Poetic rhythm is a matter of predictability.

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What creates an impression of poetic rhythm? In this paper we compare prose and children's poetry in five languages: English, Russian, Greek, French and Mandarin.

At the phonological level, these languages have diverse metrical properties. English, Greek and Russian have lexical stress, and poetic meters are generally defined in terms of the metrical foot. French has phrase-final stress while the status of lexical stress is in dispute. Mandarin has lexical tone instead of lexical stress, and traditional poetic meters are defined by patterns of tonal alternation. Other properties of poetry such as rhyming also differ.

Does it mean that acoustic correlates of rhythmicity also differ between languages? To answer this, we performed a large-scale phonetic analysis of prose vs. poetry. Our corpus consisted of 42 paragraphs and 4 poems read in each of the five languages by 10 readers; poems consisting of 8-12 lines. These are children's poems that can be read rhythmically; reading instructions were identical for all texts.

We automatically segmented speech into **C** (consonantal), **V** (vowel-like) and **S** (silence/pause) segments. Once the segment boundaries were defined, eight acoustic properties were computed for each segment. We then computed 2214 linear regressions for each language. Each predicted one of the properties for either **C** or **V** under different options: different amounts of context (the preceding/surrounding/following 0 to 8 segments), line initial/medial/final positions, and mapping sonorant sounds onto either **C** or **V**.

We found that in all five languages acoustic properties of segments in poetry could be predicted better than prose, often dramatically so. Pearson's r^2 for the linear regressions involving prose averaged 0.17, and 99% of them were smaller than 0.4: overall, the predictability of prose was unimpressive. (Pearson's r^2 is a standard measure of the success of a prediction: 0 means the prediction was ineffective, 1 means perfect prediction.) In contrast nearly 50% of the poetry regressions yielded Pearson's r^2 greater than 0.4, and 10% gave $r^2>0.8$, and were therefore able to predict the corresponding acoustic property very precisely.

We also observed a dramatic difference in the range of prediction. For prose, Pearson's r^2 increased as information from 0, 1, and 2 segments were used in the prediction, but adding more context information didn't improve r^2 any further. For poetry, on the other hand, r^2 continued to increase all the way up to 8 segments of context. This means that acoustic properties of a segment are correlated with those at least 3 or 4 syllables away: poetry exhibits much longer range correlations than prose.

So, at an abstract, linguistic level, one would hardly expect to find much similarity between poetry in these languages. In particular, it would be difficult to write a set of cross-linguistic rules that would reliably separate prose from poetry based on phonological transcription. However, the phonetic similarities are dramatic. We find that repeated, predictable acoustic properties are common to the poetic forms, and suggest that the acoustic view of children's poetry may give a simpler, more universal view than the classical linguistic analysis.