A Source-Filter Model for Generative Metrics

The goal of generative metrics (Halle and Keyser 1971, Kiparsky 1975, Hayes and MacEachern 1996, Friedberg 1997, *inter alia*) is to provide principled accounts of the structure of verse within the framework of generative linguistics. Most simply construed, this means defining what makes a line of verse metrical or unmetrical. However, all metrical lines are not treated equally by poets' grammars. Generative metrics is thus faced with the subtler problem of accounting for why some well-formed lines occur more frequently than others.

This paper addresses that question with particular reference to patterns of stress omission in Russian iambic tetrameter. Studies of Russian meter have long noted the fact that deviations from the iambic template consist primarily in placing phonologically unstressed syllables in metrically strong positions. Of the sixteen logically possible realizations of the four strong positions in a line of tetrameter, six are robustly attested in Russian verse of the eighteenth and nineteenth centuries: SSSS, SSWS, SWSS, WSWS, WSSS, and SWWS. (SSSS represents perfect conformity to the iambic template; the others represent stress omissions on one or two feet.) Taranovsky (1980) reports the following distribution of line types in eighteenth-century verse: SSSS 31.1%; SSWS 41.9%; SWSS 18.7%; WSWS 3.4%; WSSS 3.4%; SWWS 1.5%.

This paper proposes a model of metrics analogous to the source-filter model of phonation and articulation, in which the shape of the vocal tract filters the sound wave produced by the vocal folds, reinforcing some frequencies and dampening others. The source in this case is the ordinary prosody of the Russian language; the filter is a metrical grammar of categorically ranked OT constraints. A finite set of candidate lines is generated randomly based on each line type's chance of occurring naturally in prose, and the constraints select the optimal candidate from this set. Mathematically, the procedure is similar to rolling a six-sided die a certain number of times and selecting the highest number rolled. Here, the die is weighted by the prosody of Russian prose, and the metrical grammar determines which line types are to be preferred.

Consider for example a grammar with the following constraints from Friedberg (2001): NoLapse penalizes stress omission on consecutive feet; Align penalizes stress omission on the leftmost foot; Sym requires the two hemistichs of a line to have the same number of stresses; and HemSal requires the second foot of a hemistich to be stronger than the first. The ranking NoLapse > Align > Sym > HemSal yields the following hierarchy of line types: SSSS > SSWS > SWSS > WSWS > WSSS > SWWS. The chances of each line type occurring in fortuitous sequences of tetrameter in Russian prose are as follows: SSSS 12.1%; SSWS 21.4%; SWSS 22.4%; WSWS 19.6%; WSSS 10.3%; SWWS 14.1% (based on Friedberg 2001). Suppose we randomly generate three candidate lines based on these probabilities, and use the grammar to select the best of the three. This procedure yields SSSS 32.1% of the time; SSWS 38.6%; SWSS 20.8%; WSWS 7.1%; WSSS 1.2%; SWWS 0.3%.

The Russian language is the source of variation; the metrical grammar is a filter that reinforces preferred line types and dampens dispreferred ones. The constraint ranking can thus express formal ideals that are imperfectly realized in actual verse. In the example above, the grammar prefers SSSS over all other options. However, SSSS is sufficiently infrequent in the input probabilities (because Russian has many polysyllabic words and no secondary stress) that the model correctly predicts it to occur less frequently than SSWS. The independence of the source and the filter permits the latter to make the obvious generalization that the ideal line of tetrameter has four stresses without making wrong predictions about actual frequencies.

More generally, the source-filter model is conceptually attractive because it enables a categorical grammar to make predictions about non-categorical phenomena. On one hand, this is in contrast to Friedberg (1997), in which OT constraints generate hierarchies of line types, but make no prediction about how much more often a preferred type will occur. On the other hand, the present proposal also differs from the approaches of Anttila (1995) and Boersma and Hayes (1999), in which constraint rankings themselves are stochastic. Anttila uses crucially unranked constraints to account for statistical patterns in Finnish allomorphic variation; Boersma and Hayes use non-categorical rankings in which constraints can overlap. Unlike the present proposal, each of these approaches represents a departure from the standard OT of Prince and Smolensky (1993) that drastically increases the generative power of constraint-based grammars.

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