Dániel Szeredi. ***Accounting for subphonemic centralization in Hungarian.***
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1. The Hungarian vowel system

Siptár and Törkenczy (2000:51) show the usual phonological classification of the vowel system:

	[-back]		[+back]	
	[-round]	[+round]	[-round]	[+round]
high	/i/ /iː/	/y/ /yː/		/u/ /uː/
mid	/eː/	/ø/ /øː/		/o/ /oː/
low	/ɛ/		/aː/	/ɒ/[1]

Issues with the behavior of these phonemes on the surface:

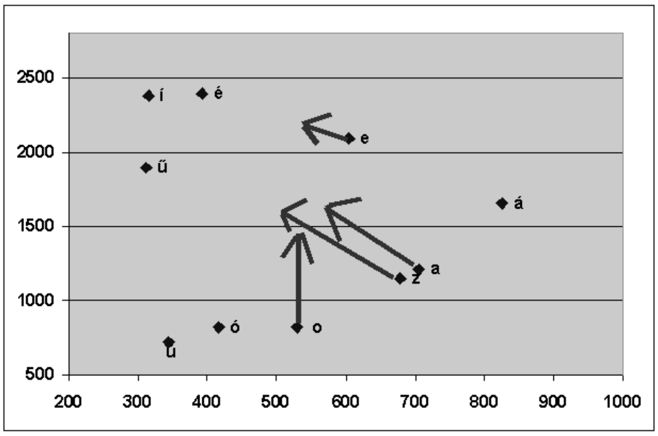
- Quantitative distinctions are getting less important and qualitative contrasts replace them, eg. /ɒ/ vs. /a/; /o/>/o̝/ vs. /oː/>/o̞/, etc. The phonemical status of long high vowels is also questionable.
- Most accounts state that there is no vowel reduction in any circumstances in Hungarian, neither in unstressed position, nor in function words. Some studies however (eg. Gósy 1997) have shown that reduction and centralization may take place in Hungarian.
- The exact quality of unstressed vowels usually contains more redundant information due to vowel harmony in Hungarian, ie. the frontness of the vowel (acoustically the F2 formant) is usually predictable. This predictability could easily lead to F2 neutralization.

2. Empirical data

The experiment: 4 environments were tested in 4 different stress and style conditions: /ʃɒk/ (a), /tɒz/, /kɛɟ/ (e) and /hoɟ/ (o) in careful speech (g), in stressed syllables (1), in unstressed syllables (2) and in unstressed function words (0). The attested reduction patterns were:

	/ʃɒk/	/tɒz/	/kɛɟ/	/hoɟ/
careful speech	[ɒ̞]	[ɒ̞]	[ɛ]	[o]
stressed	[ɐ̜]	[ɐ]	[e̝]	[o̟]
unstressed	[ɐ̜]	[ə̞]	[e̝]	[ə̠]
function word	[ə̜]	[ə̞]	[e̝]	[ə]

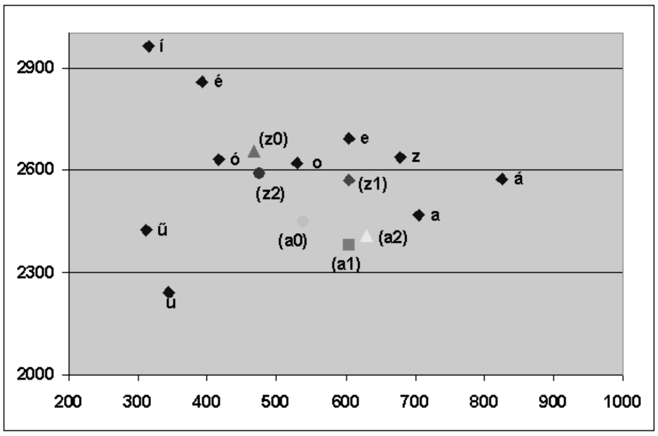
Graphically:



The most important observations are:

[1]Siptár and Törkenczy use /ɔ/ to describe this phoneme, however it is closer to [ɒ], as it will be shown

- vowel reduction on the surface is attested in Hungarian contrary to popular and textbook accounts
- the /ɛ/ phoneme does not centralize its F2 formant, and stress position does not affect the extent of F1 centralization (effect of neighboring palatal /ɟ/?)
- /o/ does centralize its F2 formant, and less stress leads to more reduction.
- /ɒ/ centralizes its both formants towards a target of [ə]. The extent of reduction is again affected by the stress conditions.
- there is a significant difference in the third formant between the (z) and (a) environment as the latter seems to have a lower F3, maybe implicating that its roundedness is more retained:



Summarizing the results compared to reduction patterns in other languages discussed in Crosswhite (2004), Flemming (2004) and Harris (2004):

	Target of centralization in						
	Hungarian	Catalan	SLPC[2]	Bulgarian	Belarusian	Central Italian	Southern Italian
a	?	ə	ə	ə	a	a	a
ɒ/ɔ	ə	-	o	-	-	o	-
ɛ/æ	e	ə	e	-	-	e	-
e	?	ə	e	i	a	e	i
o	ə	u	o	u	a	o	u

3. Theoretical accounts

3.1 Prominence reduction. In a standard OT analysis like the one of Crosswhite (2004) a prominence reducing system like the pattern seen above would be analyzed with higher ranked faithfulness constraints like Max[+high] that are demoted in casual speech to a point between a range of markedness constraints like *Unstressed/e,o, which in turn are universally ranked (cf. Crosswhite 2004). The above seen pattern can be described using the following constraint ranking in casual speech:

Max[+front] ≫ *Unstressed/ɛ,ɒ ≫ *Unstressed/e,o ≫ Max[+back] ≫ Max [+low] ≫ *Unstressed/i,u ≫ *Unstressed/ə

In this case the reduction pattern can be analyzed like[3]:

/ɛ/$_{\text{[-stress]}}$	Max[+front]	*U/ɛ,ɒ	Max[+low]	*U/e,o	*U/i,u	*U/ə
[ɛ]		*				
☞[e]			*	*		
[ə]	*		*			*

[2]Sri Lankan Portuguese Creole

[3]*U stands for *Unstressed

/o/$_{\text{[-stress]}}$	*U/ɛ,ɒ	*U/e,o	MAX[+BACK]	*U/i,u	*U/ə
[o]		*			
☞[ə]			*		*

/ɒ/$_{\text{[-stress]}}$	*U/ɛ,ɒ	*U/e,o	MAX[+BACK]	MAX[+LOW]	*U/ə
[ɒ]	*				
☞[ə]			*	*	*

3.2 Maximal dispersion and least effort. Analyzing vowel reduction Flemming (2004) proposes several types of constraints for vowel inventories: one type that enforces maximal dispersion of vowels in the space available (like MINDIST=F1:3 which is violated if two vowels are closer to each other than 3 measurements on an arbitrary scale); and another type that describes linguistic tendencies to minimize articulatory effort in certain environments (like *SHORT LOW V for F1 centralization or *HIGH EFFORT for F2 centralization); and a constraint that requires to maximize the numbers of vowel contrasts in a language. To use this framework describing the Hungarian pattern we would need further research on the effect of vowel length on reduction and on the behavior of other vowels.

3.3 Suppression of elements representing spectral salience. The analyses above above fail to answer why some faithfulness constraints like MAX[+LOW] are demoted and others like MAX[+FRONT] are not (or in Flemming's case why high effort prohibiting constraints or contrast maximizing constraints are ranked exactly where they are needed to be ranked). They seem to provide a too strong tool for vowel reduction as more reduction patterns could be described than those that exist in languages. Harris's (2004) Element Theory analysis may give a better insight as it uses such elements in describing vowels that have direct phonetically grounded representations as spectral prominence peaks, or convergences of main formants (F0-F3) as these salient peaks are considered to be perceptionally preferred in Dispersion-Focalization Theory (Schwartz et al 1997):

- (A) – convergence of F1 and F2
- (I) – convergence of F2 and F3
- (U) – convergence of low F0, F1 and F2

In this model the Catalan reduction is described as unstressed syllables (A) and (I) elements are lost, while (U) is preserved (cf. Harris 2004). The Hungarian pattern seems similar as we might assume that the (A) and (U) elements are reduced contrary to the preserved (I) element:

- /ɒ/ ($\underline{\text{A}}$+U) → [ɐ] (A+$\underline{ø}$) ∼ [ə] (ø)
- /o/ (A+$\underline{\text{U}}$) → [ə] (ø)
- /ɛ/ ($\underline{\text{A}}$+I) → [e] (A+$\underline{\text{I}}$)

This analysis can provide predictions for centralization patterns for yet untested vowels, such as /u/ would centralize towards [ə] via a possible [ʊ], but /i/ would not change, as its lone (I) element is not among the targets of reduction.

4. Further research

In further research I will investigate the pattern seen above more closely involving the following questions:

- what is the reduction pattern for other vowels, mainly /i/, /u/, /ø/, /y/ and /aː/?
- how important is the effect of neighboring consonants on the direction of reduction, as vowel qualities in the /hoɟ/ and /kɛɟ/ environments may have been influenced by the palatal consonant following them?
- does phonemic vowel length hinder reduction or long vowels neutralize in the same way as short ones? (this will enable Flemming's approach to be investigated on the Hungarian pattern as well)

5. References

Crosswhite, Katherine 2004. Vowel Reduction. In Bruce Hayes, Robert Kirchner and Donca Steriade (eds.). *Phonetically Based Phonology.* Cambridge: Cambridge University Press. 191-231.

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