Slovak prosody in the phonetics-phonology debate: Yers and emergent prosodic breaks

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Abstract

Prosody is central for understanding the cognitive system underlying human speech and relates to both more granular aspects of our phonological competence as well as more continuous aspects of observable articulatory movements and resulting acoustic characteristics. The understanding, and formal treatment, of the relationship between these two inter-related components of human speech is at the core of the cognitive approach to speech. In this presentation I contribute to this discussion by drawing links between two seemingly unrelated lines of my research on Slovak [1, 2], and argue that understanding the continuous prosodic nature of speech is critical for improving our understanding of cognitive competence underlying it. The first aspect concerns yer vowels as the proto-typical problem of Slavic phonology [1], the second involves the nature of prosodic boundaries [2].

In Slavic phonology, 'yer', or 'jer' is a widely used and recognized term for vowels that alternate with zero in many Slavic languages and can be traced to Old Church Slavonic and Indo-European. In Slovak, the presence of mid-vowels /e/ and /o/ in some words alternates with their absence as in (1).

(1) Alternations with yers in Slovak.

Nom.Sg.	Transcription	Gen.Sg.	Instr.Sg.	Gloss
pal**e**c	[palets]	palc-a	palc-om	'thumb'
lak**e**ť	[lakec]	lakť-a	lakť-om	'elbow'
p**e**s	[pes]	ps-a	psom	'dog'
kot**o**l	[kotol]	kotl-a	kotl-om	'cauldron'
pár**o**k	[pa:rok]	párk-a	párk-om	'sausage'

(2) Yer and non-yer vowels occur in similar environments

Yer	Gen.Sg.	Gloss	Non-yer	Gen.Sg.	Gloss
kábel	kábl-a	cable	Ábel	Ábel-a	name
palec	palc-a	thumb	balet	baleta	balet
párok	párk-u	sausage	nárok	nárok-u	requirement
smútok	smútk-u	sorrow	sútok	sútok-u	confluence

The patterns in (2), together with other features of Slovak, show that the yer vs. non-yer alternations cannot be treated as insertions or deletions since the environment could not be specified. Therefore, given well known reasons stemming from alternations as in (2), all phonological accounts assume that yer vowels are underlyingly different from non-yer vowels. This is common to all formal yer treatments despite important differences in theoretical machinery and predictions generated in phonological analyses using various formalizations [e.g. 3, 4, 5, 8, 9]. The second assumption, shared by all traditional accounts, is that the underlying difference between yer and non-yer vowels is neutralized in phonology (e.g. the traditional rule of Lower in [3]), and there should thus be no phonetic difference between the two vowel classes. I will review the phonetic evidence in [1] that analyzes the acoustic and articulatory aspects of producing words like in (2) and suggests that yer vowels are prosodically weaker than their non-yer counterparts and resemble vowels produced in faster speech rate. Hence, sub-phonemic prosodically-based differences might participate in modeling deep morpho-phonological alternations.

The second line of research investigates the spontaneous emergence of high-level prosodic boundaries induced by resolving low-level requirements for slower speech rate or more precise articulation in the vicinity of the syntactic affordance for such boundaries [2]. We investigate the patterns of temporal coordination among the bilabial gestures (m-opening, b-closing) and the tongue body gesture forming the vowel canonically following /b/ in real-word Slovak sequences in (3).

(3) Stimuli for emergence prosodic break; "#" denotes syntactic affordance

Slovak	IPA
Čítam (#) iba mu ...	[tʃi:ta**m**(#)i**ba**mu...]
Cítim (#) aby mu ...	[tsi:ci**m**(#)a**bi**mu]

We observed that the continuous variation of low-level tempo and hypo-hyper articulation resulted in continuous re-organization of the gestures reflecting the continuous variation in the boundary strength. The extrapolation between our findings and those reported in literature for linguistically planned brakes suggests a plausible hypothesis that both species of prosodic boundaries, i.e. 1) planned, top-down, traditionally phonological ones stemming from the interface between prosody and syntax/pragmatics and 2) emergent, bottom-up ones, realized though low-level phonetic variations, can stem from a single underlying mechanism, and can be implemented in the same way. Moreover, the observed systematicities can be accounted for using the formal optimization-based Embodied Task Dynamics model [6, 7] in which the variation in inter-gestural timing stemming from the prosodic characteristics arises through localized changes in relative demands on efficient perception, articulatory precision and temporal cohesion among the sequenced gestures.

Both lines of research thus suggest that exploring traditional phonological alternations as embedded in continuous prosodic substrate can provide novel insights into the cognitive mechanisms underlying our communicative competence.

Index Terms: phonetics-phonology, yers, prosodic boundaries, Slovak, articulation

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