PART TWO

THE WRITINGS OF THE ADVOCATES OF MULTIPLE DIVISION

The advocates of multiple division share only the view that the present tuning system is or soon will be inadequate. As the reasons for their holding this view vary, so do the remedies which they propose. Many of those whose only interest in a new system is evolutional have proposed to build systems of multiple division in which the 12-tone scale remains unchanged; it is merely subdivided. This is the basis for so-called quarter-tone music. Others have proposed temperaments based on a more perfect fifth than is available in the present equal-tempered system. Others still have proposed temperaments based on less perfect fifths but more perfect thirds, resembling the meantone systems of the past. A few have contemplated the idea of temperaments that make no attempt to duplicate the fifth or the third. Still others have despaired of meeting their acoustic demands by a performable equal temperament and have proposed unequal systems.

The following chapters are arranged according to the categories outlined above. 19-tone temperament is reserved for the end of this section in order that it may be examined in greater detail. Chapters are devoted to the early writers on 19-tone temperament and to each of its three leading modern exponents, Kornerup, Ariel, and Yasser.

CHAPTER 4

MULTIPLE DIVISION BASED ON 12-TONE TEMPERAMENT

The number of musicians who have worked with quarter-tones in their compositions is already large. The line extends from the first decade of this century (and possibly earlier) to the present,[1] and includes representatives from many countries. The ready availability of instruments tempered to 12 tones per octave has probably contributed far more than any acoustical theories (although they exist) or historical precedent (although one is said to exist) to the practical fact of 24-tone equal temperament. By taking two instruments attuned to 12-tone temperament and setting them 50 cents apart, 24-tone temperament is obtained. Two pianos, so tuned, have provided the quarter-tonists with a standard medium. Four pianos, so tuned, have provided a quarter-tone "orchestra."[2]

At least three of the quarter-tone composers have published their theoretical views at some length. The earliest of these was the German Willi Möllendorff, whose

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[1] Dupont acknowledges Richard H. Stein as having been the first to compose with quarter-tones in 1906. Op. cit., p. 115. This is probably earlier than the first quarter-tone works of Haba, Hans Barth, or Jörg Meger who, together, are credited by Novarro with originating 24-tone temperament. Op. cit., p. 248. More likely correct is José Asuar's assertion that Stein was the first to publish quarter-tone music (2 pieces for Cello and Piano, 1906). There was undoubtedly earlier experimentation.

[2] Wyschnegradsky calls his work, Ainsi Parlait Zarathustra, a symphony for an orchestra of four pianos.

pamphlet, Musik mit Vierteltönen, appeared in 1917. A decade later Alois Haba, probably the best known of the composers whose primary output has involved multiple division, published his Neue Harmonielehre. The Neue Harmonielehre was selected by Gustav Reese for inclusion in his list of the 80 most important treatises of all time about music not available in English.[3] In 1933 Ivan Wyschnegradsky, a quarter-tone composer whose works were to receive a fair measure of local success some years later, published a Manuel d'Harmonie à Quarts de Ton.

Möllendorff, Haba and Wyschnegradsky share a common interest in the problem of bridging the chasm between 12- and 24-tone music, but the attitude of each of the three men is quite different from those of the others toward this, as it is toward the goals of quarter-tone music in general.

Möllendorff's chief concern throughout his pamphlet, Musik mit Vierteltönen, seems to be the defense of quarter-tone music against charges that it is too radical. He is by present standards an out-and-out conservative. He is for retaining the traditional scales and modes, with the use of quarter-tone intervals for occasional enrichment of sonority but primarily for the enlargement of the possibilities for modulation. He divides his 24-tone system into two distinct 12-tone systems pitched a quarter-tone apart.

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[3]Reese, Fourscore Classics of Music Literature, 1957.

A large portion of this pamphlet is devoted to simple modulational formulae for moving from a given key in one 12-tone system to each of the 12 possible keys in the other system. Besides showing the formulae as musical examples he cites three general rules for such modulations, which he claims always to follow in his own practice:

1. In passing between two keys which belong to opposing 12-tone systems, use only familiar chords, each complete in a single 12-tone system.
2. Since such a procedure prevents the use of a common tone in passing from one system to the other, follow the traditional rule that in the absence of a common tone there must be contrary motion.
3. Each individual voice must move by a single quarter-tone over the break between the two systems rather than by a larger interval.

Möllendorff devotes a major portion of his pamphlet to the refutation of those arguments which he considers to be those most frequently raised against quarter-tone music. These arguments remind us that in 1917 the main current of the 20th century was still far from dictating or determining the aesthetic center of gravity. Many of the arguments against quarter-tone music in this section appear to be remarkably similar to the arguments against main-stream 20th century music in general, arguments long since abandoned. First Möllendorff cites the objection that music with quarter-tones will make people even more nervous than they already are ("die Menschen noch nervöser gemacht werden als

sie jetzt schon sind"[4]). He devotes considerable space to denying the contention. The second objection which he cites is that quarter-tone music will destroy the tempered system. This obvious inaccuracy he deals with summarily, as he does with the equally fallacious third objection, that because of the availability of quarter-tones all of the present literature will have to be re-composed (umkomponiert). The fourth argument which Möllendorff disposes of is that the introduction of quarter-tones signifies a retrogression to the primitive, even barbaric, condition of a lower cultural level. A fifth and final negative argument is cited, the only one among the five that is still heard today. This argument is that the quarter-tone would be much too small an interval to permit two neighboring tones to be properly distinguished from one another.

The objections which Möllendorff cites are far more of interest today than his routine replies, which might equally well have been written in defense of Le Sacre du Printemps. Indeed, as will emerge in the study of Haba and Busoni, the early development of interest in multiple division seems aesthetically to have been regarded as a legitimate wing of musical modernism. If this be true, the knot was probably untied just after the end of World War I when a new 20th century musical elite came to power and

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[4] Op. cit., p. 40.

defined limits of acceptability within which the multiple-division advocates could never thereafter penetrate.

Möllendorff's pamphlet is, as the foregoing might suggest, dated. Its arguments appear naive today and its musical goals quite modest. Of some interest is Möllendorff's own harmonium (which he offers for sale, citing proudly its Deutsches Reichspatent) with a keyboard design which inexplicably calls for 36 rather than 24 keys to the octave.

Alois Haba is undoubtedly the most world-renowned of the composers regularly employing multiple division. He is probably also the most agressively anti-traditional of the multiple-division composers in his attitude toward the music of the past and the composer's duty to turn away from it.[5] Most of the Neue Harmonielehre consists of a simple catalogue of possible scales and sonorities in each of several systems of equal temperament. It is in keeping with the philosophy which Haba outlines in his extended introduction that this is so. He explains that it would be wrong to single out progressions to demonstrate to the student, because the student must learn above all to create his own progressions: progressions which have never been used before.[6] Haba also

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[5]Haba's attitude combined with his renown may have contributed to the public image of the advocate of multiple division as an extreme radical.

[6]Neue Harmonielehre, p. 112.

denies the existence of any such thing as inherent harmonic tendency. Any such tendency, he asserts, exists only in the creator's mind.[7]

The impression of Haba as a kind of musical anarchist is reinforced by a reading of Haba's own view of the history of theory. Franz Skuhersky is lavishly praised by Haba for his doctrine that any triad may be used at any time on any degree of any kind of scale.[8] Karl Stecker is cited with respect for having extended this same principle to tetrads, and Vitezslav Novak is commended for having brought pentads and hexads into the same promiscuity of relationship. To all of this Haba adds his own extention: any combination of two or more tones can be used in conjunction with any other combination of tones regardless of the systems to which each set might belong.[9]

The Neue Harmonielehre begins with a thorough catalogue of possible scales and sonorities in traditional 12-tone temperament. Then follows a section on 24-tone temperament and a section of 36-tone temperament. Finally, as a crowning system, he offers 72-tone temperament which, among other things, combines all of the possibilities of each of the other 3 systems in the book. He does not make

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[7] Ibid., p. 129.

[8] Ibid., p. viii. Haba calls Skuhersky's the first truly original theory since Rameau.

[9] Ibid., p. vi.

any attempt to show the peculiar acoustic advantages of 72-tone temperament, which are worth noting (see below, page 162). He is unconcerned about reforms in notational procedures, and uses eleven different kinds of sharp signs to provide for every possible tone between the whole-tones in 72-tone temperament.

Haba's compositions have been performed in many places, often with considerable success.[10] His works include pieces for many different media and include at least one opera, Die Mutter, which appears to have been produced with considerable excitement in Munich in the late 1920's. The orchestration calls for the complete body of quarter-tone instruments available to Haba. A regular though diminished string section is supplemented by 2 quarter-tone clarinets,[11] 2 quarter-tone trumpets,[12] 2 slide trombones, a quarter-tone piano, a quarter-tone harmonium, and 2 harps tuned a quarter-tone apart. The piano, clarinets and trumpets were specially built for the occasion.[13]

Haba appears to have regarded 24-tone temperament as a basis for notation and a starting point for his system

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[10] Ibid., p. 246.

[11] According to Sigmund Klein, Quarter-Tone Data, in the Pro-Musica Quarterly of March 1925, p. 22, quarter-tone clarinets were first built for Richard H. Stein.

[12] According to Ibid., a quarter-tone trumpet was built in the 19th century in Odessa. The addition of a fourth valve connecting with a short pipe-extention is all that is needed to convert a trumpet to quarter-tone use, albeit with rather inexact intonation.

[13] Haba, Meine Vierteltonoper Die Mutter, Anbruch, Monatsschrift für Moderne Musik.

rather than as a rigid system of intonation to be adhered to at all times. In the introductory notes to his Music for Unaccompanied Violin, opus 96, Haba states that he conceives the quarter-tone as representing approximately even subdivisions of the semitones as they are normally played on the violin. This means, acknowledges Haba, that the chromatic and diatonic semitones are different in size, and the player is instructed to bear this in mind in estimating the proper intonation of the quarter-tones.[14] In the introductory notes to the companion work, Fantasy for Solo Violin, Haba also stresses the necessity for "plasticity of intonation."

Fokker interprets Haba's flexible view of the intonation of 24-tone temperament to mean that Haba is more interested in microtones in general than in the specific system of microtones he employs. It is Fokker's opinion that with the opportunity to use and hear 31-tone instruments Haba would have accepted that system.[15] This may well be wishful thinking on Fokker's part. Haba through his life's work became quite habituated to thinking along the lines of the 24-tone system, which he recognized to be a dual, conditionally related unit (as opposed to the 12-tone system which he calls an acoustically related unit).[16]

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[14]Haba, Musique pour Violon Seul, p. 5, Phantaisie pour Violon Seul, p. 3.

[15]Fokker, La Gamme... p. 152.

[16]Haba, Phantaisie pour Violon Seul, p. 5.

Ivan Wyschnegradsky belongs to a younger generation than Haba and some of his writings show the moderating influence of the neo-classical revival which temporarily halted the contempt for the practices of the past which influenced Haba so strongly. Wyschnegradsky's writings show two contradictory strains, the one exulting in the overthrow of traditional harmonic concepts in the vein of Haba, the other highly conciliatory and rational in its attempt to link the old and the new. His quarter-tone music, to judge from its critics,[17] would appear to reflect both strains, sometimes highly reminiscent of Wagner and Scriabin, sometimes extremely dissonant and anti-tonal. Periodically Wyschnegradsky returns to a concept which he calls pansonority, a concept which has as its basic premise the destruction of consonance and dissonance as polar forces.[18] However, in his other, more valuable works, Wyschnegradsky seems almost to be a different author.

Of all Wyschnegradsky's writings, the one which sheds the most valuable light on his musical practices is probably his Manuel d'harmonie à quarts de ton, published in 1933. It is a moderate work, in some respects reminiscent of

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[17] The impression is confirmed by the opinions of both the "pros" such as Boris de Schloezer, and the "antis" such as Léonid Sabanéev (Musical Times, June 1, 1929, p. 503).

[18] Wyschnegradsky, Quartertonal Music, Its Possibilities and Organic Sources, Pro Musical Quarterly, Oct. 1927, especially pp. 30 and 31.

Möllendorff. Wyschnegradsky begins, as did Möllendorff, by dividing his 24 tones into two groups of 12. One group he calls the old scale, the other, the new scale. He then considers interval nomenclature at some length, preserving the names of the intervals of the 12-tone system as they stand and adding the following new names:

Seconds, Thirds, Sixths, and Sevenths

neutre.....between major and minor
plus que majeure....¼-tone larger than major
moins que mineure...¼-tone smaller than minor
suraugmentée.....¼-tone larger than augmented
sous-diminuée.....¼-tone smaller than diminished.

Perfect Intervals

majeure.....¼-tone larger than perfect
mineure.....¼-tone smaller than perfect.

Additional Accidental Signs

raise by ¼-tone #
raise by 3/4-tone ##
lower by ¼-tone ♮
lower by 3/4 tone ♭♮

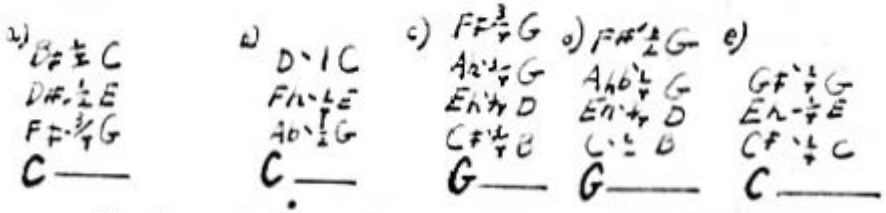
Next, Wyschnegradsky carefully considers the component parts of the 24-tone system. Eight intervals form complete 24-tone circles. This is exactly twice the number of intervals which form complete 12-tone circles in the 12-tone system. In the 24-tone system these intervals are 1/24, 5/24, 7/24, 11/24, and their respective inversions. In addition, four intervals form 8-tone circles within the system. These are 3/24, 9/24, and their inversions. Wyschnegradsky implies that the field for modulation is

greatly enriched by the availability of these additional long cycles.

The above serving to introduce the properties of the system, Wyschnegradsky begins the first of his two major units: quarter-tones as accidentals, altered chords, and the basis for modulation within a more traditional harmonic context. It is this section which bears some resemblance to Möllendorff. Wyschnegradsky, however, has codified his ideas far more carefully, and has certain tested and favored progressions to offer to the reader.

For music fundamentally in the "old" 12-tone scale, non-harmonic ornaments from the "new" scale should be no more than 3/4 tone removed from their resolutions.[19] Example 25 shows several of Wyschnegradsky's favorite simultaneous ornaments resolving over pedal-tones.

Example 25: Quarter-tone Ornaments by Wyschnegradsky



Wyschnegradsky is conscious of the enharmonic ambiguities inherent in some of his ornaments. Vertically, the upper tones of these sonorities are traditional chords,

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[19] Manuel d'Harmonie à Quarts de Ton, p. 6.

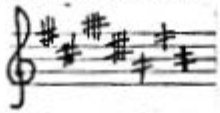
major, minor, etc., strongly suggesting spellings consistent with their sound. Horizontally, through their resolution in contrary motion, these groups of ornaments appear to require an altogether different spelling. The situation is, of course, not unprecedented, existing in such traditional functions as the augmented sixth chords which sound like dominant sevenths.

Next, Wyschnegradsky examines chord alterations by quarter-tones. He shows all (eleven) forms of an altered triad wherein one third is allowed to remain either major or minor and not altered. The so-called neutral triad, which consists of an equally bisected perfect fifth, he considers doubly altered since neither third is left unchanged.

Among his preferences in chords and scales, Wyschnegradsky lists the "Neapolitan" with root raised a quarter-tone, and the so-called Gypsy scale with its two augmented seconds decreased through the raising of their lower members by a quarter-tone. In the many chords and scales, an implied underlying principle seems to be present. Where traditional 12-tone practice admitted two sonorities whose only difference lay in the modification by a semitone of one the pitches, the use of the quarter-tone between these two pitches is acceptable practice.

This principle is carried over into tetrads. Wyschnegradsky is fond of altering the fifths of seventh

chords by a quarter-tone, placing them between the diminished and perfect categories.[20]

Next, Wyschnegradsky turns to modulation. As an introduction to his treatment of modulation between "old" and "new" tonics, Wyschnegradsky shows various key signatures for "new" major and minor scales. E ♯ major has the following signature:  .[21]

Wyschnegradsky's modulating procedure is rather like Möllendorff's in that he recommends the avoidance of any motion in any voice by large intervals between two tones in opposite systems. At the moment of modulation, only the single move to the neighboring quarter-tone is recommended. He endorses sequential formulae involving quarter-tones as an excellent means of achieving such modulation. He adds the recommendation that as the modulation approaches, the quarter-tone barrier be softened by the use of ornaments from the "new" scale. The use of seventh chords and non-harmonic tones at the point of crossing is also suggested.

The second part of the Manuel d'Harmonie à Quarts de Ton deals with "artificial quarter-tone scales." While pointing out that such scales need not use the octave as their basic unit, Wyschnegradsky chooses to restrict himself to those which do. Proceeding as did the Greeks,

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[20] Ibid., p. 12.

[21] Ibid., p. 13.

Wyschnegradsky builds his scales from identical disjunct tetrachords. He permits his tetrachords to cover 9/24, 10/24, or 11/24. For a detailed example of what he considers to be a particularly successful quarter-tone scale, Wyschnegradsky singles out the scale he calls the neutral mode, C, D, E♮, F, G, A♮, B♮, c.[22] As can be seen, the principle of this scale is that all degrees which have different tones in major and minor are represented by the quarter-tones lying between them. The key signature for this scale is ♮♯♮.

Next, Wyschnegradsky determines the most closely related transposition of the same mode. He analyzes his scale in terms of the intervals of which it is made, producing a table of all consecutive degrees, all alternate degrees, and every interval created by each third degree. The table reveals 6 instances of the neutral third, 5 of the perfect fourth, 4 of the neutral second, 3 of the major second, 2 of the major fourth, and 1 of the minor third. By this method Wyschnegradsky concludes that the circle of neutral thirds is the primary basis for modulation when using the neutral scale, just as the perfect fourth is the basis for the simplest modulation in the major or minor modes. In the course of modulating by neutral thirds, the modification of the key signature is rather interesting. As stated above, the key signature for C neutral contains

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[22] Ibid., p. 18.

3 ♮'s. The most closely related key is E ♮ neutral. The scale of E ♮ neutral is E ♮, F ♯, G, A ♮, B ♮, C, d, e ♮. No ♮'s have been added or removed, but rather a ♯ has been added. Continuing upward, the next neutral key is G, whose scale includes the F ♯ and modifies the signature of the preceding key by omitting the A ♮. Thus in proceeding upward from key to key around the circle of neutral thirds, the signatures alternately add ♯'s and omit ♮'s.

Wyschnegradsky next considers scales possessing more than 7 tones. Particular favor is accorded a thirteen-tone scale involving two disjunct heptachords (separated by a semitone), each of which consists of five semitones and a quarter-tone. The basic interval for modulation is the major fourth (the interval by which the two heptachords of the scale are separated), 11/24, which, like the neutral third, results in a complete 24-key cycle. In his "symphony," Ainsi Parlait Zarathustra, Wyschnegradsky utilizes this 13-tone scale extensively. On the occasion of one of its performances, Olivier Messaien payed special tribute to this scale in his review.[23]

A contrasting artificial scale mentioned by Wyschnegradsky is the almost equi-distant pentatonic scale. Wyschnegradsky incorrectly lists the intervals as two whole

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[23] Messaien in La Monde Musical, read as a reprint with date and page unspecified.

tones and three intervals of 5/4 tones.[24] The total falls a quarter-tone short of an octave. Presumably the scale is achieved by a single whole-tone and four intervals of 5/4 tone.

Wyschnegradsky next turns to what he calls the free use of quarter-tones. One such use is in "expressive unison." In an expressive unison, two tones are sounded simultaneously which are separated by a quarter-tone. A similar procedure is mentioned for an "expressive octave." That Wyschnegradsky thought well of this device is confirmed by the score of Ainsi Parlait Zarathustra where tremoli involving two or more simultaneous "expressive unisons" occur quite frequently.[25] In light of the frequent use of major sevenths and minor ninths in recent music of 12 tones per octave, it is interesting to speculate on whether those intervals are also used or intended as "expressive octaves." If so, the smaller deviation of the quarter-tone may be a superior means to an effect desired by many composers besides Wyschnegradsky.

Wyschnegradsky endorses parallel sonorities involving composites of quarter-tone relationships, and these also figure prominently in Ainsi Parlait Zarathustra. Parallel neutral thirds and parallel large seconds (5/24), often in

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[24] Op. cit., p. 19.

[25] Ainsi Parlait Zarathustra, publ. by L'Oiseau Lyre.

rather long chains, appear with great frequency in the score. Wyschnegradsky shows several examples of polytonality presenting simultaneously a major key using "old" tones, a minor key using "new" tones, and a neutral key using both. He also offers examples of what he calls polyatonality consisting of 12-tone patterns functioning against one-another.[26] Finally, he shows some examples of widely spaced sonorities in which all 24 tones appear.

His main text completed, the author devotes an appendix to consideration of the acoustical basis for quarter-tone music. He begins by stating that the 11th partial is the best basis for the system, a statement born out by the close equivalence between 11:8 (551.3 cents) and 11/24 (550.0 cents). If he had stopped here he would be on firm ground.[27] However, he turns to other possible acoustical sources. Regarding C as the generating tone, he decides to consider B♭ as the 7th partial, F ♯ as the 11th partial, A ♮ as the 13th partial, and the scale from B ♮ to E ♯ as every partial from the 29th to the 41st. Eb he attributes to the 57th partial while other tones still remain without partials of their own. Presumably they are derived from transpositions of the series already shown.

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[26] Op. cit., p. 22.

[27] It should be noted that the particular preference of both Wyschnegradsky and Messaien for the quarter-tone scale whose basic interval is 11/24 jibes with the excellent acoustical basis for this interval.

The above explanation is hardly satisfactory. The 7th partial is more than 18 cents removed from B♭; that this seems excessive is emphasized by the fact that 25 cents is the limit of possible error in the quarter-tone scale. Most of the higher partials are approximated far more closely, but it is difficult to take seriously any arguments that there can be a genuine acoustical basis in partials as high as 41 and 57.

In a later article,[28] Wyschnegradsky attempts to trace the sources of quarter-tone music to the Greek enharmonic tetrachord and to the music of the Arabs. He is careful to differentiate current practice from that of the ancients who used quarter-tones only as a means of altering fundamental seven-tone scales. He claims that quarter-tones can permeate the sound ideal of classical music through tendency tones. When D♯ is about to resolve to E, Wyschnegradsky prefers the use of D♯♯. To use only a few quarter-tones, however, is to commit an affront to the sense of style. He recommends the achievement of equilibrium through the use of approximately the same number of tones from each 12-tone system. This equilibrium is, in fact, encouraged by the performing medium of two (or four) pianos, since the equalization of the importance of the roles of the various performers serves to establish the

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[28] La Musique à quarts de ton et sa réalisation pratique, La Revue Musicale, Jan. 1937, pp. 26-33.

desired tonal equilibrium.

Wyschnegradsky's compositions have had a modest measure of success, with perhaps the most favorable critical reaction following a concert in Brussels in 1947. Of the many laudatory reviews of that performance, probably the most lavish praise came from Louis Verschreager, who remarked[29] that Ainsi Parlait Zarathustra offered a "prodigious revelation of a new musical domain." The dissonances he considered hardly severe for an ear accustomed to Stravinsky and Schönberg.

The greatest ferment of activity by composers of quarter-tone music took place in the 1920's and early 30's. Among its practitioners in Russia were Arthur Lourie, who, as an early commissar of music, gave multiple-division composers a strong but short-lived boost, and Georgi Rimsky-Korsakoff, son of the more famous Rimsky-Korsakoff. In Czechoslovakia, besides Haba, Fr. Wiesmeyer composed quarter-tone works, as did a whole galaxy of composers in Germany. Jörg Mager was, among them, perhaps the most important for his pioneering work at instrument construction. According to Klein, in 1925, he was at work trying to build an instrument capable of playing music written for

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[29] La Cité Nouvelle, Brussels, 18 Feb., 1947. The work was also performed in Paris on November 10, 1945, at which time one of the four pianists was Pierre Boulez.

any tuning.[30] The quarter-tonists were represented in Italy by Silvestro Baglioni, in Spain by Dominguez de Burrueta and Panach Ramos, and in France by Marina Scriabin and Yvette Grimaud, in addition to Wyschnegradsky, an import from Russia. Latin America was represented above all by Julián Carillo of Mexico, who made a quasi-religious crusade over his campaign for multiple division which he labeled 'El Sonido Trece' (the 13th sound).[31]

In the United States, Hans Barth and Mildred Cooper were among the leading exponents of quarter-tone music, but it should be mentioned that Charles Ives was continually interested in microtones, and essayed a few works with quarter-tones. He wrote a short article in Pro Musica Quarterly in which he says, "The assimilation of quarter-tones with what we have now into some reasonable and satisfactory basic plan will be, it seems to me, along

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[30] Klein, Sigmund, Quarter-Tone Data, Pro Musical Quarterly, March 1925. The names listed on this page are taken either from this article or from Asuar, Jose, De los Microtonos y su Aplicacion como Sistemas Temperados, Revista Musical Chilena, Oct-Nov. 1957, p. 59. Several names are also taken from Kallenbach-Greller, Lotte, Die Historischen Grundlagen der Vierteltöne, Archiv für Musikwissenschaft, Sept. 1927, p. 475. Miss Kallenbach-Greller attributes the first quarter-tone compositions in the 19th century to Joseph Petzval, beginning in 1862!

[31] "We are about to see the accomplishment of the greatest transcendence that has taken place since before the time of Christ; ... the psychological transformation produced by Christian doctrine was surely no greater than the formidable revolution which 'The 13th Sound' will produce in the art of tones." --- El Sonido 13, Feb. 1924, p. 6.

harmonic lines with the melodic coming as a kind of collateral . . . in a sense opposite to the way our present system has developed."[32]

Ives predicts that it will take generations or even centuries before quarter-tones are absorbed into the instinct of the inner-ear, but that it is still worthwhile to attempt to use them. He feels that chords with four distinct tones are better than triads, and that pentads are best of all, on the grounds that one member of a quarter-tone triad will sound out-of-tune but a fourth tone can correct the impression. He cites the ability of quarter-tones to "relieve the monotony of literal repetition" and to make a rhythmic contribution to structure in this way. He notes a problem which has concerned advocates of other multiple divisions (see supplement, page 398, below), namely, that it is difficult to distinguish inversions of quarter-tone sonorities. He blames his own ear,[33] but the problem may well lie in the sounds themselves.

The general interest in multiple division and in quarter-tone composition seems to have declined since the early 1930's. Nevertheless, there remain an unknown number

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[32] Ives, Charles, Some Quarter-Tone Impressions, Pro Musica Quarterly, March 1925, p. 20. Leonid Sabaneev takes just the opposite viewpoint, advising quarter-tone composers to concentrate on melody, if necessary to the total exclusion of harmony. Musical Times, June 1, 1929, p. 504.

[33] Op. cit., p. 33.

of composers who continue, in obscurity, to compose quarter-tone music, generally for two pianos. One such man is Mordecai Sandberg of New York. His musical credentials, which include a doctorate from Berlin,[34] are probably better than those of many well-known composers, but he has chosen to amass a huge body of quarter-tone works in almost total anonymity.

There is a small literature of published quarter-tone music, and a substantial literature of unpublished quarter-tone music in manuscript. More detailed studies of this branch of multiple division would well prove fruitful at this time, before much of the unpublished music becomes increasingly unavailable for research.

THE BASIS FOR 24-TONE TEMPERAMENT

There has been much severe criticism of the particular choice of 24 tones to the octave from the advocates of other schools of multiple division. Whether polemic, as when coming from Ariel,[35] or closely reasoned and moderate, as when coming from Novarro[36] or Handschin,[37]

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[34]Knowledge of his very existence, as well as the brief biographical data included, were learned quite by chance in a discussion of other matters with Fritz Kuttner.

[35]Ariel, op. cit., p. 135.

[36]Novarro, op. cit., pp. 153-4.

[37]Handschin, Akustisches aus Russland, Gedenkboek aangeboden aan Dr. D. F. Scheurleer, p. 146.

the criticism tends to follow one general line. According to these and many other writers, the basic mistake of the advocates of 24-tone temperament is that they use 12-tone temperament as their starting point . . . as their image of a perfect system. But 12-tone temperament is itself a compromise and possesses serious weaknesses which are endured for the sake of simplicity. What, it is asked, does 24-tone temperament add to 12-tone temperament in return for the extensive loss in simplicity? Unquestionably, 24-tone temperament offers a good approximation of the 11th partial. Partch and Novarro, among others, concede this. But to what avail is a good 11th partial when the 5th and 7th are lacking?

I have already discussed Wyschnegradsky's claim that 24-tone temperament improves upon the 7th partial offered by 12-tone temperament. In terms of percent of possible error, the 7th partial of 24-tone temperament is worse than the poorly approximated 7th partial of 12-tone temperament. As for the 5th partial, a moderately weak point in 12-tone temperament, it is, of course, unimproved by subdivision into quarter-tones. But, whereas the error of 13½ cents represents only 27 percent of the possible error in 12-tone temperament, the figure becomes a far less tolerable 54 percent in 24-tone temperament. It is quite understandable that the leading proponents of 24-tone temperament wrote favorably of abolishing all concepts of consonance as such.

To the obvious truth advanced by proponents of quarter-tones that all of the advantages of 12-tone temperament are retained in 24-tone temperament, the opponents insist that this is not enough. As the number of tones in a tuning or temperament is increased, imply the critics, one is entitled to increasing accuracy in the approximation of the intervals which form the acoustical basis for the musical system.

It is this altogether reasonable doctrine, that takes the factor of performance and listening difficulty into account, which renders so complex the matter of choosing a most suitable multiple division. Were it not for the reasonableness of this argument, all intonation problems could be solved by taking a basic unit so small that the deviation of all desired intervals would be minute. In 600-tone temperament no interval can be incorrect by more than a cent.

If the advocates of 24-tone temperament are somewhat at a loss in the debate over an acoustical basis, they do have serveral strong historical precedents to draw upon. There is, to begin with, the Greek enharmonic cited by Wyschnegradsky. Barbour cites Kircher's Musurgia Universalis, page 208, as evidence that Aristoxenos has long been looked upon as a precursor of 24-tone temperament.[38] Most of

[38] Tuning and Temperament, p. 117.

Ptolemy's enharmonic tunings do not divide the semitone equally, however, and the Greek enharmonic can be used to justify other multiple divisions as well as 24-tone temperament. However, another tuning of the tetrachord, listed by Ptolemy and based on "ornamental" division $\frac{1}{12}:\frac{1}{11}:\frac{1}{10}:\frac{1}{9}$, might be regarded as precedent specifically for 24-tone temperament, largely because of the prominence of 11 in the ratios. Erik Eggen, after citing the prevalence of this tetrachord in much extant folk-music, points to the ratios involving 11 and concludes that quarter-tones are thereby established as rivals to whole- and half-tone systems.[39]

The primary defense for 24-tone temperament rests neither on acoustical nor on historical arguments, however, but rather on evolutional grounds, wherein 12-tone temperament is accepted as a fixed quantity and the next musical system is postulated as developing directly out of it. There is expediency involved in such a view, and this is somewhat confirmed by evidence of a non-concern for exactness in intonation which has been attributed to the chief advocates of 24-tone temperament. Fokker, in citing Haba as regarding 24-tone temperament as a loose approximation, approves. Fritz Kuttner, citing Wyschnegradsky's piano tuning as a haphazard affair frequently involving errors

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[39] Eggen, Skala-Studier.

as great as 20 cents,[40] considers such inaccuracy to be a poor reflection on quarter-tone music.

But if expediency is the reason for the choice of 24-tone temperament, this is not necessarily to be condemned. Expediency has been a factor in the development of musical systems in the past--certainly in the development of our own 12-tone system. Perhaps the most justifiable charge which can be brought against the pioneers in 24-tone equal division is simply that they have been insufficiently critical of the past and the present.

MORE THAN 24 TONES

Other writers and composers have sought to subdivide 12-tone temperament into still finer units. Among these are Busoni, who advocated 36-tone temperament but is not known to have composed in this system; Barbieri, who has composed music in 48-tone temperament which is not, however, generally available; Novarro, who has advocated a music which, in effect, uses 60-tone temperament, although actually employing only some of the tones; and Carillo, who has composed music supposedly in 96-tone temperament (a "Preludio a Cristobal Colón," which has been published[41]

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[40] Conversation with Mr. Kuttner. These estimates are said to represent actual measurements, and my own experience with unusual tunings would lead me to concur that such errors are possible.

[41] Published by the New Music Society, 1934.

and recorded).

Busoni presents his proposal for 36-tone equal temperament in his short book, Sketch of a New Esthetic of Music. Busoni's approach is entirely evolutional. Nature's gradations of pitch are infinite, he asserts, and it is therefore incumbent upon the present generation of musicians to move a little nearer to infinitude.[42] To this end, Busoni suggests that besides two-fold division of the whole-tone, three-fold division might be used. While other writers have started with this assumption and advocated 17- or 19-tone temperament, Busoni makes it clear that he is referring to exact divisions of the tone as it now exists. Because of his basic proposal, commentators have erroneously ascribed the advocacy of 18-tone equal temperament to Busoni. He leaves little room for doubt about his intentions, however. He acknowledges that a system of third-tones without semitones would represent a net loss as against the present tuning system, owing to the disappearance of the perfect fifth and the minor third. He therefore proposes to keep both, by creating two systems of third-tones, each separated from the other by a semitone (or three systems of semitones, each separated by a third-tone). This is 36-tone temperament. Busoni would make no use, for the present, of the smallest unit, the sixth-tone,

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[42] Sketch of a New Esthetic of Music, pp. 30-31.

as such. However, he states his belief that the sixth-tone will eventually become integrated into musical speech also.[43]

It is fascinating to speculate on what Busoni's views on multiple division would be if he were alive today. Would he have turned toward 17- or 19-tone temperaments which may well achieve his limited objectives more satisfactorily than 36-tone temperament? It is quite possible that the advent of the dodecaphonic school would have satisfied Busoni's aesthetic wishes within 12-tone temperament. He quotes Nietsche approvingly: "I could imagine a music whose rarest charm should consist in its complete divorce from the Good and the Bad." This divorce has been achieved without the intercession of multiple division of the octave.

Barbieri's 48-tone temperament is passed over for lack of available materials to discuss. Novarro's implied 60-tone temperament will be discussed in Chapter 6 under the heading 15-tone temperament.

72-tone temperament is a system selected by both Haba and Novarro for special attention. Haba selects it much as Busoni selects 36-tone temperament, as a means of fusing two simpler systems. Where Busoni uses 36-tone temperament to fuse 12- and 18-tone temperaments into a single system, Haba does the same with 72-tone temperament, combining 12, 18, 24, and 36-tone temperaments. The

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[43] Ibid., pp. 31-2.

guiding principle is that all of these numbers are factors of 72. Haba revels in the vastness of the resources of 72-tone temperament. Indeed, the combinations are so numerous that his ideal of completely different harmonic progressions for each composer might have a chance at realization.

Novarro, who carefully examines the merits of every possible equal temperament by checking the correspondence of intervals within each system to small-number ratios, has a great deal to say for 72-tone temperament. Indeed, it is far more than just another multiple of 12. Among the intervals Novarro considers adequately represented in 72-tone temperament are the following, plus their inversions.[44]

21:20 as 5/72	8:7 as 14/72	5:4 as 23/72
16:15 as 7/72	7:6 as 16/72	9:7 as 26/72
10: 9 as 11/72	6:5 as 19/72	7:5 as 35/72
9: 8 as 12/72	4:3 as 30/72	

Pleased with the correspondence of the ratios based on prime numbers 7 or smaller, Novarro also assigns values within the temperament to intervals involving the 11th, 13th, and (in one case the) 17th partials.

11:9 as 21/72	11:7 as 46/72	13:7 as 64/72
11:8 as 33/72	13:8 as 50/72	17:9 as 66/72
13:9 as 39/72	11:6 as 63/72	

Except for 16:15, and the ratios involving the number 13, where the discrepancies are somewhat larger, all

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[44]Novarro, op. cit., p. 156.

of the intervals cited by Novarro are represented within 4 cents by 72-tone temperament, and most of them are realized far more closely than that. 72-tone temperament is one of those favored by the algorithmic process of Viggo Brun (for which see Chapter 13).

A brief analysis of the scale-degree numbers on Novarro's chart is revealing. The number of units in the intervals 8:7, 7:6, 9:7, 11:7, and 13:7 is always a multiple of two, informing us that the 7th partial is as faithfully represented in (72 ÷ 2 =) 36-tone temperament as in 72-tone temperament (an advantage about which Busoni says nothing, although Partch comments upon the accuracy of the 7th partial in the 36-tone system). The intervals whose ratios involve the number 11, 11:9, 11:8, 11:7, and 11:6, are all represented by scale degrees which are multiples of 3. This shows that the intervals involving the 11th partial are as well represented by (72 ÷ 3 =) 24-tone temperament as by 72-tone temperament. It will be recalled how excellent the representation of the 11th partial is in 24-tone temperament.

A similar perusal of the simple intervals involving the perfect fifth (4:3 and 9:8) shows that the scale degrees are multiples of 6. This indicates that the fifths of 72-tone temperament are still the fifths of (72 ÷ 6 =) 12-tone temperament, a fact which need not be discouraging, since the fifth is well represented in the simpler system. It should be noted that where the error of the fifth in 12-tone

temperament is less than 4 percent of the possible error, it is nearly 24 percent in 72-tone temperament. This amount is still moderate, however, by the standards of the thirds in 12-tone temperament.

The advantages which accrue from the combining of 12-, 24-, and 36-tone temperaments are summarized above. But 72-tone temperament has an important acoustical advantage which none of the other systems considered so far has. This concerns the representation of the 5th partial. It will be noted on Novarro's chart (above, page 163) that for the intervals 21:20, 16:15, 10:9, 6:5, and 5:4, the numbers of the scale degrees are all prime. This indicates that the (moderately) close approximation of the 5th partial available in 72-tone temperament is not available in any of the simpler systems based on factors of 72.

In order to appreciate completely the acoustical position of 72-tone temperament, it is advisable to consider an additive principle in the creation of compound temperaments out of simpler temperaments. This principle is implied by a number of authors and applied by others, even when not stated directly. When an equal temperament contains "a plus b" tones to the octave, where "a" and "b" do not contain common factors, then the temperament will represent a weighted mean between the characteristics of the equal temperament possessing "a" tones and the equal temperament possessing "b" tones. The temperament "a" or "b"

containing the larger number of tones will have the greater influence, in proportion to its greater size, on the characteristics of the temperament containing "a plus b" tones.

This principle is to be observed in the selection, by such theorists as Yasser and Kornerup, of a Fibonacci series of "good" temperaments. In obtaining 31 by the addition of 12 and 19, it is implicit that 31-tone temperament will represent a mean between the features of 12- and 19-tone temperaments, somewhat weighted in favor of the characteristics of 19-. The flat fifths (1/3 comma) of 19-tone temperament and the very slightly flat fifths of 12-tone temperament combine to produce a fifth flat by ¼ comma. The large major thirds of 12- and the small major thirds of 19-tone temperament combine to produce an almost perfect major third in 31-tone temperament (386.1 cents).

With this in mind, it is revealing to note that 72-tone temperament, more than a simple product of 12-tone temperament in six-fold subdivision, is also a mean between two highly regarded equal temperaments of opposite characteristics, 31- and 41-tone temperaments (whose fine qualities will be discussed at length in Chapter 5). 31-tone temperament possesses excellent representations of the 5th and 7th partials, while 41-tone temperament is especially noted for its excellent 3rd and 11th partials. 72-tone temperament also represents a departure from 53-tone

temperament, considered ideal by many music theorists, in the direction of 19-tone temperament, itself widely regarded with favor.

Although probably unrealistic for practical purposes because of the cumbersome number of tones required, 72-tone temperament is an excellent theoretical entity, worth bearing in mind as a possible meeting place between those who would base multiple division on 12-tone temperament and those who would look for other temperaments with superior acoustical properties.

A conceivable disadvantage of 72-tone temperament, as with all temperaments involving simple multiples of 12, is that the cycle of fifths does not embrace the entire system. Whether this constitutes a distinct liability or not would depend on the expectations of the musician employing the system. However, it should be noted that some musicians have postulated that the fifth should be a cyclic interval in any system, and Bosanquet eliminates systems based on multiples of 12 from his consideration for that reason. By Bosanquet's definition of regular systems (see below, chapter 5, page 70) neither 24-, 36-, nor 72-tone temperament is applicable.

The 96-fold division of the octave remains to all intents and purposes unexplored. Julian Carillo, in his Preludio a Cristobal Colón, claims to have written "the first composition in the world" in 16th tones. The 96-

division deals only with the unorthodox notation. In actuality the music is almost entirely limited in complexity to quarter-tones, with a few brief passages on one instrument in eighths of a tone. The work is for soprano (vocalizing), flute, violin, harp, quarter-tone fretted guitar, and octavina, a stringed instrument which is always played pizzicato and which, alone among the instruments, is briefly assigned eighths of a tone.

Above the figure 96 no further subdivision of 12-tone temperament has been proposed.