Getting rid of Positional Faithfulness in stressed positions:
the phonetic underpinnings of prosodic conditioning

This paper starts from a striking observation about stress-conditioned phonological processes: although a variety of processes are sensitive to the presence or absence of stress, the features targeted by these processes are extremely few. This fact poses significant problems for previous accounts of prosodic conditioning (Positional Faithfulness, Beckman, 1998, henceforth Pos-Faith). The paper lays out the problem and proposes an alternative account of possible interactions between stress and segmental structure. The key proposal is that faithfulness to the contents of stressed positions must be eliminated. The grammar of prosodically conditioned processes is *not* determined be the special status attributed to privileged positions. Instead, prosodic conditioning arises from the grammatical pressures imposed by the need to generate louder vowels and longer stressed units. These grammatical pressures target exclusively the auditory properties of stressed vowels and adjacent consonants.

Previous analyses of stress-conditioned processes claim that stressed positions have positional privileges, shared with other strong positions (e.g. the root, the initial syllable, etc). The positional privilege attributed by Pos-Faith to stressed positions results in their ability to resist phonological processes. The positional privilege is implemented in the grammar by the action of Pos-Faith constraints (IDENT-σ́ (F)), where F represents any phonological feature. It is therefore predicted that any phonological feature can show Pos-Faith effects, if it occurs in a stressed position. A study of the documented cases of stress-conditioned phonological processes (a.o. Smith, 2002; Gonzalez, 2003; deLacy, 2006; Bye and deLacy, 2008) reveals a very different picture. Duration aside, among consonantal features stress-sensitive processes target only the laryngeal and manner features in (1a). Place is never specifically targeted in stress or unstressed positions, nor are the other manner and laryngeal features, (1b).

(1) a. <u>Consonantal features affected by stress</u>:
- Laryngeal features: aspiration in voiceless stops, glottalization in stops and resonants, [±voice]
- Manner features: [±continuant], [±strident], [±delayed release]

b. <u>Consonantal features which are not affected by stress</u>:
- Laryngeal features: breathy voice, creaky voice, ejection
- Manner features: [±nasal], [±lateral]
- Place features: [labial], [coronal], [dorsal], [radical]

A feature may be the target of a stress-sensitive process in two ways: (i) it can be changed only under stress; (ii) or it can be changed everywhere except under stress. Whereas the features in (1a) are found in both classes of processes, (2a), the features in (1b) do not, (2b). Thus, contrary to the predictions of Pos-Faith, there is no documented faithfulness to place and or many manner properties under stress. These features are also never selectively targeted *under stress* by phonological processes. For instance, there is no language in which stops are nasalized or labialized, depending on whether they are inside, or outside a stressed position, or in which dissimilation is triggered or blocked in a stressed position.

Attested cases of prosodic conditioning are restricted even further. The processes that do affect the features in (1a) modify mostly the properties of the consonants' release. Bursts of stress-adjacent obstruents may be realized as affricates, or they are produced with a longer frication component of the burst, with a slight aspiration, or described as louder than bursts of non stress-adjacent consonants. It is however never the case that stress causes processes like voicing assimilation to be triggered or blocked.

(2) a. <u>Attested stress-sensitive consonantal processes (examples)</u>:
<u>Triggered in a stressed position</u>: aspiration of pre-tonic stops in Silacayopan Mixteco, affrication of pre-tonic stops in Maori, C lengthening (Urubu-Kaapor, Kuuku-Yaʔu)
<u>Blocked in a stressed position</u>: assibilation in Finnish, lenition of fortis stops in Copala Trique

b. <u>Unattested stress-sensitive processes</u>: nasalization of C in stressed position (*Bantu'), labialization of C before stressed round Vs (*Margi') voicing assimilation in stressed position (*Russian')

The central claim of this paper is that the discrepancy between the predictions of Pos-Faith and the attested patterns of stress-conditioning follows from the erroneous assumption that stressed positions are privileged positions, in the same sense of other strong positions. Stress conditioned phonological processes are *exclusively* driven by a grammatical pressure to maximize the auditory prominence of metrically strong positions. *First* we argue that every stress-sensitive process results in the enhancement of perceptually salient properties of the targeted segment (i.e. segmental duration, intensity and V height). *Second*, unlike previous formal approaches to prosodic conditioning, we predict that the set of phonological processes which can be sensitive to the position of word stress is restricted to a very small subset of all possible phonological processes. These can *only* be of two kinds, (3):

(3) a. Processes that maximize the auditory prominence of the stressed position.
These processes involve increasing the duration of the stressed position, and/or the total perceptual energy of the stressed vowel (Gordon, 2006).

b. Processes which arise as side-effects of prominence enhancing processes.
The side-effects result from the mechanisms which are set in place in order to increase the perceptual energy of the stressed vowels: increasing the subglottal pressure level, and tensing the vocal folds (Sluijter and van Heuven, 1996).

The side-effects associated with the sub-glottal pressure increase, and vocal fold tensing during the production of stress-adjacent consonants do not increase the energy level of the vowel *per se*, but enable increases of the energy level. We argue that they constitute, in addition to durational processes, the set of consonantal processes which can be conditioned by stress. The properties of the side-effects therefore derive the extremely restricted number of stress-conditioned consonantal processes. They are restricted to the very few phonetic effects that a subglottal- and thus oral pressure increase can have on the realization of stress-adjacent obstruents (increase frication noise, louder burst, slight aspiration). It is for this reason that features in (3b) are never affected by stress: they are never affected by the side-effects of prominence requirements. Similarly, not all processes involving the features in (3a) are possible cases of prosodic conditioning, but only those which are affected the side-effects.

The operative grammatical constraints in stress conditioning are formulated as OT constraints (Prince and Smolensky 1993). They are either markedness constraints that enforce metrical prominence, or effort constraints regulating the phonetic implementation of metrical prominence. Two auditory properties contribute to the perceptual saliency of a stressed domain: its total duration and the total perceptual energy of the stressed vowel. These auditory dimensions project to constraints that require the duration or the total energy to be *at least* a given value on the scale ($\acute{D}_{dur} \geq X$, $\acute{V}_{Energy} \geq X$). The increase in the durational prominence and of the total energy of the stressed vowel are determined by the interaction of these grammatical pressures with segmental markedness and faithfulness constraints in the grammar. The side-effects on the other hand arise from the interaction of the metrical requirement on the prominence of the stressed vowel and an effects of a effort constraint regulating the displacement of subglottal pressure.

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