

**Research Project financed in the OPUS programme
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**Topic: Acoustic properties of Polish geminate
consonants**

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1. Research project objectives/Research hypothesis

The objective of the project is investigating acoustic properties of consonant geminates in Polish. Geminates are an interesting phonetic/acoustic phenomenon, because the assumption that it is simply rearticulation of the same consonant, as suggested by orthographic representations, is not confirmed by auditory impressions. In fact, in casual speech the majority of geminates (e.g. *panna*) are produced with one articulatory gesture, similar to singletons (*pana*). Despite this articulatory simplification, listeners are exceptionally successful in identifying between minimal pairs such as *panna* and *pana*. Previous research with other geminating languages has shown that geminate consonants are characterized by multiple acoustic properties that are attended to by listeners in perception, such as duration of geminates, duration of neighbouring sounds, amplitude, Root Mean Square (RMS), release burst, fundamental frequency, or quality of neighbouring sounds. Compared to other languages, Polish is largely underresearched and little is known about how Polish geminates are similar or different relative to other languages. Therefore, the purpose of this project is as follows:

1. record a representative sample of Polish geminates in different speech modes (word list, sentences, careful speech, casual speech)
2. analyse the acoustic properties known from other languages
3. test these properties in perception experiments with speakers of Polish to see which, and to what extent, they are attended to in perception
4. prepare a recorded database POLGEM of annotated Polish geminates for other researchers

2. Research project methodology

We will record Polish geminates in isolation and in sentences in different speech modes from Polish native speakers. The materials will be 3 types of geminates: morpheme-internal (*ssak*), across-morpheme (*bezsens*), and across the word boundary (*nas samych*). The recordings will be analysed acoustically using the properties reported in the literature for other languages. Different properties will be used for different groups of consonants (e.g., stops, nasals, liquids, affricates). Next, the properties which appear to be statistically the most robust will be

used in perception experiments. We will use minimal pairs and nonwords with acoustically manipulated properties to test the listeners' sensitivity to the selected acoustic properties. The perceptual tasks will be identification (choose the word you hear) and discrimination (say if the words are same or different). Perception will be tested in optimal conditions (in quiet) and in adverse conditions (different levels of masking noise) to reflect perception in different types of communication environment. Finally, the recordings will be edited and annotated with textgrids in Praat and made available as a recorded database POLGEM for other researchers and other projects.

3. Expected impact of the research project on the development of science

The results will contribute to the discussion in the phonetic/acoustic literature on acoustic features of geminates in speech production and perception. This is the first study that investigates comprehensively Polish geminates using detailed acoustic measurements and perception tests. The results may be interpreted theoretically in phonetic descriptions of the Polish sound system. They may also be practically applied in automatic speech recognition systems as well as in methods of automatic transcription of large corpora in Polish. The annotated database of Polish geminates will be popularized at the national and international forum among phoneticians and speech scientists, and made available for future studies.

