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## ON HORATIU RADULESCU'S FIFTH STRING QUARTET ('BEFORE THE UNIVERSE WAS BORN') OP. 89

William Dougherty

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**Abstract:** Horatiu Radulescu's Fifth String Quartet, '*before the universe was born*', is a shining example of his radical compositional approach. With an intense interest in creating a rich, numinous sound-world constructed firmly on principles of nature, science and ancient philosophy, Radulescu developed a unique compositional language that breaks with traditional musical conventions. In hopes of illuminating the inner workings behind his often enigmatic compositional process, this article examines various aspects relating to Radulescu's Fifth Quartet: the work's formal construction, with a focus on its notation and overall large-scale harmonic development; the Quartet's rhythmic devices and their link to the philosophical underpinnings that drive the work; the extended instrumental string techniques employed throughout, the sounds they achieve, and how they are executed; and the work's spectral pitch organisation.

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Romanian composer Horatiu Radulescu embarked on his Fifth String Quartet, '*before the universe was born*', in Freiburg, in 1990, and he completed it five years later. The work is a shining example of his radical compositional approach. With an intense interest in creating a rich, numinous sound world constructed firmly on principles of nature, science and ancient philosophy, Radulescu developed a unique compositional language that breaks with traditional musical conventions. In hopes of illuminating the inner workings behind his often enigmatic compositional process, this article examines five aspects relating to Radulescu's Fifth String Quartet: 1) the motivation behind Radulescu's continual return to the traditional instrumental form of the string quartet; 2) the Fifth Quartet's formal construction, with a focus on the work's notation and overall large-scale harmonic development; 3) the Quartet's rhythmic devices and their link to the philosophical underpinnings that drive the work; 4) the extended instrumental string techniques employed throughout, the sounds they achieve, and how they are executed; and 5) the work's spectral pitch organisation.

Radulescu wrote six string quartets, spanning the years from 1968 (when, at the age of 26, he wrote his First String Quartet *Introito, Ricercare, Suonare*) to 1992 (when, at age 50, he completed his Sixth String Quartet, '*practicing eternity*'). Radulescu regarded his string quartets as having a particularly high importance in his artistic output.

His interest in this traditional instrumental form goes against his usual pursuit of radical instrumentations, heard in pieces like *Incandescent Serene*, for 12 quartets of French horn, viola, octobass flute and double bass, or *Outer Time*, for 23 flutes or 14 bass flutes and 14 sound icons. To explain his continued return to the string quartet form we must look to Radulescu's well-documented appreciation for Western historical tradition. In an interview in 1996 he stated, 'I have to say not only do I adore the Western tradition but I also think that spectrality is a global way of including also Byzantine and Indian music'.<sup>1</sup> While his interest in the string quartet may lie firmly in his admiration of historical precedent, it may also have to do with the practical implications associated with the genre. As a self-proclaimed spectral composer, Radulescu continually experimented with *scordatura* tunings, natural harmonics and microtonal inflections that stem from the harmonic spectrum. His spectral approach also leads to a constant exploration of colourful instrumental textures achieved by an innovative approach to playing technique; with strings, he was able to focus on the vast world of textures associated with alternating various bow pressures, positions and speeds.

As musical notation software evolved, Radulescu began to use Finale in the early 1990s. With a somewhat limited knowledge of engraving software, he chose to hand-write his Fifth Quartet. This is most likely because engraving the work with a program like Finale would be highly impractical – formatting, in a score that strays far from traditional notation practices, would be a nightmare for someone with minimal technical experience. Rather than using a traditional five-line staff, Radulescu employed tablature notation, denoting where on the strings the performers play. When he wanted an open string, he placed an open circle on the line representing one of the four strings. To indicate a natural harmonic, he placed a small staff with the sounding pitch on the string to be played, accompanied by a number corresponding to the partial number. Each of the 29 pages of the score is divided into four 15-second segments, adding up to one minute. The duration of each event is determined by exactly where each note lies in relation to the time indication at the top of each page. An upside-down 'L' symbol indicates where a note should stop, and a tie symbol indicates when a note should be held. The work includes a number of string techniques of Radulescu's own invention – a number of them developed in earlier works – for which he had his own accompanying symbol nomenclature. In terms of dynamics Radulescu strays from the traditional *forte*, *piano*, and so on, and rather chooses to focus on bow pressure in combination with bow speed. He indicates high pressure, or *premuto*, with an encircled upside-down triangle, normal pressure with an encircled 'N,' and light pressure or *flautando* with an encircled 'F'. The position of the bow is indicated similarly, with boxed letters. While the exact meaning of these abbreviations is not specified in the performance notes of the Fifth String Quartet, they are defined clearly in the performance notes to an earlier work, *Das Andere*, from 1984. In *Das Andere*, Radulescu defines 'SP' as *sul ponte* (on the bridge), 'VP' indicates *verso il ponte* (near the bridge), 'N' indicates normal, 'pT' indicates *un poco sul tasto* (slightly on the fingerboard), 'mT' indicates *molto sul tasto* (more on the fingerboard), and 'MT' indicates *moltissimo sul tasto* (high up on the

<sup>1</sup> Bob Gilmore, "'Wild Ocean': an interview with Horatiu Radulescu", in *Contemporary Music Review* 22/1–2 (2003), pp. 105–22, here p. 120.

fingerboard, that is, almost in the middle while using an open string, and if not, very near the left hand fingering). A line with arrowheads pointing outward on both ends indicates a very fast bow speed while a line with arrowheads pointing inward on both ends indicates a very slow bow speed. This non-traditional approach to dynamics, bow speed, position and pressure forces performers to think differently than they do when playing conventional music, ensuring a fresh interpretation that is free of many preconceived parameters of traditional playing technique. At the bottom left-hand corner of each page, Radulescu indicates a pitch spectrum on which that page's pitch content is centred (this will be discussed in more depth later). Yet when examining Radulescu's notational method in the Fifth Quartet it is interesting to note his surprising inconsistency in notational precision. While he often asks the performer to play specific natural harmonics in the extremely high register – at one point requiring the 32nd harmonic on the cello – he also permits a great deal of freedom, with techniques that ask players to perform, for example, 'two very high but simultaneous melodies on natural harmonics'. Whether this is an intentional juxtaposition of freedom and control embedded within the notation to provoke thoughtful consideration of performance practice as a whole, or just simply a lack of clarity deriving from Radulescu's assumptions about players' previous experience with his own music, is uncertain. Either way, these questions raise a number of interesting issues that performers must tackle when deciding to perform the Fifth Quartet.

With this overview of Radulescu's notational approach in mind, I turn now to the work's overall large-scale harmonic development. As previously discussed, each page's pitch content is based on a spectrum, which is indicated at the bottom left-hand corner of the page. By examining these indications, a summary of the work's harmonic development can be made (Figure 1).

Based on the work's *scordatura* Radulescu utilised six main spectral areas: C, G, D, A, E, and B. In addition to these areas, he also employs other spectra, notated by a star-like figure with two asterisks inside it. When pages contain mainly non-pitched textural sounds or vary widely in pitch content, for example a large glissando, Radulescu omits a spectrum indication (noted in Figure 1 as 'N/A'). It is interesting to note that every single page differs in its spectral pitch content. Not once does Radulescu remain in one defined harmonic area for over a minute. This suggests that his sense of harmonic pacing corresponds closely to the passing of one minute.<sup>2</sup> It is also notable that Radulescu moves almost exclusively from one harmonic area to the next (from page to page) in fourths, fifths, and seconds.<sup>3</sup> This focus on motion that seems for the most part to avoid thirds and sixths is telling of Radulescu's approach to harmonic development. One may postulate that his choice of harmonic motion stems from a desire for similarities in spectral pitch content from one minute to the next. There is a great deal of overlap in spectra based on a fundamental a fourth or fifth apart, due to the nature of the harmonic series, but very little overlap in those a third or sixth apart (see Figure 2). Harmonic spectra on fundamentals a second apart have a surprising amount of pitch similarities above the seventh harmonic as well.

<sup>2</sup> As mentioned above, each page corresponds to one minute of time.

<sup>3</sup> Exceptions: he moves by a third, G to B, between page 21 and 22, and by a sixth, C to A, on page 10.

Page # (Minute)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Indicated Spectrum	C	G	D	E	A	B	other	E-D	A	C-A	D	E	other	N/A	N/A
Page # (Minute)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	
Indicated Spectrum	D-G#	C	N/A	A	G	B	A-D-G-C	N/A	other	A	N/A	D	C	other	

Figure 1:  
Overall harmonic development in  
Radulescu's Fifth String Quartet

One area that we have yet to examine in terms of formal construction is rhythm. As Radulescu's innovative approach to rhythm in the Fifth Quartet is closely tied to the literary and philosophical underpinnings that drive the work, one must first briefly explore these references and their significance. As a man who constantly sought '...to be as close to the sound as possible, to the secret deep structure of sound'<sup>4</sup>, Radulescu drew from widely diverse cultural and historical sources, '...almost creating a new language by placing in the same melting pot English, German, Latin, Italian, French and Rumanian for the titles of his pieces, [conversing] across time with Pythagoras, Mircea Eliade, Shakespeare, and Lao Tzu'.<sup>5</sup> In his Fifth Quartet, Radulescu uses texts taken from the *Tao Te Ching*, an ancient work written by Chinese philosopher Lao Tzu in approximately 6 BCE.<sup>6</sup> The poetry of Lao Tzu particularly interested Radulescu, as he not only found it mystically evocative, but also forward-thinking in terms of scientific thought. This serves as the perfect complement to Radulescu's exacting scientific approach to spectral pitch content and his more free-thinking, other-worldly, spiritual aims. 'I'm very impressed by Lao-Tzu, very much, by the Taoist eighty-one poems. But if you read Lao-Tzu, "being and non-being create each other", it's nearly modern physics, matter and anti-matter, you see. It's a fantastic intuition he had'.<sup>7</sup> Using Stephen Mitchell's English translation of the *Tao Te Ching*, Radulescu attempts to combine three philosophical areas in performance: writing, symbolic image, magic; rhythm, phonetic spectrum, sound; and meaning, notional communication, idea and thought (Figure 3).<sup>8</sup>

Radulescu wanted a deep unity – a synthesis between the written text, its philosophical meaning, and the rhythm generated from articulating the text phonetically – that would transport the performer into a special state of awareness. To achieve this effect in more practical terms, he placed fragments from Mitchell's English translation of the *Tao Te Ching* at the top of each page of the score. The natural phonetic rhythm of these text fragments determines the rhythm of the passage below them, sometimes precisely and sometimes more impressionistically. When the symbol of a vertical line enclosed in a box is indicated, the players execute the phonetic rhythm of the text above in synch with the other players with the same symbol, while when the symbol of a (forward) slash enclosed in a box is indicated, the players execute the phonetic rhythm of the text above *out of synch* with the other players. While this aspect of performance is admittedly not entirely clear from Radulescu's performance notes, an explicit example on page 13 of the score allows one to see his intent clearly (Figure 4). In this example, Radulescu actually notates the rhythm of the text – six quavers divided into two groups of three. This corresponds to the phonetic rhythm of the text directly above, 'love the world as your self'. When looking at

<sup>4</sup> Gilmore, "Wild Ocean", p. 107.

<sup>5</sup> Franck Mallet, in Gilmore, "Wild Ocean", p. 108.

<sup>6</sup> The *Tao Te Ching* serves as the basis of philosophical Taoism.

<sup>7</sup> Gilmore, "Wild Ocean", pp. 121–2.

<sup>8</sup> Stephen Mitchell, *Tao Te Ching: a new English version* (New York: Harper & Row, 1988). Radulescu used phrases from the Mitchell translation as titles for his second, third, fourth, fifth and sixth piano sonatas, as well as the fifth and sixth string quartets.

Figure 2 illustrates pitch relations between harmonic series. The notation shows six systems of two staves each (treble and bass clef). Numerical values are placed above notes, and lines connect them to specific notes in the staves. The systems are labeled on the right as '+ Perfect 5th', '+ Perfect 4th', and '+ Major 3rd'.

Figure 2:  
Pitch relations (2 cents or less)  
between harmonic series a fifth,  
fourth, and major third apart

the positioning of the text at the top of each page in relation to the musical figures below, occasionally there is ambiguity as to which musical figures correspond to which texts. This leads one to speculate about the reasoning behind this level of notational imprecision. It is clear that Radulescu believed in a new sense of freedom brought on by the modern age. He sought to bring this freedom into his composing, while drawing connections to natural phenomena and in a similar way to the great artists and musicians of the past.

You have to work in this sense today with new means. To create a big fresco, a Leonardo in sound. Maybe more crazy, like nature is. Like the ocean. What we see today – it's sometimes more crazy. From the plane, when you see the whole ocean and whole clouds. Leonardo only imagined this. In this sense you have more freedom also.<sup>9</sup>

<sup>9</sup> Gilmore, "Wild Ocean", p. 107.

## TRY TO REALIZE IN SOUND THESE THREE DIMENSIONS

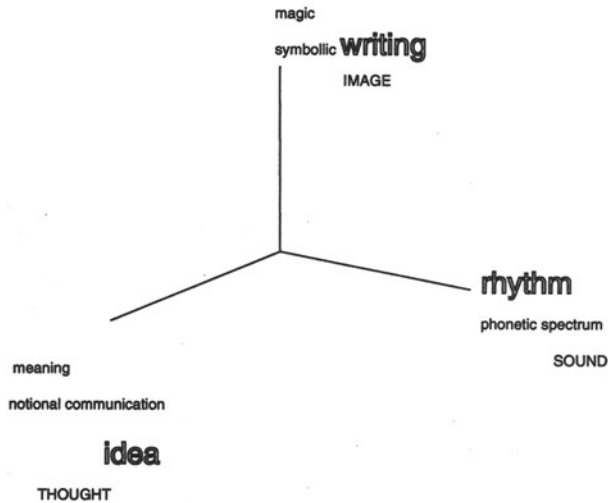


Figure 3:

From performance notes from the score of Radulescu's Fifth String Quartet. © Lucero Print, used by permission

With this insight into Radulescu's theoretical views on freedom, we can make some informed suppositions about his decision to leave some ambiguity in his rhythmic notation.

Radulescu's ingenuity extended well beyond his use of rhythm and notation. In fact, it can be argued that his discovery and use of new extended string techniques was among the most pioneering aspects of his music. In *Das Andere*, from 1984, Radulescu developed a number of extended string techniques that constantly reappear in his works over the course of the next two-and-a-half decades. In order to discuss the string techniques in the Fifth Quartet, the sounds they achieve, and how they are executed, one must look to both the performance notes accompanying *Das Andere* and Radulescu's recorded insights into these new playing methods. In an interview in 2006, Radulescu spoke in detail about these techniques, starting with string multiphonics. 'Exceptionally I use a multiphonic sound on the C string, a very special technique of bowing and fingering producing a multiple "broken" sound'.<sup>10</sup> In the notes to *Das Andere*, Radulescu writes that the multiphonic should be produced by 'fingering a natural harmonic on the slightly lower augmented 5th or a natural harmonic on the minor 10th (intervals from the open string), bowing in a very stable point of contact'. As both the minor tenth fingering and the slightly lowered augmented fifth fingerings fall in between two natural harmonics, they will produce two tones when lightly touched and bowed at a slow speed with high pressure, creating a multiphonic.

Another technique that Radulescu described when speaking about *Das Andere* is the 'u du 'u du' technique, one that he first used in his *lubiri* in 1981. 'I use a special type of phase-shifting bowing (which Rohan de Saram called 'u du 'u du'). The bow glides very swiftly over the string and seems to be rebounding off two imaginary walls'.<sup>11</sup>

<sup>10</sup> 'Intimate Rituals: works for viola'. Haratiu Radulescu in conversation with Bob Gilmore, Amsterdam, January 2006. Transcript online at <http://www.horatiuradulescu.com/interview.html> (accessed June 5 2013).

<sup>11</sup> 'Intimate Rituals: works for viola'.

hope and fear are both phantoms that arise from thinking of the self  
 when we don't see the self as self, what do we have to fear ?  
 see the world as your self love the world as your self

Figure 4:  
 Explicit rhythmic gestures in  
 Radulescu, Fifth String Quartet,  
 p. 13. © Lucero Print, used by  
 permission

In the performance notes to the Fifth Quartet, he also indicates *flautando* bow pressure and a fast bow speed. In the performance notes to *Das Andere*, Radulescu writes at length about the technique, saying that the bow must alternate between VT, *verso il ponte* (near the bridge) and mT, *molto sul tasto* (more on the fingerboard). He continues, making it quite clear how to perform the technique and the desired resultant sound:


This bowing technique requires a stiffly locked arm. The bow glides swiftly over the surface of the string changing direction very abruptly and unpredictably like the instantaneous movements of Noh Theatre.<sup>12</sup> We perceive four different pieces of information at the same time: the fundamental sound (most audible on open string), 'breathing noise' of bow hair against the string caused by the fast *flautando* bowing, rich variation of the harmonic content due to irregular point of contact changes of the bow. NB: point of contact must not vary during up bow and down bow, but instead in between bow changes, and the sudden change of bow mutes the previous vibration creating an uneven 'panting'-like rhythm.

Another extended technique used throughout the Fifth Quartet is known as 'little devils'. As Radulescu describes this technique, 'playing harmonics with one finger ... produces an irregular melody of very high harmonics, with fast bowing, interspersed with occasional sounds of the open string, like Morse signals'.<sup>13</sup> In the notes to the Quartet, Radulescu indicates that the 'little devils' are produced by playing a very high melody on natural harmonics via an unstable natural

<sup>12</sup> Here we can see, once again, Radulescu drawing inspiration from widely diverse cultures and sources. '... I'm very fond of some Japanese temple music and so on – and also Chinese and Korean and Vietnamese music and Balinese. Also African music. But we should not integrate them in music as a gadget, in the way that was in vogue even in the '60s by Stockhausen and other people. ... I think with this very global language of the spectrum, you can be somehow close to some tendencies in those musics ...' Gilmore, "Wild Ocean" p. 108.

<sup>13</sup> 'Intimate Rituals: works for viola'.



harmonic played with one finger in the *capo tasto* – the low region of the string – alternating with intermittent, 'Morse-like' signals of the open string. Radulescu writes that the irregular melody should be produced by 'caressing a small part of the string... at the bottom of the fingerboard... like a '. For more guidance in the more nuanced aspects on how to perform this technique and the desired resultant sound, he comments:

The activity of the left hand is quite refined and difficultly noticeable by an observer, and has no relation to trills or tremolo. The harmonics all have a bright and metallic sound on account of the fast bowing and +/-VP. NB In order to achieve the highest harmonics in the lowest fingering position of *capo tasto* more bow pressure should be applied at an extreme *sul ponte* point. The whole technique resembles a cloudy phenomenon with very high register eruptions like sparklings.

It is interesting to note here that Radulescu was aware the activity of the left hand would be difficult for an observer to appreciate. As the technique itself is not so difficult, he may have been striving to subvert observers' expectations. Radulescu was very concerned with the audience's perception, especially when it came to veiling his sound sources with a sort of mystique. In an interview about his piano concerto, *The Quest*, he spoke about concealing the origin of a sound to enhance the listening experience. 'God doesn't say exactly from which type of molecules he makes the beautiful colours of a cloud. I feel we should do the same: conceal cause and effect, in order to obtain a fantastic phenomenon, which would be as beautiful as possible. It's like an invasion of beauty. I think it's a type of joy, of special joy. It can be a mystic joy'.<sup>14</sup>

Briefly looking at the final three extended techniques that Radulescu employs in the Fifth Quartet, we turn first to the high double stops on natural harmonics. In the performance notes for the Quartet, Radulescu describes this as 'two very high but simultaneous melodies of natural harmonics (in between the 6th and 20th overtones; see patterns used in *Das Andere*)'. With the score of *Das Andere* as a reference, one can observe exactly what Radulescu was referring to in this direction.

The  $\Sigma$  modules of biphony are to be performed as very irregular melodies resembling Alp-horns. When dynamically very loud, the 'colliding' pitch of the double stops produce different sounds. Their very irregular periodic shape should never use periodic rhythm or glissandi. Play always *legatissimo* (changing the bow unobtrusively).

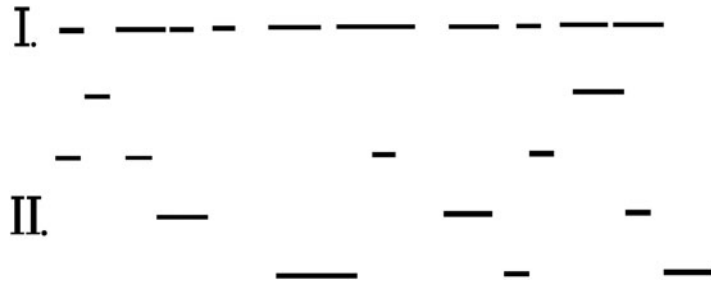
Together with these instructions, Radulescu inserts a diagram that shows the desired melodic patterns (reproduced as [Figure 5](#)). It is interesting to note that, for the most part, one of the strings remains on the same natural harmonic while the other moves in the desired melodic pattern. The melodic pattern is clearly aperiodic and irregular.

Another technique Radulescu makes use of is an arpeggio figure. In the notes to the Quartet Radulescu writes that this technique should consist of 'arpeggios of open strings varying all parameters of the bowing and using very aperiodical micro rhythm (quasi-Baroque micro-agogic fluctuation, i.e. minute and irregularly different values for each pitch) and *molto / sempre lasciar vibrare*'. While most of this description is quite clear, 'quasi-Baroque micro-agogic fluctuation' seems a bit convoluted. Agogic accents are brought about by

<sup>14</sup> Gilmore, "Wild Ocean", p. 121.

Figure 5:

Graphic representation of double-stop technique with high natural harmonics, from the notes to the score of Radulescu's *Das Andere*.  
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elongating a note or delaying its onset rather than applying a louder dynamic, as in typical accents.<sup>15</sup> In the arpeggio figures, Radulescu wanted irregular elongations or offsets of pitches to create a very free and aperiodic quality. As the typical arpeggio is very regular and even, Radulescu seems to be ensuring with his comment on 'quasi-Baroque micro-agogic fluctuation' that he will achieve a much more disjointed quality.

The final extended technique to be considered here is described by Radulescu as 'high natural harmonics in *lasciare vibrare* (unstable and slow melody) in irregular alternating with the open string'. While this description is somewhat vague, one can immediately see similarities between this technique and others already described. In fact, this technique is similar to the 'little devils' technique with high natural harmonics. The only difference is, in this example, the technique is performed with no indication of playing position, while the 'little devils' must be performed by touching natural harmonics in the lower region of the string (near the bridge). It can be assumed from this that one must play, with this technique, near the headpiece. Surprisingly, this creates an entirely different quality of sound. As opposed to the 'little devils', high natural harmonics played near the headpiece are naturally more 'airy' and less piercing.

With an understanding of the Fifth String Quartet's formal structure, rhythm and extended string techniques, one can now look at the true foundation of Radulescu's compositional language: his spectral technique. As the founder of spectralism, Radulescu based his harmonic vocabulary on the overtones of the harmonic series.<sup>16</sup> Over his lifetime, he developed a number of spectral techniques that allowed him to develop the harmonic material in his works. Before analysing his techniques of pitch manipulation in the Fifth Quartet, we must first look at the string *scordatura* he devised. In many of his works for strings, Radulescu requires the performers to tune their instruments in a spectral *scordatura*. In this case, he does so to allow the open strings to serve as partials of certain harmonic spectra (Figure 6).

For example, the slightly flat G $\sharp$  on the third string of violin I is the fifth harmonic in a spectrum based on the low E fundamental. At the same time, this pitch serves as the fifteenth harmonic of a spectrum based on low A (the lowest A on an 88-key piano). As described

<sup>15</sup> Agogic accents were important to Baroque performance practice, especially on keyboard instruments like the harpsichord and organ where the velocity and pressure of the attack does not affect the sound.

<sup>16</sup> Radulescu often claimed, controversially, that his *Credo* from 1969 for nine cellos was the first spectral work written.

HORATIU RADULESCU  
spectral scordatura in opus 89  
**BEFORE THE UNIVERSE WAS BORN** Vcl. STRING QUARTET opus 89

Violin 1  
Violin 2  
Viola  
Violoncello

Figure 6:  
Spectral *scordatura* in Radulescu's  
Fifth String Quartet. © Lucero Print,  
used by permission

earlier, Radulescu's Fifth Quartet is centred on the spectra of C, G, D, A, E, and B. Each of the strings in the *scordatura* corresponds with partials of these fundamentals.<sup>17</sup> This ingenious use of open strings to correspond with partials of the work's pitch centres allows Radulescu to use the full, natural, and resonant sound quality of open strings at many times throughout the work. It also allows him to implement his quasi-mystical, spectrally based idea of the 'emanation of the immanence'. This idea, as described in his article 'Brain and Sound Resonance', is where one plays the natural harmonics of a partial, treating the original partial as a fundamental itself.<sup>18</sup> 'Other harmonic spectra are, as it were, "immanent" within the partials of a single spectrum'.<sup>19</sup> As each open string itself serves as a partial of one of the six fundamental pitch spectra (C, G, D, A, E, and B), playing natural harmonics on any of these strings fulfils Radulescu's idea of the 'emanation of the immanence'. Following the *scordatura* page of the performance notes, Radulescu inserts two pages with each string of the 16 strings of the quartet on multiple staves. He then calculates the partials above each open string, drawing lines between identical partials naturally occurring in more than one string. This very precise pre-compositional diagram shows an intense attention to pitch detail. With the partials of each string listed and their shared content, Radulescu could readily reference harmonic numbers throughout the work, knowing that certain partials on certain strings would correspond directly with others on other strings. It is important to note that Radulescu occasionally draws lines between pitches that are 1–5 cents different in pitch, illustrating his acceptance of a small level of imperfection in tuning – an amount that is barely perceptible. In a number of the strings, Radulescu lists pitches in the extremely high partials, some of which would be next to impossible to produce accurately with

<sup>17</sup> See Radulescu's indication below each string in Figure 6 as to which strings correspond to which harmonic numbers.

<sup>18</sup> Horatiu Radulescu, 'Brain and Sound Resonance: The World of Self-Generative Functions as a Basis of the Spectral Language of Music', *Annals of the New York Academy of Sciences*, 999 (2003), 322–63.

<sup>19</sup> Bob Gilmore, 'Spectral Techniques in Horatiu Radulescu's Second Piano Sonata', *Tempo*, vol. 64, no. 252 (2010), 66–78, here p. 72 fn.15.

the flesh of a finger. Knowing this, Radulescu's desire to notate these pitches must stem from his extended string techniques which require the performers to play very 'high melodies' on natural harmonics. By notating these extremely high partials in his pre-compositional diagram, Radulescu could determine the overall pitch content of these extended techniques.

Turning to the spectral techniques of the Fifth Quartet, we must first look at Radulescu's use of sum and difference tones to construct chords. Sum and difference tones are psychoacoustic phenomena achieved when two tones are played simultaneously, producing in the listener's ear a perceived, but not actually acoustically present, third tone. As Bob Gilmore points out, this acoustic principle is an 'idea [that] is derived from the electronic music of the 1960s and '70s, where experiments with a ring modulator showed that, under certain conditions, the combination of two or more musical tones yields additional 'sum' and 'difference' tones in the ear of the listener'.<sup>20</sup> In practical terms, if one were to produce a sine tone of 1500 Hz and a sine tone of 2000 Hz, a perceived difference tone of 500 Hz would typically result. Radulescu applied this principle to chord construction in a number of his works, believing that it 'demonstrated something meaningful about harmonic relationships between tones'.<sup>21</sup> Replacing frequency numbers with partial numbers he brought these principles into practice. For example, according to the principles of sum and difference tones, he would 'generate' a thirteenth partial from the combination of the fifth partial and eighth partial ( $5 + 8 = 13$ ). From this, he would construct a chord out of the fifth, eighth and thirteenth partials. Radulescu clearly uses this technique in the sixteenth minute of the Fifth Quartet (Figure 7). In the bottom left-hand corner of the page, next to the D harmonic spectral indication, Radulescu writes '21, 13, 8, 5'. These numbers correspond to the partial numbers above a D fundamental and are related to each other through the principle of sum and difference tones ( $5 + 8 = 13$ ;  $8 + 13 = 21$ ). In the first 15 seconds of this page Radulescu creates this chord by stacking an open F $\sharp$  on the first string of violin I (partial 5), an open D on the third string of the viola (partial 8), an A $\sharp$  a quarter-tone sharper on the fourth string of the cello (partial 13) and a G slightly flat on the fourth string of violin II. On close inspection, one can see that Radulescu notates each pitch and partial number in relation to the D fundamental next to each note.

In the second chord on this same page, Radulescu uses his 'Taaroa Chord'. The Taaroa Chord, which originates from *Taaroa* (1969), Radulescu's graduation piece from the Bucharest Academy of Music, appears in a number of his later pieces, including the Second Piano Sonata. The chord appears in different guises and voicings from work to work, suggesting, perhaps that the Taaroa Chord is not one distinct chord, but rather, a chord principle. Bob Gilmore points out that in the Second Piano Sonata, the Taaroa Chord consists of an E, C, and F which correspond to the harmonics 5, 16, and 21 of a low C.<sup>22</sup> This fits clearly with Radulescu's use of sum and difference tones ( $5 + 16 = 21$ ). During the sixteenth minute of the Fifth Quartet, Radulescu writes at the bottom left-hand corner of the page 'G  $\frac{1}{4}$   $\sharp$  Taaroa Chord 15, 17, 32, 48', clearly indicating a variation on

<sup>20</sup> Gilmore, 'Spectral Techniques in Horatiu Radulescu's Second Piano Sonata', p. 70.

<sup>21</sup> Gilmore, 'Spectral Techniques in Horatiu Radulescu's Second Piano Sonata', p. 70.

<sup>22</sup> Gilmore, 'Spectral Techniques in Horatiu Radulescu's Second Piano Sonata', p. 71.

HORATIU RADULESCU    opus 89    VTH STRING QUARTET

**watch the turmoil of beings, but contemplate their return  
immersed in the wonder of DAO . . . when death comes you are ready**

**16**

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Figure 7:  
Radulescu, Fifth String Quartet,  
p. 16. © Lucero Print, used by  
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the *Taaroa* principle, but retaining both the sum and difference concept ( $15 + 17 = 32$ ) and the clash of what would conventionally be considered consonant and dissonant intervals within the chord. With this brief look at Radulescu's spectral *scordatura*, the idea of 'emanation of the immanence', the implementation of sum and difference tones, and the Taarora Chord, one can more fully appreciate Radulescu's innovative approaches to pitch organisation in his Fifth String Quartet.

The Fifth String Quartet is a wonderful example of Radulescu's compositional approach – a unique blend of science, nature, ancient philosophy and mysticism. With some knowledge of the work's formal construction, rhythm, extended string techniques and pitch content, one can grasp the evocative juxtaposition of both freedom and control and ambiguity and precision in the music of Radulescu. While some sceptics may view his mystical side as a throwback to the sixties, the deeper one looks into the complex inner workings of Radulescu's creational processes, the more revolutionary he seems. As eloquently put by clarinettist Roger Heaton, '[Radulescu's] work offers an alternative to the regression and conservatism of the neo-romantics, the often impenetrable complexities of the post-integral serialists, and the mindlessness of much minimalism – a refreshingly different music which is both "musical" and new'.<sup>23</sup>

A supplementary image for this article can be found online at [journals.cambridge.org/TEM](http://journals.cambridge.org/TEM).

<sup>23</sup> Roger Heaton, 'Horatiu Radulescu: Sound Plasma'. *Contact*, 26/1 (1983), p. 24.