Polish Stress: A Phonetic Investigation of Phonological Claims

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***Introduction*.** We present an acoustic study suggesting that Polish lacks rhythmic secondary stress, contrary to widely accepted formal descriptions. This finding challenges the existence of the rare bidirectional stress system with internal lapses, of which Polish is a crucial example. This paper carries implications for the typology of stress systems, suggesting that it should only include the attested bidirectional system with internal clashes.

Polish stress. Polish is a classic case of the bidirectional system with internal lapses (McCarthy & Prince 1993, Kager 2001, McCarthy 2003). In this system, primary and secondary stresses are assigned from opposite word edges, and a single lapse arises adjacent to main stress in odd-parity words. Hence, six- and seven-syllable words are parsed as in (1a) (Polish, Piro, Lenakel), or (1b) (Garawa). The non-initial, rhythmic stresses are often treated as tertiary.

(1) (a) [(σ̀σ)(σ̀σ)(σ́σ)]; [(σ̀σ)(σ̀σ)σ(σ́σ)] (b) [(σ́σ)(σ̀σ)(σ̀σ)]; [(σ́σ)σ(σ̀σ)(σ̀σ)]

(1) is typologically rare (Gordon 2002), and the few cases that do exist have often been challenged (Hyde 2008). Polish is the only uncontested case, with (1a) reported to apply with few lexical or morphological restrictions (Rubach & Booij 1985, Kraska-Szlenk 2003). Yet, (1a) was posited for Polish based on impressionistic evidence and without support from stress-sensitive processes (Dłuska 1957, Dłuska 1974). Further, (1a) has not been acoustically verified. Previous production studies of Polish either ignored secondary stress (e.g. Jassem 1962, Łukaszewicz & Rozborski 2008), or failed to find evidence for it, possibly due to limited data (Dogil & Williams 1999). A perception study has found Polish listeners to be remarkably inconsistent in the identification and localization of secondary stress (Steffen-Batogowa 2000).

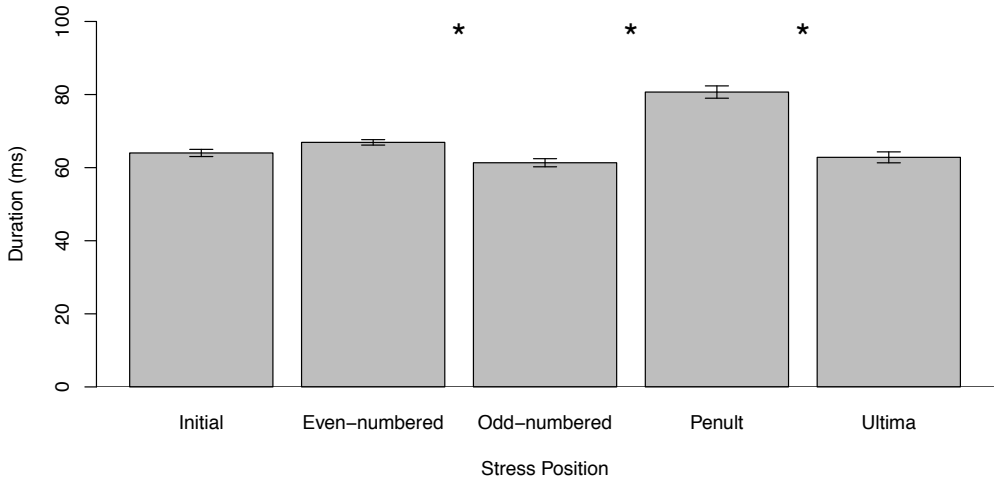
Acoustic study. We investigate the prominence of different syllable positions to verify the presence of the pattern in (1a). Ten native speakers of Polish, male and female, read a word list in slow, careful speech. The list contained 100 morphologically simple words. As all words were at least four syllables long, traditional accounts would expect them to exhibit main stress on the penult and secondary stress on the initial (e.g. ***bà*na*nɔ́*vi** 'banana.adj.'). Words at least six syllables long were additionally predicted to show tertiary stress (e.g. *bàna**lì**zɔváɲe* 'trivialization'). We labeled syllables based on their position within words, corresponding to an expected level of stress: penultimate (primary), initial (secondary), odd-numbered (tertiary), even-numbered (unstressed), and ultima (unstressed). Ultimas were treated separately because they show boundary-related lengthening (Oller 1973).

12,289 vowels were measured in Praat across parameters known to correlate with stress cross-linguistically and in Polish: maximum intensity, maximum pitch, pitch change and duration (Jassem 1962, Dogil & Williams 1999, Łukaszewicz & Rozborski 2008). Pitch values, converted to semitones (Nolan 2003), were analyzed separately for men and women. A series of repeated-measures ANOVAs and subsequent Tukey tests was conducted to test whether purportedly stressed syllables were more prominent than purportedly unstressed ones.

Results. The analysis of the parameters did not confirm the pattern in (1a). Regardless of length, all words exhibit penultimate stress and seem to lack lower levels of stress (*bana**nɔ́**vi, banalizɔ**vá**ɲe*). Main stress is found to employ multiple cues: statistical tests yield significant effects for the penult on all four acoustic variables (all $p<.001$), including vowel duration, which is a novel finding for Polish (see 2). By contrast, syllables traditionally described as bearing secondary or tertiary stress do not show prominence on any variable. Initials do correlate with increased maximum pitch and maximum intensity, but this is expected due to F0 and intensity declination over utterances (Bolinger 1964, Cohen & 't Hart 1967, Trouvain et al. 1998). This correlation can explain why secondary stress was misperceived on the initial syllable in impressionistic studies.

Conclusions. The stress parameters considered in this paper provide no evidence of (1a) in Polish. In discussion, we address other potential cues to secondary stress in Polish, both acoustic and articulatory. We highlight the contested nature of the data on the remaining few languages supposedly exhibiting the system in (1), and challenge its existence.

(2) Mean duration values



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