. *s[e]ntir* ‘to feel’ *s[jé]nto* ‘I feel’ *s[e]ntimos* ‘we feel’), where it applies without exceptions. As illustrated in (21), it is also possible to find non-alternating mid vowels (21a-c) and non-alternating diphthongs (21d-f). This discrepant pattern has a historical explanation: only mid vowels derived from the open *e* and *o* of Vulgar Latin diphthongize under stress.

⁷ The most productive Spanish diminutive suffixes are *-it-* and *-cit-*, both followed by unstressed inflectional affixes *-a(s)* / *-o(s)*, depending on the termination of the base: *Carlos* ‘male noun’ ~ *Carlitos* ‘male noun dim.’; *soprano* ‘soprano’ ~ *sopranito* ‘soprano dim.’. Basically, in order to preserve the base’s syllabic structure, the allomorph *-it-* is selected for unstressed vowel ended bases, otherwise, the *-cit-* suffix is selected: *casa* ‘house’ ~ *casita* ‘house dim.’; *café* ‘coffee’ ~ *cafecito* ‘coffee dim.’; *cañón* ‘cannon’ ~ *cañoncito* ‘cannon dim.’. For more details, see Jaeglli (1978); Harris (1983, 1993); Crowhurst (1992); Prieto (1992); Ohannesian (1996); Lloret (1996); Colina (2003) and Bermúdez-Otero (2007).

⁸ Overapplication is found in productive derivation in general (i.e. *f[jé]sta* ‘party’ ~ *f[je]staza* ‘party augm.’; *v[jé]jo* ‘old’ ~ *v[je]jucho* ‘old + *despect.*’, etc.). Due to the higher productivity and regularity of diminutivization, and also for space reasons, we limit our analysis to diminutives.

(21) *Non-alternating mid-vowels and non-alternating diphthongs*

a. non alternating mid-vowels	b. productive derivation	c. non-productive derivation
<i>b[é]so</i> ‘kiss’	<i>b[e]sito</i> ‘kiss <i>dim.</i> ’	<i>b[e]sar</i> ‘to kiss’
<i>qu[é]so</i> ‘cheese’	<i>qu[e]sito</i> ‘cheese <i>dim.</i> ’	<i>qu[e]sera</i> ‘cheese dish’
<i>r[ó]bo</i> ‘robbery’	<i>r[o]bito</i> ‘robbery <i>dim.</i> ’	<i>r[o]bar</i> ‘to steal’
<i>r[ó]sa</i> ‘rose’	<i>r[o]sita</i> ‘rose <i>dim.</i> ’	<i>r[o]sal</i> ‘rosebush’
d. non alternating diphthong	e. productive derivation	f. non-productive derivation
<i>qu[jé]to</i> ‘quiet’	<i>qu[je]tecito/qu[je]tito</i> ‘quiet <i>dim.</i> ’	<i>qu[je]tud</i> ‘calm’
<i>c[we]stión</i> ‘question’	<i>c[we]stioncita</i> ‘question <i>dim.</i> ’	<i>c[we]stionable</i> ‘questionable’

Let us turn now to the formal account of these facts. In order to distinguish between the cases in (20) and cases in (21), we assume a stem with a double underlying representation for cases in (20), with a vowel and with a diphthong (*i.e.* $n/\{o,we\}/vo$, $n/\{o,we\}/v+edad$; $n/\{o,we\}/v+ito$ vs. $b/e/so$, $b/e/sar$, $b/e/sito$; $qu/je/to$, $qu/je/tud$, $qu/je/tito$). The contextual markedness constraint responsible for the selection of the underlying representation with the diphthong is TONIC DIPHTHONG (22a), which is in conflict with the context-free markedness constraint *DIPHTHONG (22b). Both constraints are independently justified: universally, diphthongs may attract stress but diphthongs are more marked structures than monophthongs. The relevant faithfulness constraints here are INTEGRITY, which penalizes split, UNIFORMITY which penalizes fusion, and IDENTITY, which penalizes featural changes in general. As this last constraint is less restrictive than the former two, it must be ranked below them (see 23 and 24).⁹

(22) *Relevant markedness and faithfulness constraints*

- TONIC DIPHTHONG: Assign one violation mark for each stressed syllable which does not contain a diphthong (see Bermúdez-Otero 2007).
- *DIPHTHONG: Assign one violation mark for every diphthong (see Bermúdez-Otero 2007).
- INTEGRITY (INTEG): Assign one violation mark for every segment in the input which has more than one correspondent in the output. (McCarthy & Prince 1995).
- UNIFORMITY (UNIF): Assign one violation mark for every segment in the output which has more than one correspondent in the input. (McCarthy & Prince 1995).
- IDENTITY (F) (IDENT): Assign one violation mark for every segment in the output which has a different specification than its correspondent in the input (McCarthy & Prince 1995).

Tableaux (23) and (24) exemplify normal application in stressed and unstressed position, respectively.

(23) *Normal application of diphthong selection in stressed position*

$n/\{o,we\}/vo$	INTEG	UNIF	IDENT	TONIC DIPHTHONG	*DIPHTHONG
☞ a. $n[we]vo$	*		*		*
b. $n[o]vo$		*	*	*!	

(24) *Normal application of vowel selection in unstressed position*

$n/\{o,we\}/v+edad$	INTEG	UNIF	IDENT	TONIC DIPHTHONG	*DIPHTHONG
☞ a. $n[o]vedad$		*	*		
b. $n[we]vedad$	*		*		*!

We interpret the overapplication of «diphthongization» in productive derivation as being due to the paradigmatic pressure exerted by the base. The constraint O-O FAITH¹⁰ would induce uniformity in the derivational paradigm, and the constraint BASE-PRIORITY (see § 4.1) would prevent the modification of the base in order to satisfy this last constraint.

⁹ See Bermúdez-Otero (2007) for a different account of the same facts based on Stratal OT.

¹⁰ This is a shorthand which intends to include all kinds of O-O faithfulness constraints (*i.e.* OO-INTEGRITY, OO-UNIFORMITY and OO-IDENTITY).

(25) *Relevant O-O faithfulness constraints*

- a. BASE-PRIORITY: Assign one violation mark for every change in the base (Benua [1997] 2000).
 b. O-O FAITH: Assign one violation mark for each segment in the stem of a derivational paradigm member with a different featural specification than its correspondent in the stem of another member of the same paradigm (Benua [1997] 2000).

Note, however, that this account of the facts would wrongly induce the selection of the paradigm with overapplication of diphthong selection in stem-unstressed derived forms (*i.e.* **fje|stivo*; **n[we]vedad*), since it better satisfies the O-O faithfulness constraints.

4.1.1.2. *How?*4.1.1.2.1. *Relativizing TCT constraints*

In the tableau in (27) we show how this problem is solved by introducing two kinds of O-O faithfulness constraints: one related to derivational paradigms in general, which affects all the derived forms, and another (26) whose scope is the subparadigm, where we find only the base and diminutive form. According to our analysis, $\langle n[wé]vo \ n[we]vito \rangle$ constitutes a subparadigm included in the paradigm which comprises all the words derived from the base.

(26) *Relevant O-O SubParadigm faithfulness constraints*

- a. O-OSUBPARFAITH: Assign one violation mark for every segment in the stem of a derivational subparadigm member with a different featural specification than its correspondent in the stem of another member of the same derivational subparadigm. (See footnote 10.)

The following tableau illustrates the possible and structured subparadigm candidates. The ranking of O-O PARFAITH, favoring uniformity in the whole paradigm, *below* the markedness constraint *DIPHTHONG ensures normal application in non-productive derivation. The ranking of O-O SUBPARFAITH, favoring uniformity only in the subparadigm, *above* *DIPHTHONG explains overapplication in productive (diminutive) derivation.

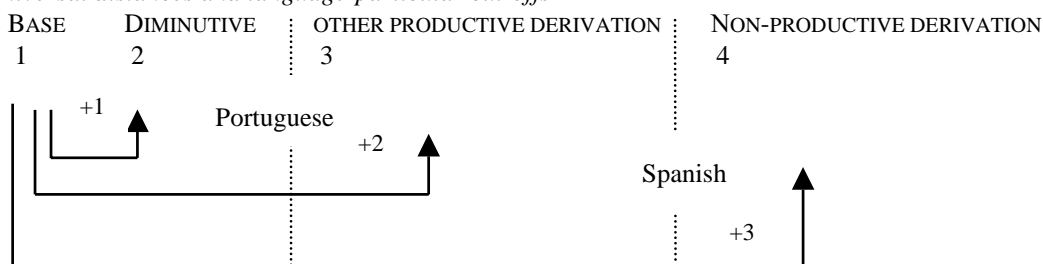
(27) *Overapplication of diphthong selection in the derivative subparadigm*

<i>n</i> / $\{o,we\}$ / <i>vo</i> <i>n</i> / $\{o,we\}$ / <i>v+ito</i> <i>n</i> / $\{o,we\}$ / <i>ve+dad</i> Base: <i>n[we]vo</i>	INTEG	UNIF	IDENT	BASE- PRIOR	O-O SUBPAR FAITH	TONIC DIPHTONG	*DIPHTONG	O-O PAR FAITH
<i>a.</i> $\langle n[wé]vo,$ <i>n[we]vito</i> <i>n[o]vedad</i> <i>overapplication in</i> <i>base / dim.</i> <i>subparadigm</i>	*		*				**	****
<i>b.</i> $\langle n[wé]vo,$ <i>n[we]vito</i> <i>n[we]vedád</i> <i>overapplication in</i> <i>the whole paradigm</i>	*		*				***!	
<i>c.</i> $\langle n[ó]vo,$ <i>n[o]vito</i> <i>n[o]vedád</i> <i>underapplication</i>		*	*	*!		*		
<i>d.</i> $\langle n[wé]vo,$ <i>n[o]vito</i> <i>n[o]vedad</i> <i>normal application</i>	*	*	*		***!		*	****

4.1.1.2.2. Paradigm generation and selection

As in the inflectional paradigms, this proposal also entails a different system of candidate generation. For each input, apart from flat paradigms, GEN generates subparadigms, and the members in these subparadigms are those evaluated by the intraparadigmatic faithfulness constraints. However, a significant difference between inflection and derivation which has relevant consequences in the formalization of paradigmatic pressures and paradigm generation is the following: whereas the members of an inflectional paradigm have some morphosyntactic features in common which straightforwardly permit the paradigm to be split according to them, the members of a derivational paradigm do not have any features in common apart from the base (stem), so that the relativization of the O-O faithfulness constraints is not apparent. In order to make explicit the stronger and the looser cohesion within a derivational paradigm, we assume that the members in it bear different universal distances (28), which would be targeted by a universal ranking of morphological markedness constraints prohibiting «derivational paradigms» with a different degrees of cohesion (29). And each language would select a different *cut-off* in order to determine what acts as a subparadigm and what does not. For instance, Spanish has a low «cohesion demand» in that all productive derivation is under paradigmatic pressure (see footnote 8), so that just the constraint PARADIGM COHESION +3 would be highly ranked. But in some languages there is a distinction between diminutivization (which is the most productive derivational process) and other appreciative derivation, such as augmentation. In Brazilian Portuguese, for instance, [l] is converted in [i] before the plural suffix *-s*. This process overapplies in plural diminutives, yielding *jorna[i]zinhos* instead of **jornalzinhos* (note that the process generally does not apply before [z]). But, interestingly enough, it does not apply in plural augmentatives (*i.e.* *jorna[l]zões*).¹¹ In Portuguese, therefore, PARADIGM COHESION +2 is ranked higher than in Spanish, thus ruling out subparadigms in which the members bear a distance $\geq +2$, such as those which include augmentatives.

(28) Universal distances and language-particular cut-offs



¹¹ Probably this discrepant behaviour is due to the fact that in Brazilian Portuguese augmentative forms are more autonomous with respect to the base than diminutives, in that they can change its Gender: the noun *mulher* ‘woman’ is feminine, but the augmentative form, *o mulherzão*, is masculine, because this appreciative form has its own Gender (Bachrach & Nevins 2008).

(29) *Universal rankings for Paradigm Cohesion constraints*¹²

Paradigm Cohesion +4 >> Paradigm Cohesion +3 >> Paradigm Cohesion +2 >> Paradigm Cohesion +1

- *PARADIGM COHESION +1: Assign one violation mark for every paradigm candidate whose members maintain a distance of +1.
- *PARADIGM COHESION +2: Assign one violation mark for every paradigm candidate whose members maintain a distance of +2.
- *PARADIGM COHESION +3: Assign one violation mark for every paradigm candidate whose members maintain a distance of +3.
- ...

4.1.1.2.3. *On Paradigmatic Pressure in Productive Derivation >> Paradigmatic Pressure in Non-productive Derivation*

The observation that productive and non-productive derivation do not behave alike is an old one. Siegel (1974), for instance, classified English affixes into two classes according to their surface behavior: affixes of class 1 (of the type *-ature*) and affixes of class 2 (of the type *-ing*). Derived forms made up with the former are less faithful to the base than derived forms made up with the latter. In many English dialects, for instance, some clusters are reduced in word-final position, as the alternations in (30a) and (30b) show. But cluster reduction unexpectedly applies in productive derived words, like those in (30b), in which the cluster is *not* found in word-final position (see, among others, Borowsky 1986, 1993; Benua [1997] 2000, and Steriade 2000).

(30) *Universal Paradigm cohesion rankings*

a. Primitive forms → cluster reduction	b. Non-productive derived forms → cluster preservation	c. Productive derived forms → cluster reduction
<i>condemn</i> conde[m]	<i>conde</i> [mn]ation	<i>conde</i> [m]ing
<i>bomb</i> bo[m]	<i>bo</i> [mb]ard	<i>bo</i> [m]ing
<i>long</i> lo[ŋ]	<i>elo</i> [ŋg]ate	<i>lo</i> [ŋ]ing
<i>sign</i> si[n]	<i>si</i> [gn]ature	<i>si</i> [n]ing

In order to account for this behavior, Benua ([1997] 2000) proposes two kinds of Output-Output faithfulness constraints relativized according to the kind of suffix added to the stem: O-O₁ for derived forms made up with affixes of class 1 and O-O₂ for derived forms made up with affixes of class 2. The latter are ranked higher than the standard I-O faithful constraints, whereas the former are ranked lower. In this paper we have shown how this asymmetry can also be captured by resorting to the notion of subparadigm.

4.1.1.2.4. *Number inflection ∪ productive derivation vs. Gender inflection ∪ non-productive derivation*

Another interesting issue detected in this paper is the relation between inflection and derivation as far as paradigmatic pressures are concerned. We have detected a superior tendency to paradigmatic pressures in Number and Productive derivational – in general, appreciative – subparadigms than in Gender and non-productive – in general, non-appreciative – derivational subparadigms, which is directly correlated with the degree of cohesion established between the members. This behavior conforms to several well-recognized pre-theoretical observations, such as the following.

¹² An extensive cross-linguistic study is necessary to establish internal paradigmatic distances according to the type of derivation. The one presented here must be considered an attempt. Appropriate criteria for shattering paradigms would be the preservation or not of the category and the preservation or not of the semantics of the base.

- *Well-known and significant similarities between productive (appreciative) derivation and inflection:* a) Appreciative derivation, like inflection and unlike non-appreciative derivation, does not originate a new entity. It connotes and does not denote. b) Appreciative derivation, like inflection and unlike non-appreciative derivation, does not change the grammatical category of the base to which it is adjoined. c) Appreciative derivation, like inflection and unlike non-appreciative derivation, is highly productive, systematic and uniform. d) Appreciative derivational suffixes appear after non-appreciative derivational ones and just before inflection. e) Appreciative derivation, as opposed to non-appreciative derivation, generally maintains the inflectional attributes of the base to which it is adjoined. f) Appreciative derivational suffixes, as opposed to non-appreciative ones, are terminal, in the sense that they are adjoined to *quasi* phonologically constructed words.
- *Well-known and significant differences between Number inflection and non-appreciative derivation:* a) Non-appreciative derivation leads to new words; Number inflection leads to different forms of the same base-stem. b) Non-appreciative derivation can maintain or change the category of the base to which it is adjoined; inflection never changes the category of the base to which it is adjoined. c) Non-appreciative derivation changes the semantics of the base to which it is adjoined; inflection generally does not change the semantics of the base to which it is adjoined. d) Derivation does not depend on syntax; inflection can do so.
- *Well-known and significant similarities between non-appreciative derivation and Gender, as opposed to appreciative derivation and Number:* a) Occasionally, Gender inflection can change the semantics of the base, as non-appreciative derivation does; Number inflection does not change the semantics of the base, and appreciative derivation does not either. b) Gender inflection is closer to the base than Number inflection; similarly, non-appreciative derivation is closer to the base than appreciative derivation. An interesting observation here is that the degree of semantic closeness is inversely proportional to the degree of formal closeness to the stem.

To sum up, Number is for Gender what appreciative derivation is for non-appreciative derivation:

NUMBER :: GENDER = APPRECIATIVE DERIVATION :: NON-APPRECIATIVE DERIVATION

Both Catalan and Spanish show instances of this correlation between Number and appreciative derivation, and Gender and Non-appreciative derivation. In Catalan, for instance, the gliding process of the voiced labiodental fricative (illustrated in 19) is found both in Number inflection and in appreciative derivation (*bla[w]*, *bla[w]s*, *bla[w]et*), but not in Gender inflection and non-appreciative derivation (*bla[β]a*, *bla[β]es*, *bla[β]or*, etc.). In Spanish, coda depalatalization overapplies both in plural forms and in diminutive forms (*donce[l]*, *donce[l]es*, *donce[l]ito*) but not in feminine forms and non-appreciative (*donce[λ]a*, *donce[λ]as*, *donce[λ]ez*). In all, a cross-linguistic study is necessary in order to establish a *common* universal hierarchy between inflectional categories and derivational processes according to their tendency to undergo pressure.

5. Concluding remarks

This paper has dealt with one of the challenges for paradigmatic models within Optimality Theory, that of inclusion in paradigms, and its main results are:

- The Optimal Paradigms model can be straightforwardly refined in such a way that the predicted symmetrical influence between the members of an inflectional paradigm is modified by giving more power of reciprocal influence to members which share more grammatical properties and less power of reciprocal influence to members which share fewer grammatical properties.
- The number of shared grammatical properties is not the only factor determining the degree of pressure. Members related by Number exhibit a higher connection than member related by Gender, an observation which is grounded on a significant amount of additional evidence, so that the ranking

OP-FAITH NUMBER > OP-FAITH GENDER can be considered universal.

- This account does not deny the pressure between members related by Gender but predicts that if in a language members related by Gender are under pressure, members related by Number will do so, but not vice versa.
- The Transderivational Correspondence Theory can likewise be modified so that the degree of productivity between the base and the derived word has a direct consequence on the degree of phonological pressure established between them. Our proposal, based on the subparadigm, can also account for this.
- A tentative proposal of the distances established between the members of a derivational paradigm with respect to the base depending on their productivity has been proposed. This is a necessary step, still to be refined on the basis of substantial cross-linguistic evidence, in order to account for asymmetries in the derivational paradigm as far as paradigmatic pressures are concerned.

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