

Crosslinguistic differences in the mapping of prominence between music and language

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One connection between musical and linguistic mental representations is the concordance of prominence patterns: When words and melody are brought together in music, phonetically stressed syllables strongly tend to fall on the strong beats of the musical meter (*STRESS-METER ALIGNMENT*, SMA), a well-known textsetting principle that also shows facilitatory effects in perception and memory [1]. Significant levels of SMA have been shown not only for languages like English, where stress is lexical [2], but also French, where word stress is controversial [3]. Despite vast typological variation across word-prosodic systems, the generalizability of SMA to other languages is lacking. Furthermore, languages realize acoustic prominence also by cues like increased duration and pitch, which may be shunted to musical notes as longer duration and higher notes. The extent to which languages exhibit these mappings, i.e. *STRESS-DURATION ALIGNMENT* (SDA) and *STRESS-PEAK ALIGNMENT* (SPA), also remains significantly understudied.

To develop a typological model of prominence pattern concordances between music and language, we asked (a) whether prosody-music alignment is generalizable to other languages, and (b) whether there is a correspondence between the weight of linguistic cues to prominence and the type of alignment found in the respective languages. We compared music-prosody alignment in lexical and predictable stress languages and compiled a database of children's songs in Russian (lexical) and Eastern Armenian (predictable final). The metrical value of each syllable was operationalized by assigning well-established musical prominence values to the syllable corresponding to each beat (Fig1). The melodic peak value of each syllable was calculated by adding up relative pitch in comparison to the preceding and following syllable (Fig2), also done for durational peak value. The degree of alignment for each of these values was computed by subtracting the mean of unstressed from the mean of stressed syllables only when they showed significant differences. These values are called *stress-meter alignment* (SMAV), *stress-peak alignment* (SPAV), and *stress-duration alignment value* (SDAV) respectively. To reach broader and gradient generalizations, these were compared to the raw data from [4] that investigated English (lexical) and Turkish (regular word-final stress).

Inferential statistics show that, in English, stress significantly aligns with meter (SMAV = 1.518) as expected [2] and duration (SDAV=0.776), but not melody. Russian, expected to pattern with English, exhibited significant alignment in not only meter (SMAV=1.586) and duration (SDAV=0.792) but also melody (SPAV=0.723). In addition to SMAV (0.53) and SPAV (0.988) [4], Turkish stress also aligned with duration (SDAV=1.419). Despite its similarity to Turkish, Armenian stress aligned only with duration (SDAV=0.736), but not with meter or melody.

Our findings reveal that the type and degree of alignment show crosslinguistic variation, not always accountable by notions like contrast and predictability. Instead, we propose an all-embracing typological model that takes into account not only phonetic, structural and syntagmatic properties of prominence but also its functional concomitants for cognitive processes. Our model thus complements previous approaches in showing that languages exhibit the parameters constitutive of prosodic prominence in variable degrees commensurate with their utility in a cognitive domain similar to but outside language.

Figure 1: Prominence values in 4/4 meter

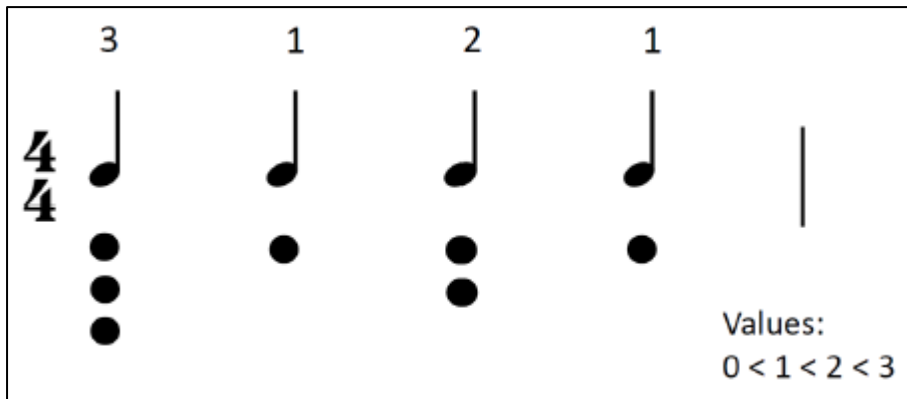
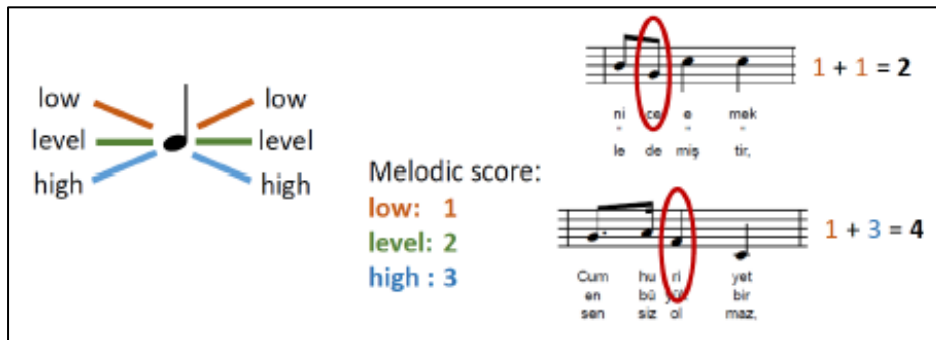


Figure 2: Melodic peak score



[1] Temperley, D. (2022). Music and language. *Annual Review of Linguistics*, 8:1. <http://dx.doi.org/10.1146/annurev-linguistics-031220-121126>

[2] Palmer, C. and M. H. Kelly (1992). Linguistic prosody and musical meter in song. *Journal of Memory and Language*, 31:4. 525-542.

[3] Temperley, N. and D. Temperley (2013). Stress-meter alignment in French vocal music. *J. Acoust. Soc. Am*, 134: 1. 520-527.

[4] Domene Moreno, C. and B. Kabak (to appear). Meter, melody, and stress in song: Theorizing prosody-music alignment through cross-linguistic evidence. In: M. Scharinger and R. Wiese (eds.), *How Language Speaks to Music: Prosody from a Cross-domain Perspective*. DeGruyter.