Navigation in Tonal Chronotope: Unification of Artistic Space in Music

For a professional musician, one of the most fascinating aspects of music is the quasi-spatial properties of tonal space and structures. Melodic structures are shaped within tonal space which is defined by a scale (tonal system of reference). It was the introduction of systematically tempered scale that allowed for re-orientation of a tonal system of reference from one tonal center to another within same musical composition. The reorientation, or tonal modulation, is the principal tool of thematic development in the European musical tradition, without which the creation of complex musical architectonics of the last four centuries would not be possible.

Musical practice shows that some modulations are more popular than others and that some modulations produce strong emotional effects. In my doctoral study, I explored affective responses to degree of modulation by asking the participants to indicate intensity of their response to each stimulus on six bipolar adjective scales related to valence, synaesthesia, potency, and tension. The first experiment examined affective responses to all twelve major and minor keys of the Western tonal schema with 48 harmonic progressions. The second experiment was focused on modulations to the close dominant and subdominant steps and to the distant descending major and used two balanced sets of stimuli: one set comprising 24 short harmonic progressions, quite similar and musically impoverished, and another set of 24 fragments from the piano compositions from the 18^{th} -19^{th} century music. All stimuli in the second experiment were in a major mode. This allowed to satisfy one of the main tenets of tonal harmony—the major mode of a final tonic triad in a modulation to a dominant step (Schoenberg, 1954).

There were several important results in this study. For example, it was found that degree of modulation, as a powerful expressive aspect, can compete with tempo, register, texture, and musical style. However, the most important results were related to the theory of tonal space.

Namely, the study identified factors which cause "folding" of tonal space (Lerdahl, 2001) during modulation to a distant tonality. An analysis of the responses allowed to categorize modulations to the distant tonalities into two groups—"pleasant surprise" and "unpleasant surprise." Each tonality in the "pleasant surprise" category had at least one of the two properties: (i) either its tonic triad included a tonic from the beginning tonality, for instance, in modulations to a descending major third (as in a modulation from C-major to A-flat-major), or (ii) the final tonic triad was a semitone shift from the beginning tonal triad, for instance, in Neapolitan (as in a modulation from C-major to D-flat-major). The latter result demonstrated the importance of approaching semitones in some popular deceptive cadences. (Another "folding" factor was related to a mode-defining third). What made the study really interesting was the fact that the listeners were presented with smooth modulations only (as compared to the interrupted cadence). In other words, the listeners sensed the different qualities of the modulations even when the beginning tonic triad and the final tonic triad were spaced in time.

Though this research in affective responses to tonal modulation (original study) belongs to music theory (Shencker, 1906/1954; Schoenberg, 1954; Lerdahl, 2001) and music perception, its hypotheses and theoretical foundations were influenced by the research in the aesthetics of music (Langer, 1941; Scruton, 1997) and art (D'Arcy, 1917; Ghyka, 1946). The dissertation was particularly affected by the works of Pavel Florensky and Erwin Panofsky. The latter's seminal study "Perspective as Symbolic Form" has the vital importance for the understanding of purposes and tradeoffs of a tempered scale in European music.

Both linear perspective and Equal Temperament produced the "unification of artistic space," both rationalized this space (via mathematics), and both introduced "psychophysiological

deviations" to the artistic space. Today, the world is immersed in triadic harmony. This means that today, while listening to music, we generally hear a mistuned scale.

The rationalization and systematic alteration of artistic space in art and music were not a whimsy or an accident, but a reflection of the "mental sets of a given milieu" (Florensky, 1920). And while the sensitivity of visual artistic space to the universal ideas was carefully examined (Panofsky, 1927; Francastel, 1967; Veltman, 1971/1987), music's responsiveness to the "mental sets," though also investigated (Cooke, 1959; Taruskin, 1997), was not analyzed in a context of the evolution of a perceptual schema. Moreover, there has not been an examination of the conceptual similarities between linear perspective and Equal Temperament. This project aims to conduct such examination.

The introduction of a tempered scale was a response to profound changes in melodic thinking. In a Baroque fugue, we follow a melodic shape and its transformation in a triadic space. In the *Sonata Allegro* form, we sense complex architectonics as a balance of structural units and as an interaction of contrasting melodic characters. These musical forms are unthinkable without tonal modulation. Away from canonical explanation of music theory, the multidisciplinary scholarship brings forth the new and important evidence obtained in an empirical study of tonal modulation, this sophisticated aspect of melodic thinking and orientation in tonal space. The comparison of tempered melodic space and linear perspective translates a scientific inquiry in the psychophysics of tonal space into a language of musical practice and visual imagery. This comparison offers us the visual "tangibles" to illustrate music's sensitivity to a cultural context.