Subfeatural representations in phonology: Encoding coarticulatory strength

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In this paper, I claim that the coarticulatory strength of certain segments must be encoded in the phonological grammar, and I propose new, scalar representations to that effect: SUBFEATURES. These representations are shown to be necessary to account for cases of "subphonemic teamwork", a cumulative effect which obtains when two segments aspiring to trigger the same categorical phonological process (e.g. assimilation), but too weak to trigger it on their own, may "team up" and together pass the threshold necessary for that process to occur.

Drawing from original fieldwork, I analyze the rich case of the doubly triggered rounding harmony of Laal (endangered isolate, Chad), which requires two triggers that can be either on the same side of the target or on opposite sides. As seen in (1), a non-round vowel /ɨ/ or /ə/ is rounded into [u] or [o] if and only if it is followed by a round vowel of identical height and backness (/ɨ…u/ → [u̲…u]; /ə…o/ → [o̲…o]), AND if it is also adjacent to a preceding (1a) or following (1b) labial consonant. The absence of even one of the triggers or conditions prevents the harmony from applying (1c-e).

(1) a. /ɓɨr-ú/ **[ɓù̲rú]** 'hook-pl' c. /ɓər-ú/ [ɓərú] 'plant-pl' e. /gɨ́n-ù/ [gɨ́nù] 'net-pl'
b. /təb-ó/ **[tò̲bó]** 'fish(sp.)-pl' d. /ɓìr-à/ [ɓìrà] 'hook-sg'

I provide instrumental evidence that the harmony is driven by subphonemic coarticulatory effects: /ɨ/ and /ə/ are subphonemically labialized to [ɨᵇ əᵇ] by the neighboring labial consonant. these labialized vowels form a natural phonological class, specifically targeted by a categorical process of rounding harmony. To account for this phonetically grounded phonological process, I propose to enrich phonology with SUBFEATURES (notation: ⟦F⟧), scalar and subordinate to binary features, representing the perceptual consequences of coarticulation. [+F] correlates by default with ⟦1 F⟧, i.e. it is realized with the full extent of the perceptual correlate of [F] (e.g. [+rd] ↔ ⟦1 rd⟧), while [-F] by default correlates with ⟦0 F⟧, having none of the perceptual correlates associated with [F] (e.g. [-rd] ↔ ⟦0 rd⟧). The vowels [ɨᵇ əᵇ] in Laal are featurally [-rd], but have an intermediate subfeatural ⟦*x* rd⟧ value ($0<x<1$), assigned by the neighboring labial consonant. The exact value of *x* depends on the coarticulatory strength of the labial trigger, and is calculated using the C(oarticulatory) function defined in (2).

(2) $C_p(x_{init}) = x_{init} + p(x_{end} - x_{init})$

Coarticulatory strength is encoded in the coarticulatory coefficient *p*, i.e. the proportion of increase or decrease in ⟦F⟧ incurred by the trigger ($0<p<1$); x_{init} is the (expected) initial ⟦F⟧ value of the target before application of *C* (⟦0 rd⟧ in Laal); x_{end} is the value of the endpoint of the ⟦0∼1 F⟧ scale towards which the function tends (⟦1 round⟧ in Laal). This is illustrated in Fig. 1 and 2 below.

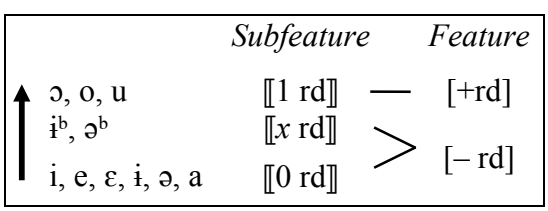

Fig.1: Featural and subfeatural scales in Laal

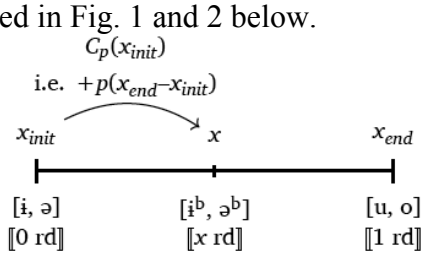

Fig.2 Application of the C function in Laal

Subfeatures are a stabilized reification of "phonetic knowledge" (Kingston and Diehl 1994); as such, they do not contradict the separation of phonology and phonetics, but rather constitute a mediating interface between them. With such representations, the doubly triggered harmony can be analyzed as a rounding harmony parasitic on height and backness, targeting vowels that are at least ⟦*x* rd⟧. Any theory of parasitic harmony would presumably account for it if it is allowed to refer to subfeatures. This approach is shown to be superior to purely grammar-driven approaches viewing subphonemic teamwork as a constraint ganging effect (either through Local Constraint Conjunction, or cumulative weight interaction in Harmonic Grammar) which fail to account for the distinctiveness between [ɨᵇ əᵇ] and [ɨ ə], thus missing a crucial generalization.