The Phonetics and Phonology of Fricative Non-Neutralization in Turkish

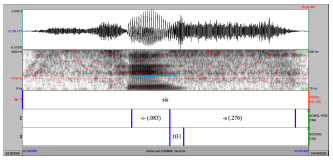
This paper reports on the results of an experiment designed to test the different predictions made by two phonological analyses of Turkish fricative devoicing. The voicing neutralization of stops in word–final positions has led authors to posit different accounts for this process of neutralization. Based on the results of an experimental study indicating that stops undergo complete neutralization in word–final positions, Kopkallı (1993) concluded that this process can be generalized to one of devoicing in all word–final positions. On the other hand, subsequent phonological analyses (Avery 1999, Petrova et al, 2006, Kallestinova, 2004) propose that Turkish stops should be analyzed as having underlying representations specified for both the [voice] and [spread glottis] features. Under this analysis, the three–way voicing contrast in Turkish can be analyzed as aspirated voiceless stops ([+sg, -voice]), voiced stops ([+voice]) and alternating stops ([-sg, -voice]). Thus, what seems to be final devoicing should in fact be analyzed in terms of intervocalic voicing ([-sg] → [+voice] / V_V) and final fortition ([-voice] → [+sg] / _#) (Iverson & Salmons, 2007), with examples given in 1:

(1)

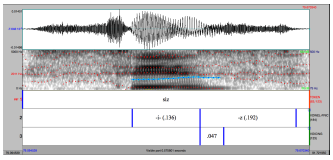
TYPE OF STOP	BARE STEM	POSSESSIVE	GLOSS
/[+sg, -voice]/	at^h (*no change*)	at^h-i (*no change*)	'horse'
/[+voice]/	ad (*no change*)	ad-i (*no change*)	'name'
/[-sg, -voice]/	t^{h}at^h (*final fortition*)	t^{h}ad-i (*intervocalic voicing*)	'taste'

Nouns such as *ad* 'horse', often classified as exceptions to final devoicing, can instead be understood as falling outside of the structural description of the rule, since they are inherently [+voice]–final (Inkelas 1995, Avery 1999). [+voice]–final nouns never alternate, and [+sg]–final nouns never alternate. Given the analysis of Turkish stops' three-way contrast as [+sg], [+voice], and unmarked, the question arises about what phonological contrast fricatives show. Beckman, Jessen & Ringen (2009) argue that the two–way fricative contrasts in Turkish can be set up as [+sg] (fortis) and [+voice] (lenis), based on Vaux (1998)'s typological evidence for a laryngeal specification of fricatives which requires a [+sg] node for all voiceless fricatives in certain languages. If this prediction is correct, then there should be no laryngeal neutralization among the fricatives: voiced fricatives should not neutralize in coda position in Turkish. The present study offers phonetic evidence that Turkish maintains the /s/∼/z/ contrast in all environments, replicating the methodology of Kopkallı (1993), who did in fact find neutralization for the stops.

8 native speakers of Standard Turkish were recorded in a sound–proof room. The subjects were asked to read lists of words which contained 60 target items and 60 fillers, all high–frequency words in Turkish. The target items consisted of 30 voiced–voiceless minimal pairs ending in a fricative consonant ({f,v}, {s,z}, {ʃ,ʒ}), all native sounds of Turkish (eg. *has* 'special' vs. *haz* 'joy'). The lists were randomized 4 times, with half presented in isolation and half embedded in a carrier sentence; in one presentation the segment following the target word started with a vowel and in the other with a voiceless stop. The tokens were analyzed using Praat. Cho & Giavazzi (2008) show evidence that surrounding vowels and fricative duration provide important cues to voicing distinction in fricatives. Based on these observations, we recorded 3 temporal measurements as illustrated in Figure 1: vowel duration, frication duration and voicing into frication.



(a) /sis/



(b) /siz/

Figure 1: Segmentation of waveform and spectrographic representation.

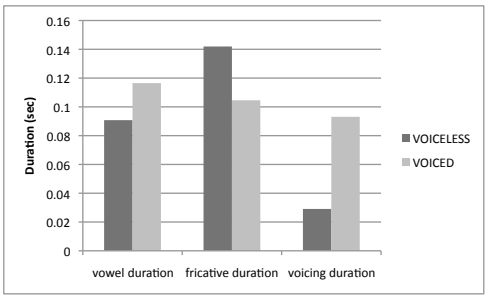
The results indicate that Turkish speakers do not neutralize voiced fricatives in word–final positions. Mixed–effects regression models (with random effects for subject and item) were fitted to each of the 3 measurements.

Underlyingly voiced fricatives came out highly significantly different from underlyingly voiceless fricatives on all 3 measures as shown in 2.

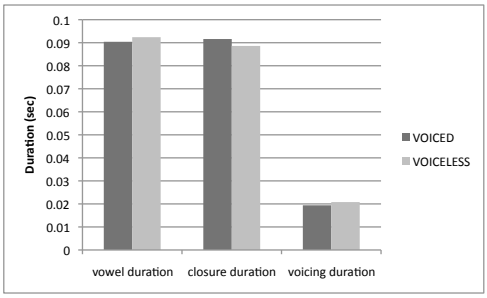
(2)

	β	t-value	p(MCMC)<0.05
Vowel.Dur	0.0302	6.440	0.0001
Fric.Dur	0.0431	16.06	0.0001
Voice.Perc	37.019	15.381	0.0001

Figure 2a illustrates the difference between the temporal parameters with respect to the voicing of the fricative; in Figure 2b we reproduce Kopkallı's results illustrating the neutralization of stops. We also looked at voicing percentages (voicing dur./fricative dur.), and found an average of 89% voicing for underlyingly voiced fricatives, and 20% voicing for voiceless fricatives. The mixed linear model showed a significant effect for this parameter between the voiced and voiceless conditions. A closer look at the two–way interaction between voicing and environment with respect to voicing percentages also shows that the effect of voicing was independently significant in each of the 3 environment conditions, supporting the conclusion that voicing does not neutralize in word–final positions.



(a) Voiced vs. Voiceless fricatives



(b) Voiced vs. Devoiced stops (Kopkallı (1993: 95))

Figure 2: Temporal Parameters

In summary, we employed the same methodology as Kopkallı (1993) – who found full neutralization for the stops – and found a lack of neutralization for the fricatives. The consequences of the phonetic findings for phonological representations are that fricatives are either [+sg] or they are [+voice] in Turkish, and hence cannot undergo rules of either intervocalic voicing or final fortition. The finding that Turkish stops and fricatives pattern differently with respect to laryngeal neutralization, then, forms part of a growing consensus that "final devoicing" cannot be represented in terms of [±voice] alone, and that two–way oppositions among fricatives may not even be based on opposite values of a single feature (cf. also Beckman, Jessen & Ringen, 2009).

References

Avery P. (1996) The Representation of Voicing Contrasts. PhD Thesis, University of Toronto.

Beckman J., Jessen M., Ringen C. (2009) German Fricatives: Coda Devoicing or Positional Faithfulness? *Phonology*, to appear.

Cho H., Giavazzi M. (2008) Perception of Voicing in Fricatives. Proceedings of the 18th International Congress of Linguists.

Iverson, G., Salmons, J. (2007) Domains and Directionality in the Evolution of German Final Neutralization. *Phonology* 24: 1-25.

Kallestinova E. (2004) Voice and Aspiration of Stops in Turkish. *Folia Linguistica* 38: 117-143.

Kopkallı H. (1993) A Phonetic and Phonological Analysis of Final Devoicing in Turkish.' PhD Thesis, University of Michigan.

Petrova O., Plapp R., Ringen C., Szentgyörgyi (2006) Voice and Aspiration: Evidence from Russian, Hungarian, German, Swedish, and Turkish. *The Linguistic Review* 23: 135.

Vaux B. (1998) The Laryngeal Specification of Fricatives. *Linguistic Inquiry* 29: 497-511.