Neutralisation: phonetic or phonological?
An acoustic and perceptual study of vowel harmony
in two dialects of Hungarian

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1 Relevance

The aim of this project is to investigate the relationship between abstract mental representations of the phonological structure of words and their acoustic and perceptual properties. In other words, it examines the nature of the mapping between phonological representation and phonetic realisation.

We plan to address two main theoretical questions. First, does the lexicon contain only abstract phonological representations, only detailed phonetic representations, or both? Second, what is the nature of the mapping between phonological and phonetic representations: one-to-one, one-to-many, or many-to-many? More specifically, to what extent does the abstract phonological representation of a word determine its phonetic realisation, and *vice versa*?

There are two related empirical areas we plan to investigate within vowel harmony: anti-harmony and vacillating stems. Hungarian[1] displays palatal (front/ back) harmony in suffixes. For instance, the suffix meaning 'in' appears as [ban] when attached to the stem *ház* [haːz] 'house', but the same suffix appears as [bɛn] when it is attached to a stem like *tűz* [tyːz] 'fire'. The phenomenon of anti-harmony in transparent stems, however, further complicates the picture. Stems containing the vowels /i/, /iː/ or /ɛ/, /eː/ (so-called neutral or transparent vowels) are divided into two classes: one class takes suffixes with front vowels, the other class takes suffixes with back vowels. The distinction between the two classes has been assumed to be lexically specified. Finally, neutral vowels also play a role in the behaviour of vacillating stems, i. e., stems containing a back vowel followed by one or more neutral vowels, e. g. *hotel* [hotel] 'hotel'. These stems display inter- and intra-speaker variation in backness harmony. The choice between front and back suffixes has been shown to correlate with the quality of the neutral vowels following the back vowel: high vowels attract front suffixes more than mid vowels (Hayes & Londe 2006; Hayes et al. 2009).

Vowel harmony has been in the centre of interest of 'traditional' phonological research, which has, however, relied on largely impressionistic descriptions of the data. Only in recent years have researchers started to re-visit traditional claims, and, beginning with the seminal study of Ernestus & Baayen (2006) on (the lack of) voicing assimilation in Dutch, show that there are languages that, although they have previously been thought to completely neutralise certain contrasts in certain positions, nevertheless retain a significant difference between what have previously been thought of as phonologically or phonetically identical sounds. One such study on Hungarian anti-harmony is Benus & Gafos (2007), who have argued that neutral vowels in anti-harmonic stems are in fact articulatorily different from what have previously been considered the same set of vowels in stems taking front suffixes.

We plan to gather data from two dialects of Hungarian: Standard Hungarian, spoken in and around Budapest, and a variety of Hungarian spoken in the south-western part of present-day Slovakia (sometimes referred to as Nyitra Hungarian). While these two dialects are quite similar

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[1] The data come from the standard (Budapest) dialect unless indicated otherwise. See Siptár & Törkenczy (2000) for a comprehensive description of the phonology of Hungarian.

in the relevant phonological aspects,[2] they display significant differences in their surface segment inventories. The standard dialect only has two non-high front unrounded vowels, /ɛ/ and /eː/, while the Nyitra dialect maintains a contrast between short /e/ and /ɛ/, as well as long /eː/.

Comparing data from these two dialects, we intend to analyse the extent to which the phonetic properties of their inventories affect their phonological patterns.

2 Aspects relating to the research project

2.1 Background and status of knowledge

There has been relatively little work on Hungarian in the current laboratory phonology paradigm, with the notable exceptions of Jansen & Toft (2002), Jansen (2004) and Bárkányi & Kiss (2006) on voicing assimilation and Benus et al. (2004); Benus & Gafos (2007) on transparent vowels in vowel harmony.

Benus et al. (2004); Benus & Gafos (2007) have studied the phonetic properties of antiharmonic transparent stems in Hungarian, where some stems with the vowels [i], [iː], [e] and [eː] take front suffixes, but other stems with the same vowels take back ones.. The traditional claim (cf. Siptár & Törkenczy 2000) here has been that the two classes show no differences in vowel quality, and thus each stem has to be lexically specified for triggering front or back harmony.

Benus et al. (2004); Benus & Gafos (2007) challenged this position, claiming that the vowels in stems triggering back harmony are pronounced with a more back articulation than the vowels in the stems that trigger front harmony, based on ultrasound and magnetometric evidence from 3 speakers of Hungarian.

While this study has successfully argued against the traditional position, it fails to answer a number of questions. First, as Hayes & Londe (2006); Hayes et al. (2009) have shown, the number of neutral vowels at the left edge of the stem has an influence on the front/back choice of the suffix, suggesting that the difference in articulation cannot be the only explanation for the different behaviour of these stems. Second, "vacillating" stems are unaccounted for: *martinizés* and *martinizás* 'drinking martini' are both acceptable (at least for a certain set of speakers).

2.2 Approaches, hypotheses and choice of method

2.2.1 Objectives

Primary objective: examining the division of labour between phonological representation, articulation, acoustics and perception in transparent vowels in anti-harmonic and vacillating stems.

Secondary objectives:

1. Collecting a reliable amount of empirical data from Hungarian vowel harmony by

   - acoustic measurements
   - perceptual experiments

2. Comparing the results to those of previous experiments by Benus & Gafos

3. Comparing the results of Hayes et al. (2009) on Standard Hungarian with Nyitra Hungarian.

4. Interpreting the results of the experiments, with possible discrepancies between articulation and acoustics (as demonstrated by Scobbie & Stuart-Smith for Scottish English) and/or between acoustics and perception.

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[2]Vacillating stems show a great deal of inter- and intra- speaker variation, but whether the former correlates with certain dialects or sociolects has not been demonstrated conclusively. Thus, one cannot declare that Standard Hungarian and Nyitra Hungarian have the same phonological patterning with respect to vowel harmony.

5. Integrating the experimental results with empirical data from other languages and considering the implications for a theory of the phonetics-phonology interface.

2.2.2 Hypotheses

As a working hypothesis, four levels are distinguished during this project: abstract phonological representations, articulatory, acoustic and perceptual levels. It has been a widely accepted view that listeners in discrimination tasks often fail to make use of acoustic differences that are clearly measurable and statistically significant, while Scobbie & Stuart-Smith (2002) have demonstrated that articulatory differences do not always have acoustic correlates. An important research question is whether phonological representations can be equated to or derived from either of these components, or whether a fourth, separate level is indeed necessary.

Unfortunately, replicating the articulatory experiments of Benus & Gafos (2007) is beyond the financial and the temporal scope of this porject. Therefore, we plan to gather data from two sources. First, we would like to record and acoustically analyse sentences containing target words comparable to the data in Benus et al. (2004); Benus & Gafos (2007) with a larger pool of speakers (minimally 10 speakers from each dialect). We also plan to gather data on vacillating stems from Nyitra Hungarian and compare them to the results of Hayes et al. (2009).

Second, we intend to carry out perception experiments regarding the same patterns in transparent vowels. This is to determine whether, if there are significant differences in the production of these data, speakers are in any way sensitive to these differences.

Third, we will replicate the experiments of Hayes et al. (2009) with Nyitra speakers to investigate whether and to what extent the differences in surface inventories influence morphophonological patters in the two dialects. Specifically we would like to compare the harmonic behavior of [ɛ] vs. [e] and [e] vs. [eː].

2.3 Methods

2.3.1 Acoustic study

The first goal of the acoustic study is to determine whether and to what extent the articulatory differences reported by Benus & Gafos (2007) influence the speech stream (recall that Scobbie & Stuart-Smith 2002 have shown that articulatory differences do not always show up in the acoustics). We plan to record data sets in carrier sentences similar to those of Benus & Gafos (2007), making sure that the consonantal and prosodic context of the target vowels is as similar as possible.

In addition, we will examine the acoustic properties of neutral vowels in vacillating stems. Since these stems show a great deal of inter-speaker variation, each subject will be tested with a questionnaire determining the acceptability of the test words with front and back suffixes prior to recording. The prediction is that the neutral vowels in these words will be pronounced more back when taking a back suffix, and front with a front suffix. We also plan to test the unsuffixed forms of these words to see whether they line up with the back-suffixed or the front-suffixed forms, or whether they display a different type of behaviour altogether.

2.3.2 Perceptual study

In this study, we plan to use the recordings from the acoustic experiment in case it shows significant differences between the production of vowels in anti-harmonic and/or vacillating stems and control stems. In case the recordings do not show significant differences, the target words will be modified to measure the smallest difference along the front/back dimension that the subjects reliably perceive.

Subjects will be asked to judge target words as acceptable, marginally acceptable or unacceptable. The test set will include all combinations of stem vowels and suffixes (stem with a

slightly back neutral vowel+back suffix, stem with a front neutral vowel+back suffix, stem with a slightly back neutral vowel+front suffix, stem with a slightly front vowel+front suffix) from both the anti-harmonic and the vacillating group, as well as control words with front vowels and (modified) slightly back neutral vowels.

3 Perspectives

3.1 Relevance to society

Linguistic prescriptivism is strongly present in Central Europe, with speakers of non-standard varieties being heavily stigmatised. Furthermore, the Hungarian minority in Slovakia has been under continuous attacks on their identity and language, the present government being especially vigorous in their attempts to constrain the use of minority languages. Thus, the Hungarian dialects of Slovakia are regarded sub-standard (even incorrect) by both standard Hungarian and Slovak speakers.

We believe that scientific study of a minority dialect can help elevate their status and strengthen the identity of its speakers.

3.2 Ethical aspects

The anonymity of subjects participating in the experiments will be respected throughout the processing and dissemination of the results.

4 Dissemination plan

The results of the project will be relevant to both phonologists and phoneticians, especially for researchers working on the interface of these two linguistic subsystems. Additionally, researchers in cognitive science and psychology are also part of the target audience of the project.

Accordingly, the target journals for disseminating the projects results are phonology journals such as *Phonology*, phonetics journals like *The Phonetician* and *Journal of Phonetics*, as well as theoretical linguistics journals including *Linguistic Inquiry* and *Lingua*.

The ultimate goal of the project is to investigate the interaction of phonology, articulation, acoustics and perception. However, the results of the experiments targeting each of these sub-components are presentable on their own. Thus, dissemination of the results can start as early as the second semester of the project, and continue throughout its duration.

Conferences are the prime venues for communicating early results and getting valuable feedback from the international research community. The meetings we are targeting during this project are the Manchester Phonology Meeting (mfm), the Old World Conference in Phonology (OCP), the North American Phonology Conference (NAPhC), the West Coast Conference on Formal Linguistics (WCCFL), the annual Laboratory Phonology conference (LabPhon), the conference of Generative Linguistics in the Old World (GLOW), and the biannual International Conference on the Structure of Hungarian (ICSH).

Beside the linguistic community, potential differences between the perception and production of speech are an excellent topic for popular science articles. We hope to make some of the results of the project accessible in this way in both English and Hungarian.

Furthermore, since there is relatively little comprehensive data (spanning acoustics, perception and phonological analysis) on Hungarian, especially its minority varieties, the data gathered during this project can serve as a basis for further research on the phonetics and phonology of Hungarian.

Finally, the planned dialectal comparison opens the way for further cooperation with the field of sociolinguistics, as well as minority education and language policy.

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