A Correspondence-theoretic Approach to Alternating Diphthongs in Spanish*

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要旨　スペイン語には、強勢が関わる二重母音と単母音の交替([yé] ~ [e], [wé] ~ [o])がある。本稿では、この交替を対応理論(Correspondence Theory)に基いて分析し、この交替は母音融合による単母音化として分析されるべきであり、その過程は、対応関係(correspondence)と韻律主要部に対する忠実性(faithfulness to prosodic heads)の制約によって説明ができることを示す。

0. Introduction

In this paper I analyse the stress-dependent alternating diphthongs in Spanish, [yé] ~ [e] and [wé] ~ [o], within Correspondence Theory (McCarthy and Prince 1995). I argue that the monophthongs are derived from their corresponding diphthongs in unstressed positions, and that the notions of correspondence and faithfulness to prosodic heads (Alderete 1995) make it possible to account for the monophthongisation by vowel coalescence. I also show that the coalescence approach to the monophthongisation process is preferable to the deletion approach because it does not require any untenable conditions.

The paper is organised as follows. Section 1 introduces some theoretical assumptions about Correspondence Theory (CT henceforth), moraic structures of diphthongs and some relevant constraints that are proposed by Rosenthall (1994). Section 2 presents the data and examines two previous descriptive approaches. Section 3 presents the correspondence-theoretic analysis of the alternating diphthongs. Finally, my conclusions are presented in section 4.

1. Theoretical Assumptions

1.1. Correspondence Theory

1.1.1. Correspondence and faithfulness constraints

The notion of correspondence was originally developed by McCarthy and Prince (1993) to account for the reduplicative copying relation. In Optimality Theory, faithfulness is a relation of representational matching observed between linguistically related forms, such as an input and an output. In Correspondence Theory (McCarthy and Prince 1995) faithfulness is measured in terms of correspondence. Thus correspondence can extend to a general relation between two related strings, e.g. input/output, base/reduplicant, etc.

(1) Correspondence (McCarthy and Prince 1995)

Given two strings S_1 and S_2, correspondence is a relation R from the elements of S_1 to those of S_2. Elements α of S_1 and β of S_2 are referred to as correspondents of one another when $\alpha R \beta$.

Given the notion of correspondence, input-output faithfulness is defined as the identity between the elements of the input (S_1) and those of the output (S_2). The identity is measured by the following constraints.

(2) a. MAX (McCarthy and Prince 1995):

Every element of the input has a correspondent in the output.

No phonological deletion

b. DEP (McCarthy and Prince 1995):

Every element of the output has a correspondent in the input.

No epenthesis.

c. IDENT[F] (McCarthy and Prince 1995):

Correspondent segments have identical values for the feature F.

CT is crucially different from the Containment-based Optimality Theory (Prince and Smolensky 1993) in assuming that a deleted element is literally absent from the output, and that an epenthetic element, which does not have a correspondent in the input, is literally inserted into the output.[1]

1.1.2. Faithfulness to prosodic heads

The observation that stressed syllables pattern differently than unstressed syllables is taken as motivation for an independent set of faithfulness constraints which specifically target the segments of the stressed syllable (Alderete 1995).

(3) a. HEAD-DEP (Alderete 1995)

Every segment contained in a prosodic head in the output has a correspondent in the input.

b. HEAD-IDENT[F] (Alderete 1995)

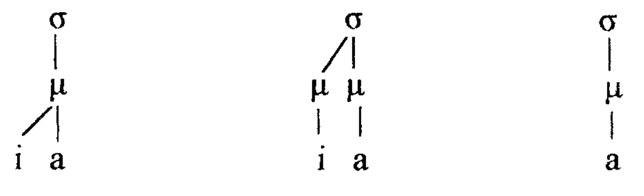
Correspondent segments contained in a prosodic head agree in value for the feature F.

HEAD-DEP (3a) means that epenthetic segments cannot be stressed nor counted in stress assignment. HEAD-IDENT[F] (3b) ensures that vowel reduction is limited to unstressed positions. The prosodic faithfulness constraints in (3) are active only when they outrank the general faithfulness constraints because the set of the prosodic faithfulness constraints is a subset of the general faithfulness constraints.

1.2. The Structures of Diphthongs

The difference between diphthongs and monophthongs is attributed to their syllabic structures: diphthongs are represented as complex nuclei, whereas monophthongs have a single nucleus. Rosenthall (1994) proposes two types of representations for diphthongs as in (4).

(4) a. [ia] b. [ia] cf. [a]



The structure (4a) represents a monomoraic diphthong: two distinct vowels are linked to a single mora, forming a mora branching structure. On the other hand, (4b) represents a bimoraic diphthong where two morae, which associate to two distinct vowels, are associated to a syllable node. These structures are subject to the following syllabic well-formedness constraints:

(5) Branching-μ (BRANCH-μ: Rosenthall 1994)

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 * μ
  / \
 Vi  Vj        (No mora branching structure)
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(6) No Diphthongs (NODIPH: Rosenthall 1994)

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  *σ
  / \
 μ   μ
 |   |
 Vi  Vj        (No tautosyllabic vowel sequence)
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In this paper, I assume that morae are present in underlying representation. Morae are identified as counting units for stress assignment in Spanish (Dunlap 1991). I also assume that the difference between high vowels and glides are attributed to syllabic affiliation (Guerssel 1986): high vocoids are vowels when they are syllabic heads; otherwise they are realised as glides. In 3.1., I will argue that the underlying representations of the alternating diphthong in Spanish is a monomoraic diphthong as (4a).

2. Alternating Diphthongs in Spanish

2.1 The Facts

In Spanish, there are well-known alternations: [yé] ~ [e], [wé] ~ [o].[2]

(7) a.	tyér.no.	"tender"	ter.nú.ra.	"tenderness"		
	cyé.go.	"blind"	ce.gué.ra.	"blindness"		
	cyér.to.	"certain"	cer.té.za.	"certainty"		
b.	bwé.no.	"good"	bon.dád.	"goodness"		
	cwér.do.	"sane"	cor.dú.ra.	"sanity"		
	fwér.te.	"strong"	for.ta.lé.za.	"strength"	(Roca 1986: 344)	

In these alternations, the distribution of the diphthongs is restricted to the stressed positions, while mid vowels occur in the unstressed positions.

It is important to note that there are unstressed mid vowels that do not alternate with stressed diphthongs, as seen in (8).

(8) a.	comér	"to eat"	cómo	"I eat"	
b.	pesár	"to weigh"	péso	"I weigh"	(Carreira 1991: 408)

In (8), where each pair of examples are morphologically related, the unstressed mid vowels correspond to monophthongal vowels in the stressed positions. The examples

(7) and (8) suggest that it is not possible to predict whether a root with a mid vowel in an unstressed syllable will have a diphthong in a morphologically related form that has the relevant syllable in a stressed position.

2.2. Two Approaches to the Alternating Diphthongs

In derivational frameworks, there have been two descriptive approaches to the alternating diphthongs in (7): the diphthongisation approach (Harris 1985, Roca 1986) and the monophthongisation approach (Carreira 1991).

In the diphthongisation approach, the alternation is analysed as a process where underlying monophthongs change into diphthongs in stressed position. For example, in Harris (1985) it is assumed that the alternating diphthongs are underlyingly mid monophthongal vowels. A rule of diphthongisation, whose application to the mid vowels is restricted to stressed position, derives the diphthongs from the monophthongal mid vowels. In unstressed position, the monophthongs appear intactly on the surface, since the diphthongisation rule cannot apply to unstressed mid vowels.

On the other hand, in the monophthongisation approach, it is assumed that the alternation is a process in which underlying diphthongs monophthongise in unstressed position. In Carreira (1991), for example, the vowel sequences, /ie/ and /uo/, are assumed to be the underlying representation of the alternating diphthongs. The vowel sequences which consist of high vowel and nonhigh vowel are initially changed into the diphthongs by the contraction rule which associates the sequences to a single V slot. In unstressed position, the rule of monophthongisation derives a single vowel by deleting the first element of the diphthongs. The rule of monophthongisaiton cannot apply to a derived diphthong in stressed position. Thus, the stressed diphthongs are realised on the surface.

3. A Correspondence-theoretic Analysis

3.1. Preliminaries to the analysis

As we have seen in 2.2., in derivational terms it is possible to analyse the alternation in (7) as a diphthongisation process as well as a monophthongisation process. In constraint-based Optimality Theory (OT), only the latter approach is possible. That is why in OT structural changes result from the constraint interaction in which the faithfulness candidates violate a higher-ranked constraint, though the candidates with structural changes violate a lower-ranked constraint.

If we take the diphthongisation approach, we cannot find any reason for the stressed mid vowels to change into diphthongs because stressed mid vowels have surface realisation in Spanish as in (8). On the other hand, if we take the monophthongisation approach and assume a monomoraic diphthong as (4a) for the underlying representation, the monophthongisation process is straightforwardly accounted for by the constraint evaluation where a BRANCH-μ violation caused by the monomoraic diphthong is more serious than any violation that is incurred by the optimal monophthongal candidate.

3.2. *Underlying Structures*

For the reasons just mentioned in 3.1., I adopt the monophthongisation approach to the alternation in (7) and assume the monomoraic diphthongs in (9) as the underlying representation of the alternating diphthongs.

(9) a. /ie/ b. /ue/

In (9), high and nonhigh vowel sequences are linked to a single mora, forming a mora branching structure.

3.3. *Monophthongisation as Coalescence*

The process that changes /ie/ to [e] and /we/ to [o] can be explained in two ways. One possibility is to delete the first element of the diphthongs. However, this operation yields [e] from /ue/ as well as /ie/, thus we must require additional condition that leads to change [e] to [o] in order to have a correct result. Instead of assuming /ue/ for the [wé] ~ [o] alternation, we can assume /uo/ as the underlying representation to account for the alternation. However, this approach also have a difficulty in deriving [we] from /uo/ because the diphthong [wo] has surface realisation in Spanish, as in *afectwóso* "affectionate", *sinwóso* "winding", etc.

Another possibility to account for the monophthongisation is to coalesce the vowels of a diphthongs to a single vowel. In this approach, the process is analysed by assuming that underlying diphthongs coalesce with the backness of the first element showing up with the highness of the second as in (10).[3, 4, 5]

(10)a.	$/u_1/$	$/e_2/$	→	$[o_{12}]$
	$[+high]_1$	$[-high]_2$		$[-high]_2$
	$[+back]_1$	$[-back]_2$		$[+back]_1$
b.	$/i_1/$	$/e_2/$	→	$[e_{12}]$
	$[+high]_1$	$[-high]_2$		$[-high]_2$
	$[-back]_1$	$[-back]_2$		$[-back]_1$

As opposed to the deletion approach, the coalescence approach can directly account for the [we] ~ [o] alternation. There is no need of relying on any additional conditions that leads to change /e/ to [o] or on the untenable constraint that prohibits /uo/.

3.4. Constraint Ranking and Evaluations

In this subsection, I will show that the ranking of the constraints and their interaction straightforwardly account for the process of vowel coalescence. My argument consists of two aspects: prosodic and segmental aspects. I will start up with a prosodic aspect. Before we go into the discussion, it must be noted how coalescence is expressed under Correspondence Theory.

3.4.1 Coalescence in Correspondence Theory

Lamontagne & Rice (1995) account for coalescence as a process where two elements of the input correspond to a single element in the output as in (11).

(11)	*Input*	*Output*
	$/k_1\ ʔ_2/$	$[k'_{12}]$

As is expressed by the indices in (11), the input segments /k/ and /ʔ/ correspond to the output segment [k'], forming a multiple correspondence relation. The correspondence relation incurs violation of the constraint UNIFORMITY.

(12) UNIFORMITY (McCarthy & Prince 1995)

No element of the output has multiple correspondents in the input.

The constraint UNIFORMITY requires a one-to-one correspondence relationship between the elements of the input and those of the output. In addition to constituting a UNIFORMITY violation, coalescence also incurs some IDENT[F] violation because the segment that is produced by coalescence is, in principle, not featurally identical to the corresponding segments in the input.

3.4.2 Prosodic analysis of monophthongisation

The prosodic aspect of the alternating diphthongs in Spanish is that in unstressed positions the underlying monomoraic diphthongs are merged into monophthongs by coalescence, while they surface as diphthongs in stressed positions. This phenomenon can be accounted for by the constraint ranking in (13).

(13) HEAD-IDENT[F], MAX ≫ BRANCH-μ ≫ UNIFORMITY, IDENT[F]

The tableau (14) illustrates the constraint evaluation for diphthong in the stressed position.[6, 7, 8]

(15) Rising diphthong in the stressed position:Input = / $tu_1é_2$ /

	H-IDENT	MAX	BRANCH-μ	UNIFORM	IDENT
a.☞ [$tw_1é_2$]			*		
b. [$té_2$]		*!			
c. [$tó_{12}$]	**!			*	**

In (14c), the higher-ranked HEAD-IDENT[F] blocks coalescence in the stressed position. The violation of IDENT[F] incurred by coalescence entails the violation of HEAD-IDENT[F] because the diphthong is in a prosodic head. The deleted form (14b) is not optimal because its violation of the high-ranked MAX constraint is fatal. As a result, the faithful candidate (14a) is evaluated as optimal, although it violates BRANCH-μ.

The tableau (15) illustrates the evaluation in the unstressed position.

(15) Monophthong in unstressed position: Input = / tu_1e_2 /

	H-IDENT	MAX	BRANCH-μ	UNIFORM	IDENT
a. [tw_1e_2]			*!		
b. [te_2]		*!			
c. ☞ [to_{12}]				*	**

In unstressed positions HEAD-IDENT[F] is irrelevant because the vowels is not in the prosodic head. The coalesced candidate (15c) therefore incurs violations of the lower-ranked constraints UNIFORMITY and IDENT[F]. Thus, this candidate is preferred to the faithful candidate (15a) which violates the higher-ranked constraint BRANCH-μ. The candidate (15b) is excluded because deletion is always prohibited by the higher-ranked MAX.

The output forms of the underlying /ye/ are evaluated in the same manner: in stressed position, the faithful candidate, [yé], is selected as optimal because the other candidates violate the higher-ranked constraints HEAD-IDENT[F] and MAX. In unstressed position, on the other hand, the ranking MAX ≫ BRANCH-μ ≫ UNIFORMITY selects the coalesced candidate, [e], as the optimal candidate, since the candidate derived by deletion violates the higher-ranked constraint MAX and the candidate with a diphthong is excluded by a violation of BRANCH-μ.

3.4.3. Segmental analysis of the monophthongisation

As is noted in 3.3., the coalesced vowels preserve the [back] specification in the first element of the diphthong and the [high] specification in the second. This segmental alternation is produced as the result of the interaction of the constraints listed in (16).

(16) a. *[+high]: Avoid the featural specification [+high].

b. *[+back]: Avoid the featural specification [+back].

c. IDENT[+back]: An input [+back] segment is also [+back] in the output.

Among the constraints in (16), *[+high] and *[+back] express the marked status of both featural specifications. These constraints are assumed to dominate *[−high] and *[−back] in Spanish, so that the front mid vowel [e] has unmarked status among the vowels[9]. Given these constraints, the constraint ranking is established, as in (17).

(17) IDENT[+back] ≫ IDENT[F] ≫ *[+back], *[+high]

In (17), [F] in the IDENT[F] indicates other featural specifications than [+back].

The following tableaux (18) and (19) illustrate how the candidates of the input /ue/ and /ie/ are evaluated.

(18) Mid back vowel [o] : Input = / u_1e_2 /

	IDENT[+back]	IDENT[F]	*[+back]	*[+high]
a. [i_{12}]	*!	*([-high])		*
b. [u_{12}]		**([-high, -back])	*	*!
c. [e_{12}]	*!	*([+high])		
d. ☞ [o_{12}]		**([+high, -back])	*	

Among these four candidates in (18), the front vowel candidates (18a, c) incur a fatal violation of the highest-ranked IDENT[+back] because they do not preserve the [+back] specification in the input. Other candidates (18b) and (18d) are tie with respect to IDENT[F], so the decision is up to the markedness constraints. And the mid back vowel candidate (18d) is evaluated as optimal because it does not violate *[+high] which is violated by candidate (18b).

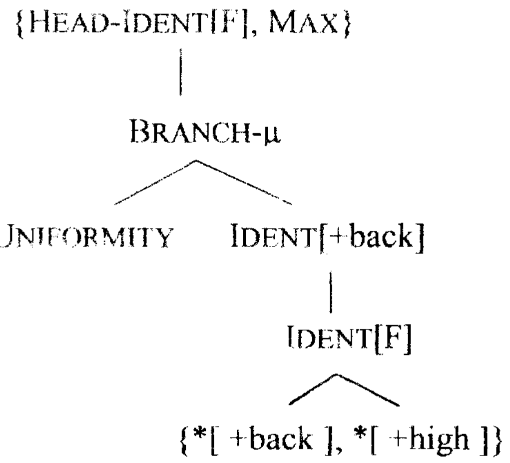
(19) Front mid vowel [e] : Input / i_1e_2 /

	IDENT[+back]	IDENT[F]	*[+back]	*[+high]
a. [i_{12}]		*([-high])		*!
b. [u_{12}]		**!([-high, -back])	*	*
c. ☞ [e_{12}]		*([+high])		
d. [o_{12}]		**!([+high,-back])	*	

In the case of the front vowel sequences /ie/, in which there is no [+back] vowel, the high-ranked IDENT[+back] is irrelevant. The back vowel candidates (19b, d) incur more IDENT[F] violation than the front vowel candidates (19a, c) do, thus the candidates (19b, d) are rejected. For the candidates (19a, c), the front mid vowel candidate (19c) is preferred to the front high vowel candidate (19a) because it satisfies *[+high] constraint while (19a) does not satisfy the constraint.

3.5. Summary of the Constraint Ranking

Based on the arguments established so far, the constraints relevant for the alternating diphthong constitute the following constraint hierarchy.

(20)


4. Conclusion

In this paper, I have proposed a constraint-based analysis of the alternating diphthongs in Spanish. The analysis argues that the alternating diphthongs should be treated as a process of monophthongisation and that the process can be accounted for by vowel coalescence in unstressed positions. Vowel coalescence in unstressed positions is explained by the constraint ranking, HEAD-IDENT[F] ≫ BRANCH-μ ≫ IDENT[F], UNIFORMITY. The OT analysis of the alternating diphthongs eliminates the need for any unfavourable condition, which must be required in the previous derivational approach.

Notes

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1. In Containment-based Optimality Theory, where all elements of the input are required to appear in the output, it is assumed that a deleted element is present in the output but not parsed, and an epenthetic element is inserted as a form of empty structure that is to be filled out later in the phonetics.
2. I basically use Spanish orthography to describe the data, except relevant vowels, which are underscored. I also indicate stress in positions not needed orthographically to facilitate the discussion. " . " indicates a syllable boundary
3. Roundness is also inherited from the second element of the diphthong.
4. The choice of featural specifications depend on particular languages. For the typology of vowel coalescence, see Casali 1996.
5. Indices express the inheritance of the features from input to output.

6. It is assumed that stress is determined independently by the ranking of the constraints that are not relevant here. For OT analyses of stress assignment in Spanish, see Rosenthall (1994) and Colina (1995).
7. The segment /t/ in onset positions is added to show that the candidates are well-formed with respect to syllabic well-formedness constraints other than BRANCH-μ.
8. In the tableaux, constraints are listed horizontally. A thick vertical line indicates domination of the constraint to its left over the one to its right. Asterisk mark violations and exclamation marks indicate that the violation is fatal. ☞ identifies the optimal candidate.
9. The constraints concerning the markedness of the [round] specification have the same distribution as those of the [back] specification. Therefore, to simplify the discussion, these constraints are ignored here.

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