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Original Article

Научная статья

A Microtonal Analysis of Igor Stravinsky's Concept of Pitch and Its Resulting Scale

Микротональный анализ концепции высоты тона Игоря Стравинского и её итоговой шкалы

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Abstract. Igor Stravinsky towers as the most prominent composer of the 20th century. When asked on a television broadcast what the Maestro believed to be the next direction in music, Stravinsky claimed that it would be microtonality. The author of the article, who is a prominent specialist in microtonality, proposes a microtonal interpretation in performances of Stravinsky's musical compositions. He substantiates the validity of such an approach from Stravinsky's particular spelling of certain chromatic intervals in his musical works, which clearly infer certain intervals from the overtone series, as well as the composer's words pronounced in his written texts. What Stravinsky had in common with other musical geniuses of the 20th century and earlier times was the inner hierarchical ordering of a constellation of tonal relationships. However, each of these composers had a completely different model of idealized intonation constituted in their respective minds. The author's additional experience with microtonality was his thorough study of historical European and non-European alternate tunings and temperaments, as the result of which he has been able to determine which of them are appropriate for being employing in performing music by composers from past epochs, such as J.S. Bach, Mozart

Аннотация. Игорь Стравинский сохраняет позицию величайшего композитора XX века. Когда его однажды спросили, что маэстро считает следующим направлением в музыке, он ответил, что это будет микротональность. Автор статьи, известный специалист по микротональности, предлагает микротоновую интерпретацию в исполнениях музыкальных произведений Стравинского. Он обосновывает правомерность подобного подхода, ссылаясь на особое написание композитором некоторых хроматических интервалов в его сочинениях, ясно предполагающих определённые интервалы обертонового ряда, а также на высказывания композитора, опубликованные в его работах. Что роднит Стравинского с другими музыкальными гениями XX века и более раннего времени, это внутренний иерархический распорядок совокупности тональных соотношений. Однако у каждого из композиторов была своя собственная модель идеализированной интонации, сформированная в их умах. Дополнительный опыт автора в области микротональности состоит в доскональном изучении им исторических европейских и неевропейских строев и темпераций, в результате чего он смог определить, какие из них подходят для исполнения музыки композиторов прошлых эпох, таких как И.С. Бах, Моцарт и Бетховен.

and Beethoven. This provides additional substantiation for microtonal interpretations of performances of Stravinsky's music. Citing the northern Lithuanian folk music tradition as expressed in the Sutartines, as being close in its essence to the microtonal interpretation of the great composer's oeuvres, the author presents the 128-note-per-octave scale created by him for use in his own musical compositions, based on the extension of the overtone scale to the eighth octave as a viable tuning to apply to Stravinsky's music.

Keywords:

Igor Stravinsky, overtone series, higher harmonics, microtonality, bassoon, pitch, 128-note-per-octave scale

Это привносит дополнительное обоснование микротоновой интерпретации музыке Стравинского. Попутно упоминая Сутартинес — традиционные хоры северной Литвы — как близкие по сути микротоновой трактовке музыки великого композитора, автор представляет созданную им гамму из 128 нот в октаву и используемую в его собственной музыке, основанной на расширении обертонового ряда до восьмой октавы, как подходящий строй для применения к музыке Стравинского.

Ключевые слова:

Игорь Стравинский, обертоновый ряд, высшие гармоники, микротональность, фагот, звуковысотность, гамма в 128 нот в октаву

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Beginning the bassoon as a teenager, it wasn't long before I made the acquaintance of the greatest composer of the 20th Century through his music. The *Rite of Spring* with its famous opening bassoon solo was among my earliest classical music icons. The *Firebird* Berceuse solo is another bassoon solo worthy of mention. Igor Stravinsky seemed to know how to write for bassoon brilliantly.

When I have performed Stravinsky in my professional life, I never felt especially restricted to a "tuning system." The notes hollered and roared; they were not well behaved and contrite. I played the parts very much by ear to my section and to the winds generally, as opposed to responding to an intellectual decision determining which way to pitch sharps as opposed to their respective flats (e.g., *C#* vs. *Db*).

But along the way I found other 20th Century composers who vied for my attention, individual musicians plucked out of time, to include Harry Partch, Charles Ives, and Johann Sebastian Bach. Something each composer had in common, I came to discover, was an inner hierarchical ordering of a constellation of tonal relationships. Yet, each of these composers had a completely different model of idealized intonation constituted in their respective minds.

Any organ tuning Johann Sebastian Bach (1685–1750) was likely to use for his music was tuned to a well tempered arrangement. My book *Bach and Tuning*¹ examines tuning practices at the time of Bach and the great likelihood that he was consistent with the same tuning on organs, which today is called *Werckmeister III tuning* (although at the time it had no specific qualified name



other than well temperament). The *III* in its name is its actual position as third in an order of six monochords etched into a copperplate that was given with a purchase of the 1691 publication of Andreas Werckmeister's *Musicalische Temperatur*. In this temperament, Bach would have different sentiments available in different keys. There would be 39 different intervals in this well temperament, no doubt invented for keyboard improvisers to circumnavigate the 24 major and minor keys.²

Charles Ives's story is scandalous, with then teenager Elliott Carter reporting 40 years after the fact that he saw with his own eyes how Ives changed his dates, as well as switching his chromatics. Carter reported this to Beethoven biographer Maynard Solomon, who spread the gossip to The New York Times music critic Donal Henahan, that Charles Ives "was a cheat" who nefariously wanted to appear more dissonant in his scores, so as to appear as if he foreshadowed Europe in the new language of dissonance.³

Turns out the flats for Ives are intended to be pitched sharper than the flats according to the Pythagorean plan of intonation he had in mind, such that reading his revised notation properly demonstrates a chromaticism of 24 notes or more through the spiraling of pure fifths. New notes could be gained by spiraling additional fifths. Ives could imagine a personal model of idealized intonation in his mind which might be called extended Pythagorean tuning, and which has available to it a unique microtonal dimension of intervallic relationships.⁴ This intonation for the majority of Ives's music is in addition to notated quartertones, or even eighthtones.

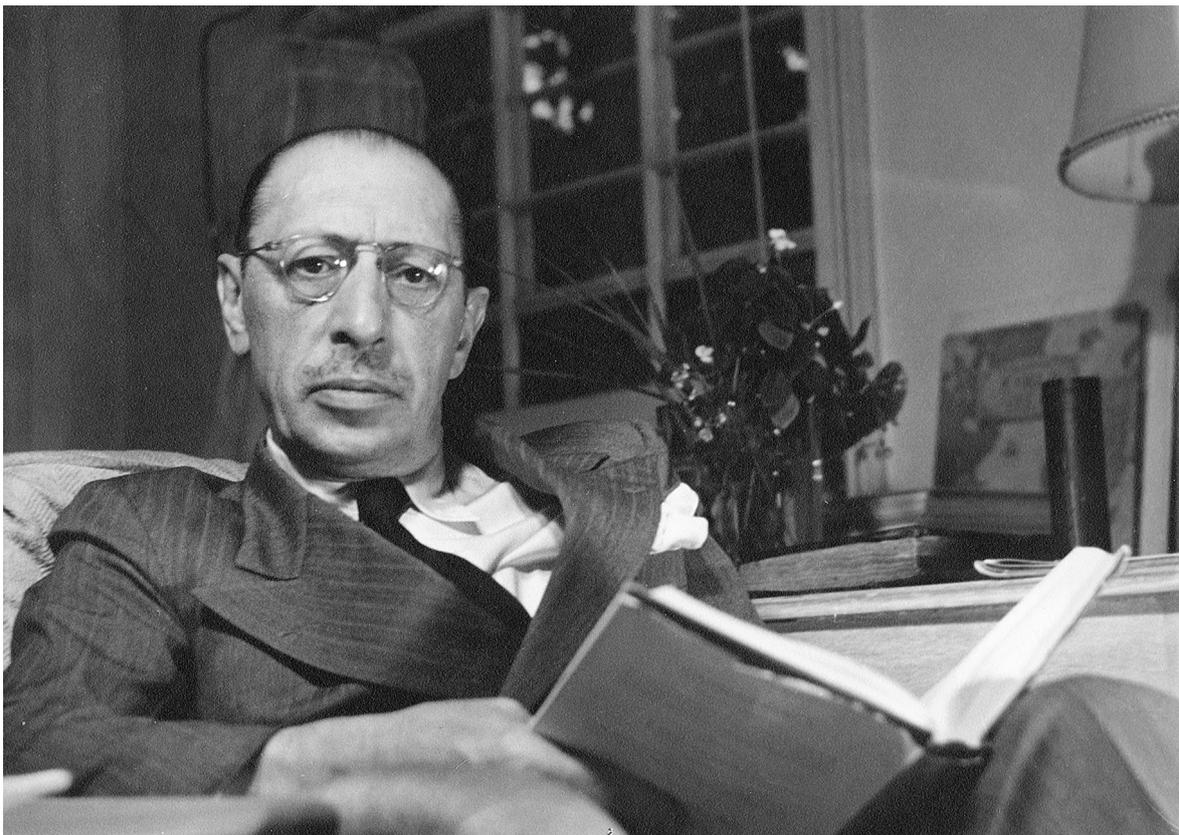
Igor Stravinsky would seem at first brush to be a twelve-tone equal temperament composer since he never said otherwise, and he favored the piano since an early age. The piano is after all the stereotypical 12-tone equal temperament instrument, what with its metal string inharmonicities, its blank nodes where the felted hammer strikes, its duplication and tripling of strings meant

to be identical, and its countless calculated countings of acoustical beatings by the rushed piano tuners.

However, a closer look reveals that Igor Stravinsky had a completely different model of idealized intonation in his mind. It was possible to deduce what his idealized tuning would be for future performances of his music, yes even the *Rite of Spring*. And of course, Stravinsky might even suggest his method to others for the future, but surely after he had left the scene.

Stravinsky never spoke of his music as 12 equal divisions of the octave. And like with Charles Ives, eight years his senior, a microtonal dimension of musical intervals appears in notation. Stravinsky indicated a difference in meaning between a notated *Db* and the notated *C#* found in close proximity. They are not treated as identical by any means, as seen in his voice leading, and in player interpretations. For Ives, the *C#* is higher in pitch than its chromatic neighbor *Db*, quite the opposite view than that of Stravinsky. How is this known? Through the study of tuning, it is known that the use of the overtone series as a source of knowledge of interval relationships mathematically measures the *C#* lower than *Db* by a distinct difference, every time.

Igor Feodorovich Stravinsky (1882–1971), by his own admission to his protégé Robert Lawson Craft (1923–2015), as heard in a televised interview of 1957, composed mainly at the piano. To hear Igor Stravinsky say it, "It was always about the piano," and his first career was as a pianist. Stravinsky went on to discuss his need to feel the vibrations of music tactilely as his primary reason for playing the piano. My emphasis on Stravinsky's active relationship to the physically felt vibrations on the piano is because it is not in any way associated with the concept of "equalness." Stravinsky simply admonished those listening to his voice to follow his earnest advice, "You have to touch the music, not only to hear it!" Stravinsky followed that with a theatrical demonstration, placing a pencil in his



*Photo 1. Igor Stravinsky
[photo © Boosey & Hawkes / Gene Fenn]*

mouth, only to lightly touch the tip of his pencil to the music stand of the piano, while playing. Stravinsky continued by speaking of his constant conducting around the world as being critical to his need to be physically connected to music vibration in his life.

Stravinsky's early study of scales was with a student of Rimsky-Korsakov, which he repeatedly described in the Interview with Craft as "very dull!" Stravinsky's disdain for harmony was reason enough for Nikolai Rimsky-Korsakov (1844–1908) to recommend that Igor Stravinsky not go on to the conservatory. In contrast, Stravinsky was rather in love with counterpoint. Even in his serialism, Stravinsky felt the tonal pull of his notes in his mind, if not always in what his ears heard back.

Robert Craft: Do you think of the intervals in your series as tonal intervals; that is, do your intervals always exert tonal pull?

Igor Stravinsky: The intervals of my series are attracted by tonality; I compose vertically and that is, in one sense at least, to compose tonally.⁵

When Craft specifically asked for the Maestro's definition of music, Igor Stravinsky was fully prepared to be precise and crisp conceptually. He replied, right on cue: "Music is an organization of tones, an act of human mind."

Stravinsky then pointed readily to a quote by philosopher Arthur Schopenhauer (1788–1860), who he claimed was speaking about music when Schopenhauer wrote about that consciousness: "And the musical tones inhabit, and form a universe of their own, and with the human mind has created the materials, introduced them to order."⁶

Neither Ives nor Stravinsky could get past the imagination phase, to transcend as Ives intimated. Harry Partch was able to do so,



and wrote a book, *Genesis of a Music*,⁷ on how he manifested the tuning specificities of his original compositions. Partch's system of "monophonic fabric" was reduced to a 43-note scale. It was clearly a completely different model of idealized intonation he constituted in his mind, a model based on the 11th harmonic limit of the overtone series, and its relative undertone series, in what is called "11 limit just intonation." With Partch there is finally the ability for a composer to hear original music compositions performed successfully in their intended idealized intonation.

In publishing a book chapter titled, "Some Musical Questions" from *Memories and Commentaries*, Robert Craft once again prepared questions for the Maestro to answer, for publication. This time, Stravinsky advanced his ideas about pitch in a rare and unique manner.

Robert Craft: Is any musical element still susceptible to radical exploitation and development?

Igor Stravinsky: Yes, pitch. I even risk a prediction that pitch will comprise the main difference between the 'music of the future' and our music, and I consider that the most important aspect of electronic music is the fact that it can manufacture pitch. Our mid-twentieth century situation, in regard to pitch, might perhaps be compared to that of the mid-sixteenth century, when, after Willaert and others had proven the necessity of equal temperament, the great pitch experiments began — Zarlino's quarter-tone instrument, Vicentino's thirty-nine-tones-to-the-octave archicembalo, and others. These instruments failed, of course, and the well-tempered clavier was established (though at least three hundred years before Bach), but our ears are more ready for such experiments now-mine are at any rate. I had been watching the Kuramatengu play in Osaka one afternoon recently and had become accustomed to the Noh flute. Later in a restaurant, I suddenly heard an ordinary

flute playing ordinary (well tempered) music. I was shocked, music apart — I think I could keep the music apart anyway — by the expressive poverty of the *tuning*.⁸

Stravinsky's prediction of future radical advances in pitch was tongue in cheek, for he was well aware of the contemporary microtonal achievements by such 20th century pioneers as Harry Partch, Ivan Wyschnegradsky, Julián Carrillo, and Alois Hába. But rather than acknowledge any success to them, he preferred an answer meant to supersede them. Admittedly, no one previously had conceptualized straight up harmonics in a public way in his lifetime, who might have caught his attention. Harry Partch was disqualified because he used an undertone series to profoundly affect the results. And Stravinsky did not himself utilize electronics to hear back the higher relationships of the overtone series. He could only imagine them, perhaps with Lithuanian folk music influence.

That Stravinsky chose "pitch," exclusively, as the musical element to watch for the future for music matches well my own musical investigations. Music has indeed moved enormously through new tuning systems and approaches. By not mentioning his specific preferences, as both Bach and Ives did not, Stravinsky kept close to the vest his personal side of music making. Personal, yet primary, based on his microtonal response to Robert Craft's open-ended question. No doubt hedging his bets, Stravinsky's prediction was already becoming a reality in his lifetime. Stravinsky sought to give a historical perspective to his predictions about pitch: "Our mid-twentieth century situation, in regard to pitch, might perhaps be compared to that of the mid-sixteenth century, when, after Willaert⁹ and others had proven the necessity of equal temperament, the great pitch experiments began — Zarlino's quarter-tone instrument, Vicentino's thirty-nine-tones-to-the-octave archicembalo, and others."

The second historical name that Stravinsky drops in regard to pitch is Gioseffo Zarlino (1570–1590), Nicola Vicentino's teacher. Zarlino was an ethnic Italian, the catalyst for the beginning of the first non-Flemish dynasty of Renaissance composers. Zarlino was known to favor 2/7ths comma meantone, as compared with the garden variety quarter-comma meantone of the Flemish composers. Most importantly, Zarlino acknowledged his support for the use of equal temperament for fretted instruments. I had been unfamiliar with any specific quartertone instruments devised by Zarlino. However, a simple Google search will bring up "Zarlino's quartertone instrument."¹⁰

Nicola Vicentino (1511–1575) was infamous in his lifetime as a microtonal musician, someone who added smaller relationships to the cultural pitch palette, including his building two multi-keyed keyboards. Vicentino positioned a dot above a note to indicate a slight sharpening of pitch, measured at less than a quartertone, although thought of generically throughout history as a quartertone simply for its diminutive size. Stravinsky was incorrect with his statement that Vicentino designed a archicembalo with "39 tones to the octave" as the instrument actually only had 36 keys total, as did a second instrument built by Vicentino.¹¹ Although, most modern scholar musicians interpret Vicentino's music through a 31-tone equal temperament lens, a tuning invented and promulgated by Christiaan Huygens in the Baroque era, designed to serve as a circular quarter comma meantone, Nicola Vicentino's aim was to rediscover the microtonal intonation of the ancient Greeks.

Stravinsky was correct that these extra-keyed instruments were one-offs, and might be seen today only in museums, or through recent reconstructions. Knowledge of the well temperament of Bach was understandably substituted with modern equal temperament, even in Germany. Well temperament offers different sentiments in different keys, 39 different intervals per

octave in Werckmeister III, while equal temperament has identical keys and is as such, redundant.

Stravinsky's rude comment about electronics is telling. By stressing that "the most important aspect of electronic music is the fact that it can manufacture pitch," one is both immediately drawn into the wonder with which modern electronics and computers have revolutionized music, along with its intrinsic microtonal potentiality, but also to Stravinsky's paucity of electronic works as somewhat anathema to his acoustic based aesthetic.

Most exciting is Stravinsky's rejoinder to present day circumstances regarding new adventures with pitch. "[B]ut our ears are more ready for such experiments now — mine are at any rate." My life has certainly improved my ear to the point that I work in a tuning named 128 tuning. It is based on a scale of the 128 notes found in the eighth octave of the overtone series above a single fundamental pitch, usually "A" for its commonality for tuning instruments and for the ease of naming by letters. After 15 years of work in making 128 music, there are now several albums exclusively in 128 tuning, as well as new works by prominent contemporary composers, internationally.

Stravinsky's signals that he "is ready" for pitch experimentation. Since his passing, microtonal music has been in ascendancy, and it is possible now for anyone to purchase the appropriate reasonably affordable synthesizer to admit the new microtonal vocabulary to the body of music. His admission here that he, at least, is ready, hints of the loneliness of his continual musical journeys. When he was a student of Nikolai Rimsky-Korsakov in St. Petersburg, Russia, he was in a fertile environment, surrounded by others eager to imagine intonationally on a grand scale. Stravinsky's music would remain in conventional notation, but it would permit a harmonics interpretation, with a 128 tuning interpretation, possible by the existence of a scale formed by the eighth octave of the overtone series.



Hermann von Helmholtz's famous book *On the Sensation of Tone*,¹² expected to have been in the personal library of Charles Ives, demonstrated that modern conventional notation allowed for three (3) different interpretations of its symbology:

1. Conventional equal temperament interpretation allows for a common pitch for sharps and their nearest flats.
2. *Meantone and just intonation* interpretation, wherein sharps are pitched lower than their nearest flats. And
3. *Pythagorean tuning* interpretation in which sharps are pitched higher than their nearest flats. Charles Ives idealized #3, and I propose that Igor Stravinsky idealized #2, but to imagine higher harmonics than had previously entered much of contemporary theory, practice, or research.

When Stravinsky brought up his observance of a Japanese Kuramatengu play in the widely viewed television broadcast interview, he wasn't expecting his listening audience to be familiar with that particular type of musical presentation, with its distinctive sounding Noh flute. Rather, he was emphasizing that his prediction of pitch was deeply anchored in world music, and neither restricted to either the present day, or to European culture. The world of cultural microtonal music included, but was not limited to, Dastgah (Iran), Maqam (Egypt, Turkey, Syria), Pelog & Slendro (Indonesia), Higher Harmonics (Lithuania), and Equiheptaphonic-7-tone equal temperament (Thai, North Solomon Islands, Puna of Panama).

Stravinsky then announces he has the mental ability to strip the Japanese Noh flute of all its cultural accoutrements, to the exclusion of pitch expressivity, so that he can compare them in his mind, one abstract tuning to the next. Here we have evidence of Stravinsky's ability to abstractly retain and compare two different flute traditions, separated by the passing of several hours, for their expressivity, all while mentally removing other musical considerations. Stravinsky's last sentence is startling coming

from a European composer, as he found modern tuning left him wanting: "I was shocked, music apart — I think I could keep the music apart anyway — by the expressive poverty of the *tuning*¹³."

As for the use of 128 tuning, found ordered in the eighth octave of the overtone series, I offer the following evidence for its appropriateness. As Stravinsky used chromatic notation it is only possible to be taken literally with the acceptance of greater than 12 notes in an octave, and considered these intervals to be in his musical vocabulary. Yet Stravinsky did use equal temperament. 128 tuning provides for a major third positioned in the overtone series 3 cents flat of equal temperament, a perfect fourth tempered only 1 cent lower than an idealized equal temperament interval, and an exact tritone in equal temperament to within a fraction of a single cent from a harmonic.

The simple use of the tritone in equal temperament, measured at less than a cent in difference from the position of the 181st harmonic, is comfortably within 128 tuning which reaches to the 255th harmonic. As the best representative of the harmonic series of all the notes in 12-tone equal temperament, the tuning Stravinsky expected to receive in his performances, Stravinsky nevertheless uses the tritone as a consonance in the opening of the *Rite of Spring*. After an outline of *A minor* in the unaccompanied bassoon solo, the melody at last resolves to *D#* — the tritone — as a comfortable and pleasant consonance. A *D#* interpreted as a precise 180th harmonic is 10 cents flatter at 590 cents than the equal temperament *Eb* at 600 cents.

The interval that first alerted me to the possibility of understanding Stravinsky through a microtonal lens was his consonant use of the tritone. The tritone, the result of bisecting an octave, had been used by other composers besides Stravinsky as a consonance, certainly by jazz musicians who modulate by tritones. Leonard Bernstein's *West Side Story*'s famous Maria melody

has a tritone as its second interval, which is always sung lovingly and without any accent. Tritones, treated as a traditional dissonance, are typically accented. “Maria” is distinctive in its use of a consonant tritone in a song.

Leonard Bernstein’s broadcast of his Harvard Lectures titled *The Unanswered Question* maintained that the piano was representative of the overtone series, with nary a mention of its classic equal temperament (although he did mention “theoretical” microtonal music more than once). Bernstein spoke sparingly about higher overtones, although he did argue for the 19th harmonic (which he confused with the 18th harmonic) as the basis for Western music’s origin for the modern minor third. The minor third is traditionally taught as arriving from an undertone derivation. In contradistinction, Bernstein properly acknowledged that major and minor thirds occur simultaneously in the overtone series, with the minor third described as “sad” precisely because it is so far away from the fundamental when it first appears. The 19th harmonic is only two cents shy of modern equal temperament at 298 cents and is represented well in 12 edo (equal divisions of the octave) at 300 cents, especially when vibrato is involved in playing the notes

The major third of equal temperament is historically claimed as the fifth harmonic tempered 14 cents sharp into a value of 400 cents, to which an orchestra with the stature of the New York Philharmonic tunes. 14 cents is quite a bit of stretching for a harmonic to be tempered, so much so that I question whether we indeed need to look for a different source. As it happens, the 161st harmonic at 397 cents only needs to be tempered sharp three cents. Despite the newness of the number 161, this interval makes much more sense as the true modern source of the major third. (The 5th harmonic is no doubt beautiful and useful for early music, and for producing the 6/5 minor third which was constructed by the utilization of an undertone series.)

The minor sixth is best represented by the 203rd harmonic. Equal temperament’s minor sixth is tempered two cents higher in temperament. The major sixth is best represented by the 215th harmonic, this time tempered two cents lower in temperament.

The perfect fourth in equal temperament is measured at 500 cents. Early music produced the *raison etre* for its perfection as due to its derivation in the undertone series, and as the result of the subtraction of a perfect fifth taken from an octave, leaving a historic perfect fourth at 498 cents. However, the 171st harmonic is only a single cent sharper than equal temperament at 501 cents, not even noticeable to traditional listeners.

The major seventh is best represented by the 121st harmonic at the end of the seventh octave of the overtone series, and equal temperament’s version has tempered it sharp by 3 cents. Fundamentally, there are 5 out of 12 notes of 12-tone equal temperament found as harmonics exclusively in the eighth octave of the overtone series, and they are already a part of contemporary music practice. These are the major third, perfect fourth, major sixth, minor sixth, and the tritone. 128 tuning removes all traces of temperament from contemporary music and is meant as an advancement in music in the spirit of Stravinsky’s emphasis on pitch.

The minor second is best represented by the 17th harmonic in 128 tuning, placing it five cents sharper than equal temperament. (It would be one cent lower than a 271st harmonic from a projected ninth octave of the overtone series, but that entails a projected 256 tuning). My composition *Asteroid Belt* for cello makes exclusive use of the virgin notes of the ninth octave of the overtone series.¹⁴ In 128 tuning the leading tone semitone of *G#–A* has 14 different possible intervals to choose from, as compared to the lowest semitone of *A–Bb*, befitting its role as a leading tone.

The minor seventh is best represented in 128 tuning by the 57th harmonic at 1001 cents. (See a complete list of all 128 pitches in an attachment at the end of this paper.) Equal



temperament tempers the minor seventh found in the overtone series flat by a single cent. The major seventh is best represented by the 121st harmonic which is measured at 1103, only 3 cents tempered down to the 1000 cents of equal temperament.

Lastly, the major second is measured at 205 cents by virtue of the 9th harmonic and

may be notated by a B natural (or an *H* in German). With the whole tone we have it tempered the 5 cents flat.

Table 1 shows Igor Stravinsky’s scale in higher harmonics (24 total notated pitches used in his scores) which I derived through tuning to the 8th octave of the overtone series (128).

Table 1. Igor Stravinsky’s Scale in Higher Harmonics (24 Total Notated Pitches Used in His Scores)

Notated Pitch	Cents Value	Harmonic	Interval	Tempered to ET
A (ET)	= 0	1	unison	identical
Bbb	= 13	129	sixteenth tone	+ 13
A#	= 92	135	small semitone	+ 8
Bb (ET)	= 105	17	semitone	- 5
Cb	= 192	143	minor whole tone	+ 8
B (H) (ET)	= 204	9	major 2nd	- 4
B#	= 286	151	small minor third	+14
C (ET)	= 298	19	minor 3rd	+ 2
C# (ET)	= 397	161	major 3rd	+3
Db	= 408	81	Pythagorean ditone	- 8
Cx	= 491	85	major “fourth”	+ 9
D (ET)	= 501	171	“perfect” 4th	- 1
D#	= 590	45	D# tritone	+ 10
Eb (ET)	= 600	181	Eb tritone	less than a cent off
Fb	= 693	191	1/6th comma meantone 5th	+ 7
E (ET)	= 702	3	perfect 5th	+ 2
E#	= 790	101	small minor sixth	+10
F (ET)	= 798	203	minor sixth	+ 2
F# (ET)	= 898	215	major sixth	+ 2
Gb	= 906	27	Gb	- 6
Fx	= 992	227	small minor seventh	+ 8
G (ET)	= 1001	57	minor 7th	- 1
G# (ET)	= 1103	121	major 7th	- 3
Ab	= 1110	243	big major 7th	- 10
Gx	= 1193	255	pre-octave	+ 7

One piece of aural evidence is a miniature bassoon duet by Igor Stravinsky titled *Lied Ohne Name* (1918), published by Boosey & Hawkes (1979). I first played the one-page score in NYC, recording it with my colleague, bassoonist Sara Schoenbeck.¹⁵ It has both the *C#* and the *Db* working tonally as distinctive. (Incidentally, the *C#* used in the performances used the 5th harmonic instead of the 161st harmonic, making for an even warmer performance.)

The evidence continues with a solo recital I gave at the Nicolai Rimsky-Korsakov Home Museum in St. Petersburg in 2012 at the invitation of musicologist Lidia Ader (see Il. 1). During the Sunday Recital, I asked

the full audience if I might be permitted to perform Stravinsky's *Leid Ohne Name* (*Song Without Name*) for them twice, once in conventional tuning, and once in 128 tuning. And with their eager approval, I continued to everyone's evident amazement to demonstrate the "expressive" difference in the music, this time with Russian bassoonist Rezeda Gabdrakhmanova (see photo 1). (I had previously compiled a book of bassoon fingerings in 128 tuning for the bassoon based on an A = 440 and could pass this to other bassoonists for study.) The comparison of the two versions to the Russian concert goers was clear, as was their obvious preference for their collective 128 experience.



Il. 1. St. Petersburg Recital Poster
[designed by Ciarán Ó Meaícar]



*Photo 1. Bassoonists Johnny Reinhard (the author)
and Rezeda Gabdrakhmanova
play Igor Stravinsky's "Lied Ohne Nahme"
in higher harmonics at Rimsky-Korsakov Home Museum,
St. Petersburg, Russia
[photo credit: the author]*

I can indeed imagine all of the great works of Stravinsky being performed in the future within a microtonal dimension. In fact, since writing a paper at Columbia University, *Phenomenology and its Application to Microtonal Music*, I believed all music was “microtonal.” After all, I was in the Ethnomusicology department of the General School of Graduate Studies and I would define microtonal music as if it was a universal, except for 12-tone equal temperament. After 40 years of directing the American Festival of Microtonal Music Inc. in New York City (since 1981), I developed a definition of microtonal music for the new virtual microtonal university that started September 2021 on Zoom. This definition permits me to see Igor Stravinsky as a microtonalist in spirit even as he never produced a piece of obvious microtonality

in his lifetime. And now I can confidently state the following: all music is microtonal music cross-culturally. Twelve-tone equal temperament is, in itself, a microtonal scale, only it enjoys exorbitant attention and hegemonic power, so we focus on the other tuning arrangements.

Of course, I recognize the liberties that a talented modern orchestral musician may take in order to acquire greater expression in the playing of a piece of music, often starting with instrumental tone. However, as with the short Stravinsky bassoon duo *Leid Ohne Name* previously demonstrated, *Firebird* and the *Rite of Spring* would also benefit from losing its tempering, the deliberate out-of-tune-ness inflicted for an earlier historical compromise, for the powerful justness of 128 tuning’s intonation (see Il. 2 and Il. 3, and Table 2).

Fagotto I.

Il. 2. “Berceuse” from Igor Stravinsky’s “Firebird” for bassoon

Left Hand	1 bis, 1, 2, 3, 4 ● 10-12 ● 13-14 ● 9 5 ● 19, 20, 20a 6 ● 15, 22 7 ● 21 8 18, 17, 16	Right Hand
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Il. 3. Bassoon Template



Table 2. Bassoon Fingerings and Grippings for the Melody of Stravinsky’s “Berceuse”

FINGERING														
No B-hole			A key rim											
17	13		7											
9	5		18											
<i>Bb</i>	low <i>F</i>		<i>B</i>											
DEVIATIONS IN CENTS														
+5	+8		-8	0	+5	+1	+5	0						
NOTE NAMES														
<i>Bb</i>	<i>Db</i>		<i>Cb</i>	<i>Eb</i>	<i>Bb</i>	<i>D</i>	<i>Bb</i>	<i>Eb</i>						
INTERVALS														
303		216		308		705		406		396	495			
CONTINUING MELODY:														
			3		A key rim									
			6		7									
No 13		13		18				No 13						
<i>F</i>		<i>E</i>		<i>B</i>				<i>F</i>						
+5	-2	-7	0	-8	0	+2	-2	-7	0	0				
<i>Bb</i>	<i>F</i>	<i>Fb</i>	<i>Eb</i>	<i>Cb</i>	<i>Eb</i>	<i>E</i>	<i>F</i>	<i>Fb</i>	<i>Eb</i>	<i>Eb</i>				
703		109		93		382		382		98	96	105	93	0

128 tuning allows for the simultaneity of any and all of its pitches, in any combinations, to have the sensibility of being a single chord. The greater counterpoint provided by the added microtonal vocabulary removes the dull identity-less harmonies of conventional equal temperament that Stravinsky found boring and dull. The full Gestalt of an harmonics-rich tuning, on top of the already established brilliance of Stravinsky’s imaginative rhythms and orchestration, further enriches the charms of tonality.

Thanks to Richard Wagner,¹⁶ any other composer to follow in his tradition, certainly someone who sat at the piano to compose, would find each note related to every other note in a unified field theory for harmony

using the tuning system of 12-tone equal temperament.

Finally, it is the power of Slavic and Baltic folk musics that provided the true foundation needed to bring out his musical ideas, although Stravinsky was known to credit his dreams at night for his font of creative ideas. It just so happens that there is a particular Baltic folk music that is rich with higher harmonics. Young Igor Stravinsky likely picked up on the higher harmonic microtonal music of Lithuanian folk music, as he paid attention to these European roots throughout his youth.

According to Lithuanian composer and scholar Vytautas Germanavičius and his recent July 3, 2021 Zoom presentation titled: *Identification of Microtonal Intervalllic*

Relations in Lithuanian Vocal and Instrumental Folk Music and their Application in Music Composition (as part of the Salzburg, Austria based Ekmelic Conference held virtually in 2021), folk music in his country may normally reach the 31st harmonic in the polyphonic

popular North Lithuanian Sutartinės (see Table 3). Using a *Melodyne* instrument, Vytautas Germanavičius analyzed numerous Lithuanian music types for their specific harmonic identities, and generously shared his data for this paper.

Table 3. Number of Harmonics Identified in Recorded Samples of 39 Sutartinės, 34 Monodies, 16 Horns, 7 Panpipes, 3 Kanklės (Stringed Instrument)

Harmonics:	1	3	5	7	9	11	13	17	19	21	23	25	27	29	31
Sutartinės:	39	2	3	1	1	1	8	4	2	1	1	5		13	1
Monodies:	34	4	2		2	5	2	3	5	6	1	2		7	
Horns:	16	1	4	2			3	1	1	4	1			3	
Panpipes:	7	1	1		1	2	1							1	1
Kanklės:	3	4	2												

The lecture further discussed Lithuanian wooden trumpets that are pre-tuned to higher harmonic proportions. The instruments are rather solid so that children can readily play them, and they are an old part of the Lithuanian culture. The concept, as I understand it is that people learned to sing these same higher harmonic instrument relationships from the pre-tuned wind instruments, only to expand upon them. Germanavičius found higher harmonics were the most common: “In this table you can see the number of overtones with their serial numbers that were detected and calculated when analyzing the vocal and instrumental music samples. I identified the most common 9 overtones Nos. 29, 13, 21, 17, 19, 25, 3, 11, and 5 (Bb^+ , $G\#^+$, $-F$, $C\#$, Eb , $G\#^+$, G , F^+ , E) and additionally 5 microtonal overtones Nos. 29, 13, 21, 25, 11 (Bb^+ , $G\#^+$, $-F$, G^+ , F^+) in vocal music, as well as not so frequently used overtones Nos. 7, 23, and 31 ($-Bb$, $-G$, B^+). For instrumental music were

identified 3 microtonal overtones Nos. 29, 21, and 13 (Bb^+ , E^+ , $G\#^+$). And for all samples commonly used microtonal overtones are Nos. 29, 21, and 13 (Bb^+ , E^+ , $G\#^+$).¹⁷

Lithuanian folk song motifs and music ideas posted from Juška’s Anthology correspond to Igor Stravinsky’s melodies in *The Rite of Spring* as identified by prominent contemporary musicologist Richard Taruskin (1996) (see Il. 3).¹⁸

Lithuanian musicologist Rūta Stanevičiūtė has recently written about microtonal music from a Lithuanian perspective. In the published article *Microtonal Music: From the Baltic to the Adriatic and Beyond the Atlantic* Rūta Stanevičiūtė focuses on the greater question of new pitches, not dissimilar to that of Igor Stravinsky, and also with the power of the Lithuanian folk tradition in harmonics behind them.¹⁹

I am grateful to have had the opportunity to have been quoted as a feature on just that very question, the future of pitch, in



No. 157

Tu, mi - nu se - se - ré - lé
 Še se lé gul bu že le! Kad no - ti
 var gė varg ti te kek už bau džiau nin kė.

No. 787

Kad aš e - jau par dva - rė, aš ti - ja - nuj
 "La bu diė - nė" ma li ju - nas ko - kė.

No. 142

Tė - vu - žė - li ma - nu! Sen - gal - vė - li ma - nu!
 Lejs k ma - nę, tė - ve - li j dva - rė scu žy - ti.

No. 249

O kad aš bu - vau jau - nas ne - ve - dęs,
 a! a! a! a! vis mer - ge - les my - lė - jau.

No. 271

O kad aš gė - riau, pa - si - ge - riau;
 j sta - kies šė - dau, pa - svi - rė - jau.

No. 409 (model for leaping grace notes)

Pa - si - sė - jau a - vi - žu - pri - nu te - vu dir - ve - lę;

Introduction to Part I

For.
solo ad lib.

Vėsnijė gadanija ("Les Augures printaniers"), [19]

For.
 Sketchbook, p. 3

Igra umikanija ("Jeu du rap"), 3 after [27]

Tromba piccola in re
 Sketchbook, p. 7
 cf. 1 after [46]

Vėsnijė khorovodė ("Rondes printanières"), [48]

Es clar.
 Bass clar. (sta.)

Sketchbook, p. 7 (zapėranijė khorovodėnėje [Khorovod incantation])

Il. 3. Lithuanian folk songs from Juška's anthology
 corresponding with Stravinsky's melodies
 in "The Rite of Spring" identified by Taruskin

[Source: Lithuanian folk songs from Juška's anthology corresponding with... |
 Download Scientific Diagram (researchgate.net)]

the Stanevičiūtė article published by the Lithuanian Music Centre: "Our ears are expanding in correspondence with our minds and appreciating finer degrees of musical intervals is a natural consequence. Hegemonic 12-tone equal temperament was the opposite direction having reduced our appreciation of intervallic specialness in lieu of uniformity of irrationality."

"Eighth Octave of the Overtone Series Tuning," otherwise known as "128 tuning" for its number of pitches in the scale is ideal for its inclusion of 12-tone equal temperament relationships. As indicated in Robert Craft's innocent question, 128 tuning is exactly the answer to the "radical exploitation" of pitch for which Stravinsky opined.

ATTACHMENT

128 Notes of Eighth Octave Overtone Tuning

Harmonic	Cents	Name of interval
1	0	unison
129	13	sixteenthtone
65	27	eighthtone
131	40	smaller quartertone
33	53	quartertone
133	66	large quartertone
67	79	small semitone / 3-eighthtones
135	92	minor semitone
17	105	Bb, major semitone
137	118	large semitone
69	130	big semitone
139	143	small three quarters of a tone
35	155	large three quarters of a tone
141	167	diminished whole tone
71	180	small whole tone
143	192	minor whole tone
9	204	B, major whole tone
145	216	large whole tone
73	228	whole plus eighthtone
147	240	5ET diesis
37	251	five quarters of a tone
149	263	diminished minor third
75	275	low minor third
151	286	small minor third
19	298	minor third
153	309	low just minor third (referencing 316)
77	320	high just minor third (referencing 316)
155	331	large minor third
39	342	big minor third
157	354	neutral third
79	365	tiny major third
159	375	eighthtone flat major third
5	386	C#, just major third
161	397	ET major third
81	408	Pythagorean ditone
163	418	large Pythagorean ditone
41	429	Db
165	440	small quartertone sharp major third
83	450	quartertone sharp major third
167	460	tiny fourth
21	471	low fourth
169	481	minor fourth
85	491	major fourth
171	501	ET perfect fourth



43	512	perfect fourth, D
173	522	fourth plus comma
87	532	fourth plus a fifth tone
175	541	fourth plus small quartertone
11	551	eleventh harmonic
177	561	tiny tritone
89	571	low tritone
179	581	minor tritone
45	590	D#
181	600	Eb, ET tritone
91	609	large tritone, Eb in tonal music
183	619	big tritone
23	628	eighthtone high tritone
185	638	quartertone and sixteenth flat dominant
93	647	quartertone flat dominant
187	656	tiny dominant
47	666	small dominant
189	675	eighthtone low dominant
95	684	irregular perfect fifth
191	693	sixth comma flat fifth
3	702	perfect fifth
193	711	poodle fifth
97	720	large fifth
195	729	howling dominant
49	738	sixthtone high dominant
197	746	three quartertones high perfect fifth
99	755	quartertone high perfect fifth
199	764	quartertone and 16th tone high fifth
25	773	quartertone and eighthtone high fifth
201	781	almost minor sixth
101	790	tiny minor sixth
203	798	ET minor sixth
51	807	minor sixth
205	815	just minor sixth
103	824	large minor sixth
207	832	big minor sixth
13	841	thirteenth harmonic
209	849	quartertone high minor sixth
105	857	quartertone plus minor sixth
211	865	almost major sixth
53	874	tiny major sixth
213	882	small major sixth
107	890	just major sixth
215	898	ET major sixth
27	906	major sixth
217	914	sixthtone high major sixth
109	922	eighthtone high major sixth
219	930	eighthtone and 16th tone high major sixth
55	938	large major sixth

221	945	big major sixth
111	953	three quartertone sharp major sixth
223	961	small harmonic seventh
7	969	harmonic seventh
225	977	large harmonic seventh
113	984	tiny minor seventh
227	992	small minor seventh
57	999	G, minor seventh
229	1007	large minor seventh
115	1015	big minor seventh
231	1022	double perfect fourth
29	1030	eighthtone high major seventh
233	1037	eighth- and 16th tone high minor seventh
117	1044	three-eighths flat major seventh
235	1052	quartertone flat minor seventh
59	1059	tiny major seventh
237	1066	diminished major seventh
119	1074	eighthtone flat major seventh
239	1081	small major seventh
15	1088	major seventh
241	1095	large major seventh
121	1103	ET major seventh
243	1110	big major seventh
61	1117	Ab, large minor seventh
245	1124	eighthtone plus major seventh
123	1131	leading tone major seventh
247	1138	sharp leading tone major seventh
31	1145	hyper leading tone major seventh
249	1152	quartertone flat octave
125	1159	three-eighths flat octave
251	1166	eighthtone flat octave
63	1173	small octave
253	1180	comma flat octave
127	1186	dipped octave
255	1193	preoctave



NOTES



¹ Reinhard J. Bach and Tuning. *Sources and Studies in Music History from Antiquity to the Present*. Vol. 47. Frankfurt am Main: Peter Lang Verlag, 2016. 297 p.

² Ibid.

³ Henahan D. “Did Ives Fiddle with the Truth?” *The New York Times*, February 27, 1996.

⁴ See more: Johnny Reinhard. *The Ives Universe*. Academia.org, Lambert Press, 2004. 128 p.

⁵ Craft R. “Some Musical Questions” from

Memories and Commentaries, Doubleday & Co., Garden City, (1959) 2009, pp. 115–116.

⁶ Schopenhauer A. *The World as Will and Representation*, translated from the German by E.F.J. Payne, in 2 Volumes. Dover Publications, New York, 1966. 694/1246 p.

⁷ Partch H. *Genesis of a Music: An Account of a Creative Work, Its Roots and its Fulfillments*. A DaCapo Paperback, Second Edition, New York (1949) 1974. 544 p.



⁸ Craft R. “Some Musical Questions” from *Memories and Commentaries*, Doubleday & Co., Garden City, (1959) 2009. 154 p.

⁹ Adrian Willaert (1490–1562) was the prominent Flemish composer who was part of a dynasty of Dutch speakers in the Mediterranean, and who was preceded by Dunstable, Binchois, Dufay, and Tinctoris. Their revolution in tuning was through meantone tuning, which followed the Pythagorean tuning of spiraled fifths from the Middle Ages. The obvious exception was for fretted and strummed instruments such as the lute. Willaert is credited with a single composition that is said to have been designed for equal temperament. [Historical Temperaments, Intonation & Singing (davidfriddle.com)] Adrian Willaert confounded supporters of Pythagorean and Just intonation with his four-voice piece ‘Quid non ebrietas,’ written in 1519. Willaert intentionally wrote it so that performers would constantly run into musical commas, each setting the singers slightly off course. When sung in Pythagorean tuning, the melody concludes with a disastrous leap, slightly larger than a pure octave. Just Intonation produces a final octave leap too narrow. He designed the music to fail with either system; rather, he espoused a radical new tuning – what we today call equal temperament.

¹⁰ See more: Denzil Wraight. *Zarlino’s 24-Note Harpsichord Built by Domenico da Pesaro, 1548*. URL: <https://denzilwraight.com/24note.htm> (access date: 11/12/2021).

¹¹ The scales of the two instruments are identical, comprising thirty-six physical keys that are organized into two keyboards, each with three rows of keys. The Venetian organ builder Vincenzo Colombo built these instruments on Vicentino’s commission. No historic specimen survives, but thanks in part to diagrams and descriptions that Vicentino published in *L’antica musica* and in another document, *Descrizione dell’Arciorgano* (1561), modern reconstructions have been possible. See more: [Microtonal Keyboard Instruments in Early Modern Europe | Sound & Science: Digital Histories](#).

URL: <https://soundandscience.de/contributor-essays/microtonal-keyboard-instruments-early-modern-europe> (access date: 13/12/2021).

¹² Helmholtz H., von. *On the Sensation of Tone*. Trans. by Ellis A. Dover Publications, Mineola, NY, 2013. 608 p.

¹³ The italics for the word “tuning” in the quote belong to either Stravinsky or the publisher. They are not mine.

¹⁴ *Asteroid Belt* was premiered by cellist Dave Eggar on September 5, 2021 on opening day of Microtonal University over Zoom.

¹⁵ It has since been released as a video on the AFMM channel on YouTube. See more: Igor Stravinsky. *Lied Ohne Name*. URL: <https://www.youtube.com/watch?v=29LyoE77IyE> (access date: 09/12/2021).

¹⁶ “Wagner may have been Stravinsky’s *bête noire* but, like all great artists who came after Wagner, Stravinsky benefitted from Wagner’s model, even if he rejected his aesthetic.” See: Broening J. *A Violent Luxury: Robert Craft and Igor Stravinsky*. *The New English Review*. March 2018. URL: <https://www.newenglishreview.org/articles/a-violent-luxury-robert-craft-and-igor-stravinsky/> (access date: 11/25/2021).

¹⁷ Only a few days after the Lithuanian harmonics lecture, composer scholar Ben Lunn in Scotland sent me two YouTube videos, which serve as great ambassadors to the rich treasure of higher harmonic folk music. My thanks to Ben Lunn for providing these links: <https://www.youtube.com/watch?v=JXPZYU-xzU> (wooden trumpets) and <https://www.youtube.com/watch?v=zeEnhlRteiA> (a cappella voices).

¹⁸ See source: https://www.researchgate.net/figure/Lithuanian-folk-songs-from-Juskas-anthology-corresponding-with-Stravinskys-melodies-in_fig2_321821601 (access date: 11/30/2021).

¹⁹ Stanevičiūte R. *Microtonal Music: From the Baltic to the Adriatic and beyond the Atlantic*. *Lithuanian Music Centre*. URL: <https://www.mic.lt/en/discourses/lithuanian-music-link/no-23-january-december-2020/ruta-staneviciute-microtonal-music-from-baltic-to-adriatic-and-beyond/> (access date: 12/22/2021).

SOURCES

1. Berger A. Problems of Pitch Organization in Stravinsky. *Perspectives on Schoenberg and Stravinsky*. Ed. by Benjamin Boretz and Edward T. Cone. New York: Norton, 1972, pp. 123–154.
2. Craft R. “The Rite of Spring”: Genesis of a Masterpiece. *Perspectives of New Music*. 1966;(5)1:20-36.

3. Craft R. "Some Musical Questions" from *Memories and Commentaries*. Garden City: Doubleday & Co., (1959) 2009, pp. 115–116.
4. Craft R., ed. *Stravinsky: Selected Correspondence*, vols. 1, 2, and 3. New York: Knopf, 1982, 1984, and 1986.
5. Germanavičius V. Identification of Microtonal Intervallic Relations in Lithuanian Vocal and Instrumental Folk Music and their Application in Music Composition. Forthcoming publication by Lithuanian Academy of Music and Theatre, Vilnius: *Lithuanian Musicology*, 2021, No. 22.
6. Reinhard J. *Eighth Octave of the Overtone Series Tuning*. Available from the American Festival of Microtonal Music, 2011. NYC. 27 p.
7. Schoenberg A. *Theory of Harmony*. University of California Press, (1978) 1983, 464 p.
8. Stravinsky I., Craft R. *Conversations with Stravinsky*. Berkeley: University of California Press, 1980. 140 p.
9. Stravinsky I., Craft R. *Memories and Commentaries*. Berkeley: University of California Press, 1981. 183 p.
10. Stravinsky I., Craft R. *Expositions and Developments*. Berkeley: University of California Press, 1981. 168 p.
11. Stravinsky I., Craft R. *Dialogues*. Berkeley: University of California Press, 1983.
12. Stravinsky V., Craft R. *Stravinsky in Pictures and Documents*. New York: Simon and Schuster, 1978. 688 p.
13. Taruskin R. Russian Folk Melodies in *The Rite of Spring*. *Journal of the American Musicological Society*. 1980;(33)3:501.
14. Taruskin R. Chernomor to Kastchei: Harmonic Sorcery; or, Stravinsky's 'Angle.' *Journal of the American Musicological Society*. 1985;(38)1:72.
15. Taruskin R. Stravinsky's 'Rejoicing Discovery' and What it Meant: Some Observations on His Russian Text-Setting. *Stravinsky Retrospectives*, ed. by Haimo E., Johnson P. Lincoln: University of Nebraska Press, 1987, pp. 162–199.
16. Toorn P.C., van den. Some Characteristics of Stravinsky's Diatonic Music. *Perspectives of New Music* 1975;(14)1:104; 1977;(15)2:58.

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