

## **Study of incomplete voicing neutralisation in production and perception in Shughni and its methodological implications**

Yury Makarov

*University of Cambridge (United Kingdom), Institute of Linguistics, RAS (Russia)*

Languages differ in what set of acoustic correlates is associated with the production and perception of consonant voicing. For example, preceding vowel duration in English is claimed to be an acoustic cue for voicing in utterance-final obstruents [1]. On the other hand, it was shown not to be the case for monolingual speakers of Russian, who produce significant differences only in durations of closure/frication and release [2].

Although research into final laryngeal neutralisation has yielded significant results in terms of possible scenarios of neutralisation and acoustic correlates of voicing [3], there are still problems to be addressed. Firstly, the majority of data discussed in the literature concerns major European languages such as English or German. While these languages are of course worth studying, the typological investigation of laryngeal features would benefit from bringing data from lesser-resourced languages, potentially exploiting different means of signalling underlying laryngeal features. Secondly, some studies, e.g. [2], do not clearly distinguish between the significance of some acoustic event in production and perception. Nevertheless, it is well known that the former does not necessarily result in the latter. For instance, in German, unlike in English, differences in preceding vowel duration are significant only in production [4]. The proposed study aims to deal with these issues by describing final laryngeal neutralisation in Shughni, a minor language of Pamir, as well as suggesting a methodology for investigating this process in both production and perception.

Shughni is an Iranian language spoken by ca. 100,000 people in the Pamir Mountains. Its final obstruents are usually devoiced utterance-finally, though the neutralisation appears to be incomplete to the ear of a non-native speaker (especially in plosives due to aspiration, see below). The main correlates of final voicing in Shughni obstruents are preceding vowel duration and closure/frication voicing as well as final aspiration duration and intensity in plosives [5].<sup>1</sup> The role of these acoustic features in perception, though, remains uncertain. To bridge this gap, a series of perception experiments involving a digital questionnaire was carried out [6]. The questionnaire was a web<sup>2</sup> page with tasks requiring the subjects (20 speakers of Shughni) to listen to an audio recording and choose the meaning associated with the pronounced stimulus. The answer and response time were recorded. The stimuli included naturally pronounced Shughni lexemes that had a minimal pair and their modified versions, ending in dental plosives and alveolar fricatives (e.g., *kot* 'short', cf. *kod* 'dog'). The modification (always one at a time) made a particular acoustic feature, typologically associated with voicing (either vowel/closure/frication/aspiration duration or aspiration intensity or closure/frication voicing, etc.), prominent in comparison to the unmodified pronunciation. The tasks consisted of part I, where the stimuli and fillers were played in isolation, and part II, involving the modified and unmodified versions played successively in one stimulus; in part II, subjects were to choose the meaning associated with the word they heard first.

In the talk, the methodology and results of these perception experiments will be discussed with a particular focus on the connections between acoustic feature prominence in production and perception. Preliminary analysis suggests that, despite clear differences in production and apparent ease of perception, final aspiration seems not to aid in the perception of voicing in final plosives in Shughni. On the other hand, other cues such as vowel duration and closure/frication voicing play a significant role in perception. It is likely that acoustic cues can have different weight and the correct perception of phonological voicing depends on their interaction.

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<sup>1</sup> There may be other cues; a more detailed account of acoustic cues to voicing in Shughni is currently prepared.

<sup>2</sup> The experiment, however, was held in person; I controlled the way participants listened to the recordings and chose the answers to reduce the influence of extralinguistic factors.

## References

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