
Book Review

Reviving the lost science of well-tempered tuning

by John Sigerson

Tuning: Containing the Perfection of Eighteenth-Century Temperament, the Lost Art of Nineteenth-Century Temperament, and the Science of Equal Temperament, Complete with Instructions for Aural and Electronic Tuning

by Owen H. Jorgenson

Michigan State University Press, East Lansing, 1991

798 pages, hardbound \$65

Owen Jorgenson, an expert on piano technology who teaches at Michigan State University, has turned his lifelong preoccupation with musical tunings other than modern equal temperament, into a comprehensive, hands-on manual for enabling teachers and students of piano tuning to begin to break the "tyranny of equal temperament" which has prevailed over the past century, and to reconstruct the tuning systems which were required by the great composers of classical polyphony. The manual is chiefly aimed at professionals, containing practical instructions on 120 different methods of tuning keyboard instruments by methods ranging from variants on the ancient Pythagorean tuning, through meantone and well-tempered tuning, all the way to equal temperament. However, the interspersed brief discussions and short essays are also strewn with gems of historical observations which are of great use to all those who are striving today to rescue civilization from its current cultural morass through reviving the principles of classical polyphony based on the bel canto vocalization of classical poetry.

A few comments are necessary in order to situate the issue of equal temperament versus well temperament for those not familiar with the technical details: Up until the middle of the 19th century, the current of Christian-Platonic scientific inquiry ranging from Plato through Nicolaus of Cusa, Leonardo da Vinci, Johannes Kepler, and Gottfried Leibniz, and

including J.S. Bach, viewed the apparent anomalies which always cropped up in the attempt to construct a usable musical scale, as yet another demonstration of what has come to be termed the "curvature of space-time." More specifically, the attempt to construct a musical scale solely by algebraic ratios of the simple counting numbers (1:2, 2:3, 3:4 and so forth) always had the result that certain intervals of that scale would sound so harshly "out of tune" that they were unusable for musical performance. The musical scale was therefore assumed to reflect some higher ordering process, which could perhaps be approximated by some more complex ordering of rational numbers, or perhaps by other numbers whose cardinality was determined in a different way, closer to the way a living process works. According to this outlook, the practical construction of the musical scale can be refined in successive steps, as that natural ordering process is discovered with decreasing degrees of imperfection.

Johannes Kepler made a profound discovery in this regard, when he demonstrated that the configuration of the planetary orbits of our Solar System is congruent with the ordering of the musical scale. Leibniz's development of the concept of "least action" on the basis of Nicolaus of Cusa's work, provided the context for the circles around J.S. Bach to devise systems of tempering which lawfully determined and yet contained no wildly out-of-tune "wolf" intervals. Subsequently, Kepler's finding about the universality of the well-tempered system was resoundingly confirmed in the early 19th century by Carl Friedrich Gauss, who found that the newly discovered asteroid belt precisely fit Kepler's specifications for a "missing planet" at the position represented by the note F-sharp. More recently, in 1985 Lyndon LaRouche demonstrated that the location of the primary natural register shift of the bel canto singing voice, which lies between F and F-sharp, uniquely locates the absolute values of the well-tempered scale such that middle C must be located at or very near to 256 cycles per second.

The well-tempered system was therefore not *invented* as a convenience for practicing musicians; it is part of the natural

ordering of the universe, an ordering which has been *discovered* with increasing accuracy over the course of the past 2,500 years. Our knowledge of this grand display of natural beauty will doubtless arrive even closer to the truth as we begin to grasp the full implications of an array of scientific investigations which are under way today in the realms of the harmonic ordering of the elements and of plasma structures ranging in size from the subatomic to the astrophysical.

Soulless romanticism

The concept of *equal tempering*, on the other hand, is a product of the mechanistic, gnostic-romantic current of thought which views anomalies such as those found in the construction of a musical scale, as bothersome impediments to an otherwise logically consistent, arbitrary construct. In the 19th century, this current was most prominently represented by the mechanistic Hermann Helmholtz, who maintained that music is solely concerned with the degree of physical pleasure derived by the vibrations of inanimate objects. According to this degraded view, the musical scale itself is an arbitrary construct which society agrees upon, in a kind of Rousseauvian social contract, in order to “flatten out” or otherwise suppress what is believed to be the *inherent imperfection* of the physical universe. All ideas of perfection are relegated to the mystical realm of the unknowable.

The romantic view puts primary emphasis on the “vertical” side of music, treating groups of notes played simultaneously (“chords”) as the primary “substance” of musical action on the listener’s senses. Equal tempering arose out of the effort to minimize the effect of the “disruptive” anomaly (called a “comma”) by algebraically distributing it equally among each of the 12 steps of the scale, such that each interval is algebraically equal to the successive ones. It is, as it were, a communistic “leveling” principle applied to the musical scale; and it is not accidental that its emergence during the early 20th century coincided with the crystallization of the twin irrationalist currents of communism and fascism.

In utter contrast to this romantic viewpoint, the classical viewpoint of *well tempering* treats the ordered succession of tones in one or more *sung* voices (polyphony) as primary. Chords do not have any primary existence, but are thought of as momentary coincidences in time of two or more polyphonic voices. Each interval in the scale is a unique individual—a Leibnizian monad—which bases its existence not on its perfect identity with its neighbor, but on its relation to the ordering principle of the scale as a whole.

It is against this background that we can appreciate the significance of what Mr. Jorgenson informs us about the drastic change in accepted keyboard tuning practices over the past 100 years. In the chapter entitled “Why Equal Temperament Was Not Commonly Practiced on Pianos Before the Twentieth Century,” he reports that before this century, tuners of keyboard instruments approached tuning the scale

in an entirely different way than today:

“Today, in the late 20th century, the term ‘tuning by ear’ means that one is not using any electronic tuning aids or devices [an all-too common practice which inevitably results in a poorly tuned instrument—JWS]. It means that one is using his ears to count and compare the beat frequencies [interference patterns caused by slightly out-of-tune upper partials] of various tempered intervals. During the 19th century and before, the term ‘tuning by ear’ meant the opposite; that is, one did *not* count or compare beat frequencies. In fact, one did not listen to beats at all. . . .

“In the past, tuning by ear meant that one judged the relationships between the two notes of an interval by listening to the two notes melodically only. *The first note was never sustained while the second note was being played.* Therefore, no beats could be heard. *In other words, tuners tuned in the manner that singers sing. The art of singing was considered a valuable basis for this technique*” (emphasis added).

This fact has great significance not only for tuning, but for the way we think about the concepts of *consonance* and *dissonance* in general. In the romantic Helmholtzian view, the degree of consonance or dissonance between two tones is entirely a question of the degree of “smoothness” or “harshness” to the physical senses produced by conflicting upper partials in the overtone series produced by dead vibrating objects. But it is clear from Jorgenson’s report that for those minds steeped in the tradition of classical polyphony, it is not the physical senses, but the *human mind* which is the arbiter of consonance and dissonance. I.e., the mind “hears” the tones “sung” in succession, and then judges them according to the *higher ordering principle* upon which the creative activity of the mind itself is based.

The concept of ‘color’ in music

Jorgenson reports that even through the late 19th century—by which time it had become common practice to listen for beatings in the vertical intervals of fifths and fourths in order to temper them—the finest piano tuners still did not strive for a mechanistic equal temperament, but rather “they listened to the color-qualities and not the beats of the thirds and sixths. Thus, their musical experience, along with their aesthetic quality judgments of third, sixths, and triads, influenced their tempering. The result was that the traditional characters of the keys were still preserved.”

By “characters of the keys,” Jorgenson means that the slightly unequal intervals which characterize all tuning systems except equal temperament, give each key a distinguishably different character or “color.” This is equally true of the older meantone temperaments—which did not permit modulation throughout all the keys—as it is of the well-temperament promoted by the circles around J.S. Bach. As a good demonstration of how this works, Jorgenson recommends tuning a keyboard to the well-temperament specified by J.S. Bach’s contemporary Andreas Werckmeister, and

transposing Bach's Prelude and Fugue in C major from the first volume of *The Well-Tempered Clavier* into C-sharp major, and noticing how dissonant it sounds. Conversely, one can transpose Bach's Prelude and Fugue in C-sharp major into C major, and "notice how dead and lifeless it sounds."

Equal tempering obliterates such distinctions. Strict equal tempering only arose at the beginning of the 20th century, when the dionysiac irrationality of Wagner's "chromaticism" began to be supplanted by the equally irrational formalism of atonality. Jorgenson writes that equal temperament achieves "a homogenized neutral gray coloring that is completely dependable without any changes while modulating through all the keys. No variety during modulation is the equal-tempered ideal. *Equal temperament therefore has no tonality, and it is the most appropriate for the atonal 20th-century music.* The qualities sacrificed in order to make equal temperament possible are harmoniousness in the commonly used keys, key-color changes allowing variety when modulating, and the 'characters of the keys'" (emphasis added). (Helmholtz, who detested J.S. Bach, recommended a solution even more radical than equal tempering: Junk Bach's polyphonic tradition altogether by forcing a return to the old meantone temperament.)

Newton and tone-deafness

Jorgenson's argument in favor of key-color versus the grayness of equal tempering is refreshing and useful, as far as it goes. However, he lets romantic irrationality reenter through the back door, by not proceeding to the next step of considering that these "characters of the keys" must have the same quality of *absoluteness* as do the colors of the electromagnetic spectrum. Although broad differences in key-colors can be distinguished regardless of which pitch is chosen as the absolute reference (e.g., at the modern, arbitrary high tuning of A=440 Hz), those colors will always remain "off-color," as in a poorly reproduced color photograph, to the extent that the scale is not set to the natural tuning of C=256 Hz as specified by LaRouche and others. The naturally tuned well-tempered scale also possesses an additional feature which further enhances those color distinctions between the various keys: Each key is uniquely characterized not only by a distinct set of intervallic relationships, but also by a distinct set of implicit register shifts for the various species of bel canto singing voice.

It is probably too much to expect that a book primarily intended as a review of the past few centuries' tuning practice, would pursue such a line of inquiry. But the absence of a single mention of the momentous work of Johannes Kepler, who vigorously opposed the arbitrary equal tempering system as propounded by his contemporary Marin Mersennes, leads one to suspect that for all the wealth of material presented in this volume, it is still only a small part of the picture. It is to Jorgenson's credit that he freely admits that his book is primarily a history of tuning in England and the United

States. Yet his blanket assertion that the picture was not substantially different in continental Europe, cannot be entirely true, since the clash between the Kepler-Leibniz continental current and the British gnostic empiricists typified by Isaac Newton, extended to every field of knowledge. Perhaps Jorgenson's oversight is a result of the undue amount of respect which he accords to Helmholtz and his tone-deaf epigone, Alexander John Ellis, both of whom were dedicated to poisoning continental scientific practice from within, with their British empiricism.

These criticisms are in no way intended to belittle the tremendous practical value of Jorgenson's book for reestablishing the practice of well-temperament and for burying equal temperament along with the rest of the cultural detritus of the 20th century. His many practical observations on old tuning procedures also underline the need for us not only to retune our instruments, but also our ears, in order to properly hear classical polyphony. For instance, Jorgenson points out that whereas our modern ears have been accustomed by equal temperament to tolerate only slight temperaments of fifths but can tolerate quite large temperaments of thirds away from the "just" or Platonic whole-number ratios, exactly the reverse was true during the 17th century, when thirds would be heard out of tune if they were altered by more than a very slight margin, whereas fifths and fourths were still heard as tolerable when they were as much as three times more tempered than they are today. Just as our eyes have been spoiled by the ugliness of modernist architecture and "art," so our ears have been desensitized and spoiled by the unrelieved monotony of equal tempering, and music teachers, students, and listeners alike are bound to benefit greatly by hearing the works of the great masters of classical polyphony performed according to the variety of well-tempered tuning schemes assembled here.

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