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A typological study of vowel interactions in Basque

In this paper, the phonological micro-variation found in vowel interactions in Basque is studied. For this purpose, an integrated use of formal phonological theories (Element Theory & Turbidity Theory), 'newly' available corpus data of Basque and computational tools (OT-Help 2.0) is made. It is shown that the account taken can generate grammars for all the robustly attested patterns but fails to generate the unattested ones.

Problem In Basque, an uninflected NP like *gizon* 'man' takes the suffix /-a/ to derive the absolutive DP *gizona* 'the man'. When the stem ends in a consonant, the suffix takes the form [a] in all varieties of Basque. However, when the stem ends in a vowel (e.g. *neska* 'girl'), dialectial variation can be found (e.g. *neskia, neskie, neski, neska* 'the girl'). This paper focuses on three main processes and their interactions, affecting stems ending in /a,e,i/:

(1) *Low vowel raising*: /a - a/ → [ea]

(2) *Mid vowel raising*: /e - a/ → [ia]

(3) *Low vowel assimilation*: /i - a/ → [ie]

Given that process (1) can feed process (2), which in turn can feed process (3), stems ending in either /a,e,i/ can take one of 4, 3 and 2 forms, respectively. From a logical point of view, these nine (4+3+2) forms can be combined in 24 (4·3·2) different patterns (corresponding to 24 potential dialects). In our reference dataset, only 13 of these patterns are robustly attested.

Methodology With the help of a software to calculate factorial typologies (OT-Help 2.0), this paper develops a formal analysis of the vowel interactions in Basque given in (1)-(3) and assesses its predictive power. This is checked against data extracted from two sources, containing alternations for more than 150 locations: Hualde & Gaminde (1998) and Aurrekoetxea & Videgain (2013). We show that the proposed analysis accounts for all the attested patterns of this specific type of vowel interactions in dialects of Basque and at the same time excludes the unattested patterns. Furthermore, we show that an analysis based on Element Theory (Backley 2011) and Turbidity Theory (Goldrick 2001; henceforth OT-TT; a subbranch of OT that distinguishes projected/underlying features (illustrated by ⁚) and pronounced/surface features (illustrated by ⁛)) can account not only for the transparent cases but also for a counter-feeding opaque interaction between two phonological processes involved in vowel interactions.

Analysis In order to account for the attested systems of vowel interaction and at the same time to exclude the unattested patterns, an OT-TT analysis is proposed that resorts to the following constraints (where E stands for either element |A| or |I|):

(4) PROJECT(E): Assign a violation mark for every pronounced E that does not correspond to any projection of E.

(5) PRONOUNCE(E): Assign a violation mark for every projected E that does not correspond to any pronunciation of E.

(6) OCP(E): Assign a violation mark for every pair of adjacent root nodes that pronounce E.

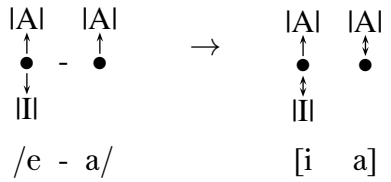
(7) OCP(root): Assign a violation mark for every pair of adjacent root nodes that pronounce the same set of E's.

(8) SPREAD(E): Assign a violation mark for every pronounced E that does not spread (i.e. that is not pronounced by a neighboring root node).

(9) SPREAD(E)': Let the set *S* of projected E's by a root node be identical to the set {E}, i.e. {E} $\subseteq S \wedge S \subseteq$ {E}. Assign a violation mark for every pronounced E $\in S$ that does not spread.

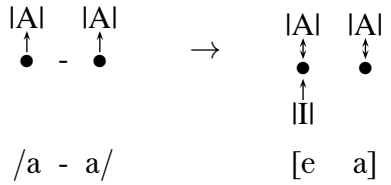
The three processes under consideration can be formalized as in (10)-(12). All possible rankings of the constraints (4)-(9) account for all the robustly attested vowel interactions.

(10) /e - a/ → [ia] mapping



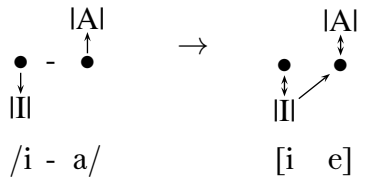
The process of *mid vowel raising* is formalized as underpronunciation of an underlying |A|: only |I| is pronounced in the output representation. This unfaithful mapping is triggered by OCP(|A|), which crucially outranks PRONOUNCE(|A|).

(11) /a - a/ → [ea] mapping



The process of *low vowel raising* is the result of pronouncing an |I| that is not projected together with the projected |A|. We propose that the pronunciation of a non-projected |I| is due to the satisfaction of OCP(root), which outranks PROJECT(|I|).

(12) /i - a/ → [ie] mapping



The process of *low vowel assimilation* results from the pronunciation of |I| by both its own root node and the suffixal root node. This process is interpreted as being triggered by SPREAD(|I|), which dominates OCP(|I|).

The two dialects given in (13) show counterfeeding opacity between mid vowel raising and low vowel assimilation. In these dialects, |I| only spreads when it is the exclusive E projected by the root node, but not when it co-occurs with another projected E, such as |A|. In other words, only the faithfully derived segment [i] (/i/ → [i]) triggers low vowel assimilation, but not the unfaithfully derived segment [i] (/e/ → [i]). This process is formalized as the outranking of the more stringent SPREAD(|I|) by the less stringent SPREAD(|I|)' (cf. (9)). The whole constraint rankings for the opaque dialects are given in (13):

(13)

Dialect	/a - a/	/e - a/	/i - a/	Constraint ranking
16	[ia]	[ia]	[ie]	OCP(root) ≫ PROJ(|I|) OCP(|A|) ≫ PRON(|A|) SPREAD(|I|)' ≫ OCP(|I|) ≫ SPREAD(|I|)
4	[aa]	[ia]	[ie]	PROJ(|I|) ≫ OCP(root) OCP(|A|) ≫ PRON(|A|) SPREAD(|I|)' ≫ OCP(|I|) ≫ SPREAD(|I|)

Conclusion By combining Element Theory and OT-TT with computational tools designed to investigate phonological typologies, we showed that with the constraint set given in (4)-(9) the full set of the attested dialectal vowel interactions (cf. (1)-(3)) in Basque can be accounted for. In contrast, the same constraint set cannot generate any of the unattested patterns. We hope that our approach also contributes to a more general discussion of methodological aspects in the study of phonological (micro-)variation.

Selected references Aurrekoetxea, G. and X. Videgain (eds.). 2013. *Euskararen Herri Hizkeren Atlasa 5. Izen morfologia*. Bilbo: Euskaltzaindia. ■ Goldrick, M. 2001. "Turbid output representations and the unity of opacity". In M. Hirotani, A. Coetzee, N. Hall and J. Y. Kim (eds.), *Proc. of the North East Linguistic Society* 30: 231–245. Amherst, MA: GLSA. ■ Hualde, J.I. and I. Gaminde. 1998. "Vowel interaction in Basque: A nearly exhaustive catalogue". *Studies in the Linguistic Sciences* 28(1): 41–77.