PLACE ASSIMILATION IN SANSKRIT:
an Optimality Theory Approach

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ABSTRACT

We propose on this article that by considering the phonological phrase (ϕ) the domain for "place assimilation" in Sanskrit another phonological process of "vowel sandhi" emerges for the purpose of repairing an asymmetrical rhythm pattern.

1. Introduction

"Assimilation" according to Generative Phonology (Clements&Hume, 1995) is a phonological process by which one segment copies feature specifications from a neighboring segment.

dhṛtarāṣṭra uvāca –
[[dharma-kṣetre kuru-kṣetre]ϕ [samavetā yuyutsavaḥ]ϕ]IP
[[māmakāḥ pāṇḍavāś caiva]ϕ [kim akurvata sanjaya]ϕ]IP

dhṛtarāṣṭra uvāca – King Dhrtarāṣṭra said; dharma-kṣetre kuru-kṣetre – in the religious place called kurukṣetra; samavetāḥ – assembled; yuyutsavaḥ – desiring to fight; māmakāḥ – my sons (headed by Duryodhana); pāṇḍavāḥ – the sons of Pāndu (headed by Yudḥistira); ca – and; eva – indeed; kim – what?; akurvata – did they do; sanjaya – O Sanjaya.

"King Dhṛtaraṣṭra said: O Sanjaya, what did my sons and the sons of Pāndu do, having assembled at the sacred land of Kurukṣetra, desiring to fight?"

The "prosodic hierarchy" from the *Bhagavad-Gitā* 1:1 (Gosvāmi Mahārāja 2011, Prabhupāda 1972) above presents a symmetry of two intonational phrases (IP) as follows:

[[8σ 4∑ 2ω]ϕ [8σ 4∑ 2ω]ϕ]IP
[[8σ 3∑ 3ω]ϕ [8σ 3∑ 3ω]ϕ]IP

The underlying prosodic word (ω):

/pāndɑvāḥ/ "the sons of Pandu"

extracted from the third phonological phrase (ϕ) surfaces as:

[ˈpāndavāʃ]

(1) Rule:

[-cor, -ant]→[+cor, -ant]/_____ [+cor, -ant].

The rule above states that a velar voiceless fricative /h/ is realized as a palatal voiceless fricative [ʃ] when followed by a palatal voiceless obstruent /tʃ/ .

In other words the encounter of these two classes of different segments results in sharing a single class of place features.

1.1 Other similar examples from Bhagavad-Gitā:

dhṛṣṭa-ketuś cekitānaḥ kāsi-rajaś ca viryavān
purujit kuntibhujaś ca śaibyaś ca nara-pungavaḥ (1:5).

Also present are dhṛṣṭaketu and cekitāna, the heroic king of kāsi, Purujit, Kuntibhoja, the most valiant śaibya, and other noble men.

More recently phonological theories have adopted what is commonly known as a "non-linear" approach to the internal structure of segments.

2. The Feature Geometry Model (Clements 2004, Clements&Hume 1995, Halle, Vaux & Wolfe 2000).

This approach proposes to characterize feature structure within the general framework of autosegmental phonology.

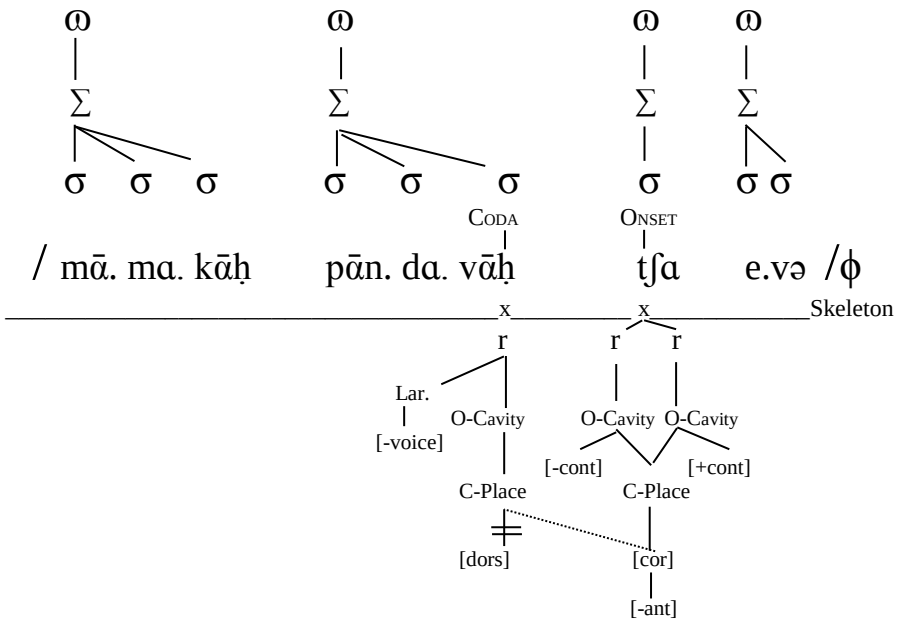
This theory varies in terms of segment-internal structure. Clements (2004) and Clements&Hume (1995) propose a feature tree whose terminal nodes [+/-spread glottis], [+/-voiced], [distributed], etc. are the features themselves. Its intermediate nodes (the Laryngeal, Oral Cavity and Place nodes) are feature classes and the root node (r) dominates all other features.

For the Articulator Theory – AT (Halle, Vaux & Wolfe 2000) the groupings of features in the tree reflect the anatomy of a vocal tract. The lowest constituents (nodes) are made up of features executed by each of the six articulators, and the next highest constituents (nodes)—Place and Guttural—refer to articulator groups that are anatomically adjacent. The features [consonantal] and [sonorant] are assigned to the root node (r) of the tree.

2.1 Place Assimilation.

Based on Feature Geometry Models (Clements 2004, Clements&Hume 1995, Halle, Vaux & Wolfe 2000) we present a phonological analysis of place assimilation in Sanskrit.

(2)



As shown above (2) the second prosodic word (ω) presents a velar voiceless fricative /h/ phoneme that occupies a "CODA" position on its third syllable.

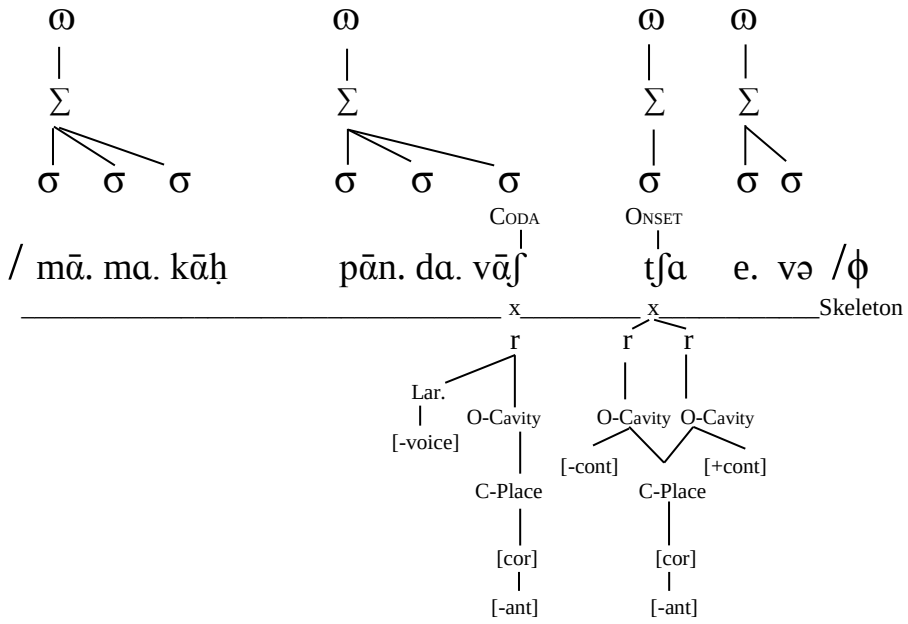
This phoneme assimilates the "place articulation features" of the following segment (ONSET position) classified as a "contour segment" (Clements&Hume, 1995): two root nodes under a single skeletal position.

The realization of speech over time is represented by a concatenation of phonemes that occupy the "timing slots – x_s" (Kenstowicz, 1994).

The phonological process begins by the spread of C-Place – contour segment – to the preceding segment (regressive assimilation) as indicated by the dashed lines while the C-Place node of the latter is being delinked "=" and deleted.

Notice that this phonological process affects only the lower-level structure of the geometrical tree (partial assimilation) while its higher-level remains constant.

(3)



The assimilation process (3) results in a homorganic articulation (palatalization) for both of them carry now the same C-Place feature values.

The advantage of organizing features in a "geometrical tree" provides a formalism to express the fact that only a small number of features (natural classes) spread together in rules of assimilation (Davenport&Hannahs, 1998).

As shown above (3) this phonological process takes into account the syllable – (σ) as the domain for "place assimilation" but we will need a higher-level prosodic constituent to solve an "asymmetrical rhythm pattern" (notice that the total number of syllables decreases in an unnatural order).

3. The Phonological Phrase (ϕ)

Phonology, according to Generative Grammar (Kenstowicz, 1994), postulates abstract representation distinctions between on the one hand an "Underlying Level" (phonemic – the distinctive aspect of language) and on the other hand a "Surface Level" (phonetic – the physical aspect of language).

(4) Underlying Level (phonemic): /(σ σ σ)ω (σ σ σ)ω (σ)ω (σ σ)ω/ ϕ
/ mɑ̄.ma.kɑ̄h pɑ̄n.da.vɑ̄h tʃa e.və /

vowel sandhi
↓

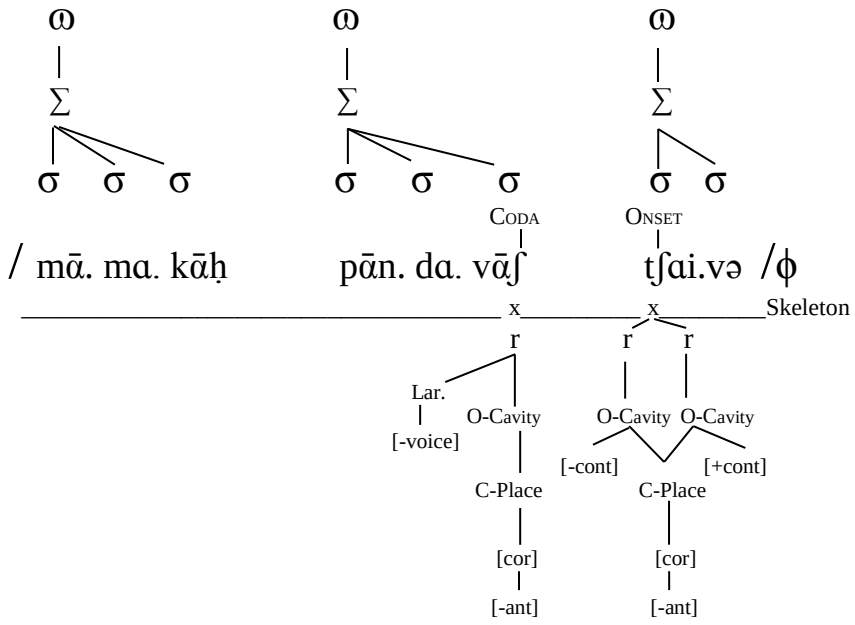
Surface Level (phonetic): [(σ σ σ)ω (σ σ σ)ω (σ σ)ω] ϕ
[mɑ̄.ma.kɑ̄h pɑ̄n.da.vɑ̄ʃ tʃai.və

As shown above (4) the phonological phrase (ϕ) on the "underlying level" presents four prosodic words (ω) with an asymmetrical decreasing number of syllables.

For the purpose of repairing the referred "rhythm pattern" above the phonological process of "vowel sandhi" emerges on the "surface level" and instead opts for a more natural number of syllables by deleting the fourth prosodic word (ω).

Returning to the Feature Geometry Model (Clements 2004, Clements&Hume 1995, Halle, Vaux & Wolfe 2000) this same phonological phrase (ϕ) can now be viewed in its right symmetry (5) as follows:

(5)



This same phonological process of "place assimilation" in Sanskrit can also be illustrated in the Optimality Theory Model (Prince&Smolensky, 1993).

4. The Optimality Theory Model (Prince&Smolensky, 1993)

Constraints:

UNARYFT]ω: a prosodic word must have an unary foot.

*/tʃ/ C-PLACE(REGRESSIVESPREADING): /tʃ/ C-PLACE spreads regressively to the antecedent segment.

*SANDHI: vowel sandhi.

I-O-IDENTSyll: surface syllables must be faithful to their underlying correspondents.

(6)

Input / mɑ̃.mɑ.kɑ̃ḥ pɑ̃n.dɑ.vɑ̃ḥ tʃɑ e.vɑ /ɸ	UNARYFT]ω	*/tʃ/ C-PLACE REGRESSIVE SPREADING	*SANDHI	I-O-IDENTSyll.
→ [mɑ̃.mɑ.kɑ̃ḥ pɑ̃ṇ.ḍɑ.vɑ̃ʃ tʃɑi.və]ɸ				*!
[mɑ̃.mɑ.kɑ̃ḥ pɑ̃ṇ.ḍɑ.vɑ̃ḥ tʃɑ e.və]ɸ		*!	*!	
[mɑ̃.mɑ.kɑ̃ḥ pɑ̃ṇ.ḍɑ.vɑ̃ḥ tʃɑi.və]ɸ		*!		*!

In Optimality Theory (Prince&Smolensky, 1993), grammatical rules (constraints) are violable and they stand in conflict with each other (Rocca&Johnson, 1999).

These conflicts are generated by "faithfulness" and "markedeness" constraint families (kager, 1999).

Faithfulness constraints demand that surface forms must be faithful to the corresponding lexical forms (underlying level) while markedeness constraints require lexical changes (on the surface level) for the purpose of simplifying language *outputs*.

The *Tableaux* (6) above illustrates the interactions of markedeness and faithfulness constraints:

The first constraint UNARYFT]ω belongs to the faithfulness family and it occupies the highest position on the ranking. It demands an "unary foot (∑) per word (ω)" and no violations are incurred by any of the *output* candidates.

The second constraint */tʃ/ C-PLACE(REGRESSIVESPREADING) belongs to the markedeness family. The first candidate satisfies it by assimilating /tʃ/ C-PLACE spreading while the other two candidates violate it.

The third constraint *SANDHI belongs to the markedeness constraint: it requires that the encounter of two vowels /a/ - /e/ (underlying level) should result in a [ai] vowel sandhi (surface level). The first and third candidates satisfy this requirement while the second candidate violates it.

The fourth constraint I-O-IDENTSyll. (I-O stands for "faithfulness between *input* and *output*") belongs to the faithfulness family and demands that surface syllables must be faithful to their underlying correspondents. Only the second candidate satisfies this requirement while the first and third candidates violate it.

The optimal *output* is the first candidate for being able to satisfy the first three highest constraints.

5. CONCLUSION

By accepting the phonological phrase (ɸ) as the domain for "place assimilation" in Sanskrit we were also able to capture "rhythm pattern adjustments" for the benefit of the overall architecture of the language.

The grammar (the constraint ranking) for the phonological phrase /mɑ̄makɑ̄ḥ pɑ̄ndavɑ̄ḥ tʃa eva /ɸ is: UNARYFT]ω>>*/tʃ/ C-PLACE(REGRESSIVESPREADING)>> *SANDHI>> I-O-IDENTSyll.

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