Form and function in Roberto Gerhard's *String Quartet no. 1*

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ABSTRACT

Roberto Gerhard was known for his unique treatment of the twelve-tone system. A student of the Spanish nationalist composer, Felipe Pedrell in Barcelona and also a pupil of Arnold Schoenberg in both Vienna and in Berlin, Gerhard's musical trajectory led to a synthesis of these disparate compositional traditions.

In this paper I will explore the development of Gerhard's formal procedures. Here, his first string quartet becomes a useful tool to illustrate how he made the transition from one musical style to another. The work, composed between 1950 and 1955, is governed by a single twelve-tone row, but the first movement follows the classical model of sonata-allegro form, while mathematical proportions govern durations and formal elements in later movements.

I will first investigate how Gerhard's theories led to new pitch structures and relations that emerge in the opening movement. I will also explain how he used these structures to create "tonal" effects in this sonata-form movement. Then, in the third movement, I will examine Gerhard's unique mathematical approach to formal design, focusing on his theory of serially controlled proportions. Thus, through an analysis of the first and third movements of his *String Quartet No. 1*, I will examine how Gerhard's theories on form allowed him to compose highly elaborate structures while still allowing room for creative responses.

1. HEXACHORDAL HARMONY

The classical sonata form, according to the tradition set by the *first* Viennese school, is generally described as a harmonically driven, thematically based structure. According to William Caplin, sonata form may be based on the initial conflict and resolution of thematic groups in contrasting keys within a tonal idiom. [1] But when tonality is abandoned, must we also abandon the sonata form structure?

Gerhard and other twelve-tone composers seemed to think that the sonata principle could be adapted to the twelve-tone idiom without incorporating its tonal schemes. Yet, according to Joseph Straus in his book *Remaking the Past*, the most refined examples of twentieth-century sonata form are those that address the harmonic and thematic struggle presented by the nature of the form, something that I suggest Gerhard accomplishes in his *String Quartet no. 1*. [2]

For Gerhard, the form could provide a framework for both harmonic and thematic implications that, over the course of a composition, could be introduced, developed and ultimately resolved. His themes, marked by specific harmonic and melodic material, are easily identifiable as units that join to create a complete musical composition. But because composers had to consider the problem of how to build the connections and relationships required of a sonata-form movement in the absence of tonality, we can also examine how Gerhard approached this challenge.

Gerhard's strategy was to use closely related hexachordal segments to create large-scale connections in his sonata-form movement. Thus, thematic contrast is achieved through his use of clearly delineated primary and subordinate themes. Harmonic contrast results from his unique

treatment of related and unrelated hexachords. As a result, the first movement of Roberto Gerhard's *String Quartet no. 1* is a twelve-tone work, but it also follows the classical sonata-allegro model, which reveals an exposition, complete with two themes, a development section, and a reversed recapitulation. [3] In this quartet, he derives these hexachords from the single row and its transformations that govern the pitch content of the entire composition. As seen in Figure 1, the prime form of the row appears as two consecutive six-note chords in the first movement.

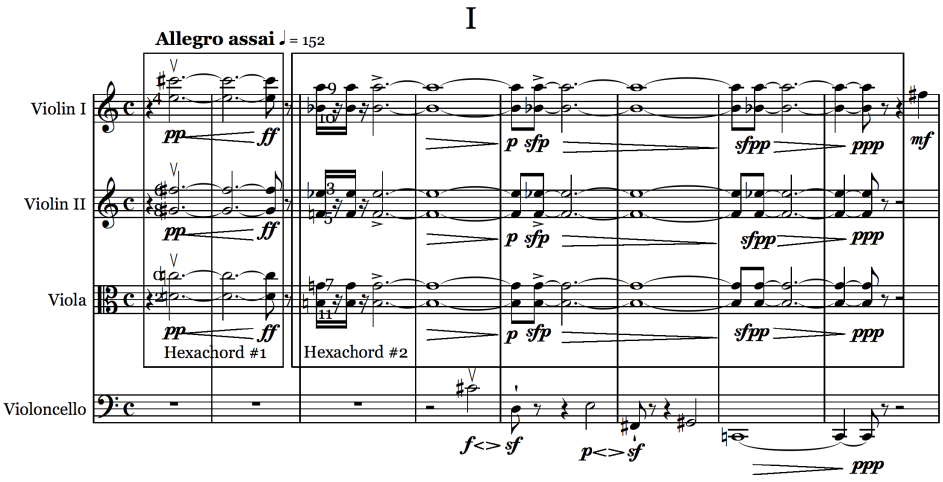

Figure 1. Opening hexachordal division of the row – Gerhard, *String Quartet no. 1*, movement I, mm. 1-11. © Copyright 1958 Boosey & Hawkes Music Publishers Ltd. Reprinted by permission.

Gerhard's division of the row into two complementary hexachords at the beginning of the quartet signifies the importance the hexachordal relationship plays in this work. Furthermore, each hexachord of his original row is a member of SC 6-22 (012468), which is self-complementary. As a result, every hexachord—whether drawn from the beginning or end of the row—is related by transposition and inversion along with its retrograde. Gerhard takes this a step farther by choosing to associate row hexachords that share five pitch classes. For any row hexachord, there will be two other row forms that share five pcs. [4] Because Gerhard exploits this relationship exclusively in the first movement of his *String Quartet no.1*, I will refer to hexachords exhibiting this relationship as being *closely* related.

While each prime-form hexachord has only one inversionally related companion that shares all six pcs, there are two hexachordal transformations for every closely related six-note segment. This latter relationship is seen in Figure 2, which presents a "hexachordal matrix," rather than the more familiar, traditional Babbitt square. In this "hexachordal matrix," each prime form of the row is reordered from the lowest to highest pcs within its two complementary hexachordal boundaries. Lines drawn from each hexachord to the other are matched with the line's closest relative.

This concept of closely related hexachords is significant because, though Gerhard never writes of it in his articles or lectures, it plays an important organizational role in his music. Building on this relationship, Gerhard moves seamlessly among row transformations by keeping at least five common tones between every connecting hexachord. As a result, he can progress through a multitude of rows while always maintaining an impression of aural similarity. Gerhard's progression through closely related hexachords resembles, in a way, how tonal composers move through closely related keys in a tonal composition. For example, it was common practice for tonal composers of the eighteenth and nineteenth centuries to modulate between closely related key areas. Likewise, Gerhard uses his hexachords in much the same manner. Because he treats his hexachords like tonal pillars—or rather, as the thematic and harmonic material for drawing the necessary connections required of such a form—he can uphold the sonata principle by preferring to progress only among closely related hexachords. Thus, his tone row's hexachords function in much the same way as tonal regions in conventional sonata-allegro movements. Indeed, his

twelve-tone quartet follows the traditional model of a sonata-form first movement, but in the absence of tonality, the harmonic connections created by his closely related hexachords become a necessary feature of his formal design.

Hexachord 1		Hexachord 2	
P0	0 – 2 – 6 – 7 – 8 – 10	1 – 3 – 4 – 5 – 9 – 11	I11
P1	1 – 3 – 7 – 8 – 9 – 11	0 – 2 – 4 – 5 – 6 – 10	I0
P2	0 – 2 – 4 – 8 – 9 – 10	1 – 3 – 5 – 6 – 7 – 11	I1
P3	1 – 3 – 5 – 9 – 10 – 11	0 – 2 – 4 – 6 – 7 – 8	I2
P4	0 – 2 – 4 – 6 – 10 – 11	1 – 3 – 5 – 7 – 8 – 9	I3
P5	0 – 1 – 3 – 5 – 7 – 11	2 – 4 – 6 – 8 – 9 – 10	I4
P6	0 – 1 – 2 – 4 – 6 – 8	3 – 5 – 7 – 9 – 10 – 11	I5
P7	1 – 2 – 3 – 5 – 7 – 9	0 – 4 – 6 – 8 – 10 – 11	I6
P8	2 – 3 – 4 – 6 – 8 – 10	0 – 1 – 5 – 7 – 9 – 11	I7
P9	3 – 4 – 5 – 7 – 9 – 11	0 – 1 – 2 – 6 – 8 – 10	I8
P10	0 – 4 – 5 – 6 – 8 – 10	1 – 2 – 3 – 7 – 9 – 11	I9
P11	1 – 5 – 6 – 7 – 9 – 11	0 – 2 – 3 – 4 – 8 – 10	I10

Figure 2. All of the possible closely related hexachords for the tone row of Gerhard's *String Quartet no. 1*

In the opening movement of the string quartet, Gerhard's primary and subordinate themes maintain their identities in the exposition by adhering to the pitch material that defined them. For example, the primary theme is composed only of hexachords closely related to the two halves of the row form P6. The subordinate theme, on the other hand, which begins in m. 41, is made up of P7 hexachords and their close relations.

Furthermore, each theme of the exposition is identified, not only by its melodic material, but also by the hexachords that define it. This is also true of the quartet's recapitulation, which is marked by the return of the subordinate theme, entering before the primary theme. Gerhard brings back both the primary and subordinate themes at their original pitch levels (or rather, with their original hexachordal transformations), but attempts to satisfy the sonata principle by simply composing an accompaniment for the subordinate theme that is made up of three hexachordal transformations that are closely related to the pitch material of the primary theme. This may be seen in Figure 3 in your handout. Here, Gerhard ushers in the subordinate theme at its original P7 row transformation, and complements this collection with the addition of an accompaniment composed of the row forms P3, P6, and P9. One interesting point that I do not have time to fully address here is that in addition to achieving thematic and harmonic conflict and resolution in this movement, Gerhard also incorporated folkloric rhythmic elements to mark key structural areas. [5]

Gerhard's decision to incorporate these row forms into the texture follows naturally from the fact that the hexachords of P3 and P9 are closely related to the hexachords of P6, the latter of which is the original row form of the primary theme. By pairing the subordinate theme's P7 construction with the hexachords of the primary theme, Gerhard allows the subordinate theme to maintain its identity while adding the familiar, "tonic-like" elements of P3, P6, and P9. [6]

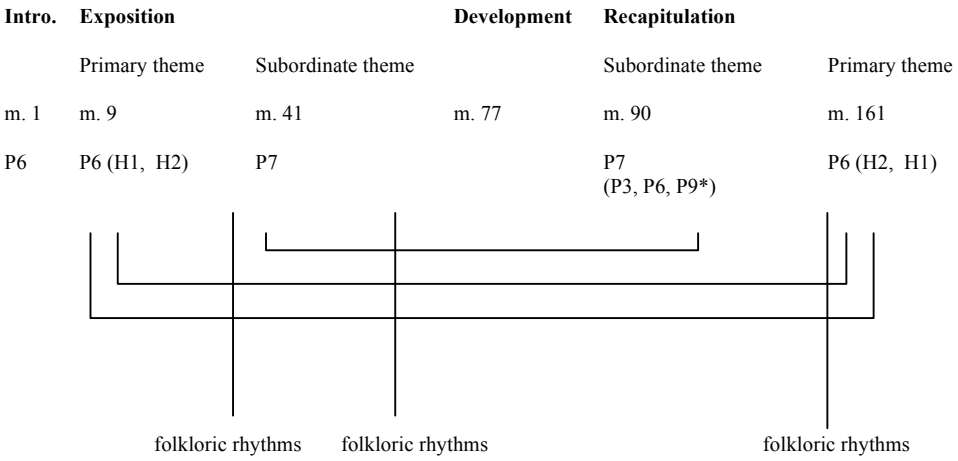

Figure 3. Formal balance and use of closely related hexachords in Gerhard's *String Quartet no. 1*. Recall that P3 and P9 are closely related to P6 as seen in Figure 1.

As expected, the primary theme at last returns in the recapitulation and is composed entirely using the original P6 row form. Because of the addition of the P3, P6, and P9 row forms at the beginning of the recapitulation as an accompaniment to the subordinate theme, the exclusive return to P6, then, is congruent to the arrival of tonic in a tonal composition.

It should also be noted that when the primary theme returns in the recapitulation, Gerhard also reverses the order of the hexachords of P6, as noted on the graph in Figure 3. When the primary theme enters in the exposition, its first six pitches are composed of the first hexachords of P6. However, in the recapitulation, the theme is introduced by the second hexachord while being accompanied by the first. Figure 4(a) shows the entrance of Gerhard's primary theme in the exposition; and Figure 4(b) shows the entrance of primary theme in the recapitulation. [7] So not only does Gerhard achieve the sonata principle in an atonal setting, he attains symmetry and balance by composing the movement as an arch form.

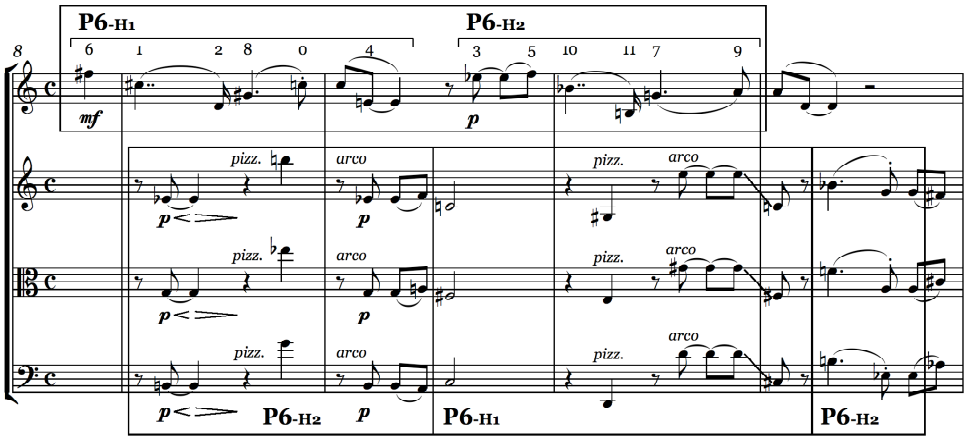

Figure 4(a). Entrance of the primary theme in the exposition – String Quartet no. 1, movement I, mm. 8-12. © Copyright 1958 Boosey & Hawkes Music Publishers Ltd. Reprinted by permission.

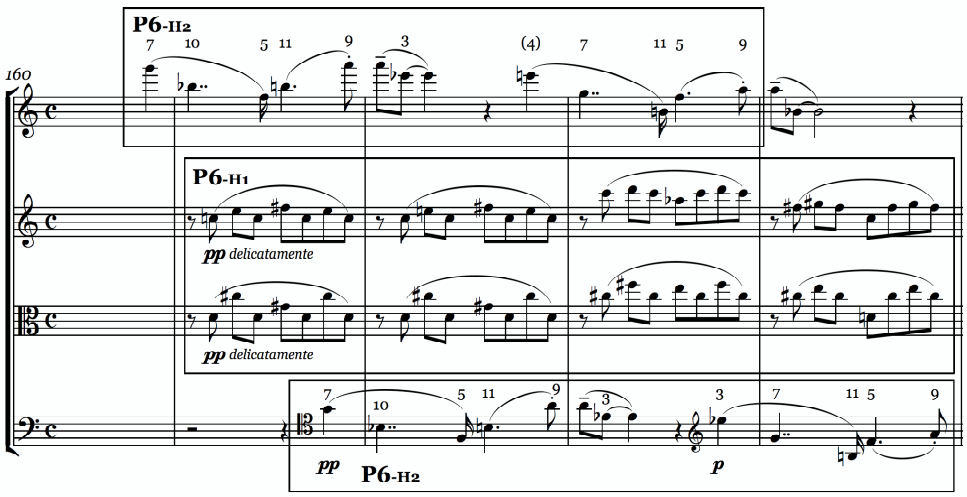

Figure 4(b). Entrance of the primary theme in the recapitulation – String Quartet no. 1, movement I, mm. 160-64. © Copyright 1958 Boosey & Hawkes Music Publishers Ltd. Reprinted by permission.

I find that because Gerhard defines his themes by both their *ordered* melodic content and their *unordered* pitch-class content, his use (and manipulation) of closely related hexachords becomes a tool for creating structural unity. Ultimately, his combination of thematic and harmonic material draws the necessary large-scale connections required of a sonata and brings the movement to a close. Thus, Gerhard's merging of tonal and atonal elements on the surface helps to reinforce the traditional features of this design.

2. GERHARD'S RENDERING OF THE COMPLETE SERIAL FIELD IN MOVEMENT III OF STRING QUARTET NO. 1

The most important characteristic of Gerhard's musical output during the 1950s was his use of the twelve-tone method as a combinatory code. Under this code, rows could be segmented and reordered. Gerhard applied this same code to rhythm, meter, duration, and form. [8] Roman Vlad recognized the application of the theory in Gerhard's first string quartet in the essay, "My First Introduction to Roberto Gerhard's Music."

> In the final two movements of the *Quartet*, Gerhard tries to rationalize such correspondences and to establish between the pitch- and time-dimensions of the music precise connections, which derive from a preconceived constructive plan. Thus, to every note in the series measured in semitones from a 'root-note' in the hexachordal system, a number is made to correspond which can equally refer to a scale of time or of metrical values. Such a plan of organization may appear extremely rigid. But Roberto Gerhard is no pedant. He always knows how to preserve his freedom of action in confronting any musical problem. [9]

Gerhard's handling of the twelve-tone row and its corresponding time series is reflected in his rendering of the complete serial field in the final two movements of his String Quartet no. 1. The third movement of the first string quartet, titled *Grave*, constitutes Gerhard's 'first radical application' of his serially derived proportion theory and it is clear that Gerhard approached the third movement as a concentrated study or a compositional etude. [10]

Thus, in addition to a tone row, Gerhard employs a rhythmic series in the third movement of the first quartet to govern, as Julian White puts it, "the movement, duration, and temporal succession of the total sound events." [11] This same theory is also applied to the *Molto allegro* fourth movement.

3. REGARDING PITCH IN STRING QUARTET NO. 1, MOVEMENT III

The hexachord plays an important role in the third and fourth movements of Gerhard's first string quartet as it does in every other movement of the work. But in these movements he not only employs hexachordal combinatoriality to provide formal structure by serializing not only the pitch content, but also each row's order within the framework of the movement. Gerhard's approach to these latter movements marks a return to the more formalistic approach used in the first movement. He begins the third movement by pairing each tone row with its inversionally related complement. For example, the opening row of the movement, R9, is paired with its inversional complement, I8. These two transpositions are related through hexachordal combinatoriality and they appear in the score separated by rests in m. 5 as shown in Figure 5.

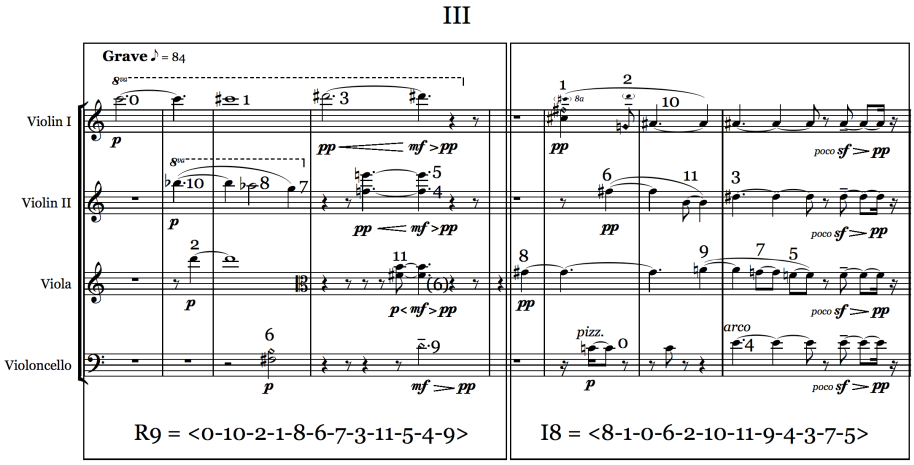

Figure 5. Pairing of inversionally related R9 and I8 – String Quartet no. 1, movement III, mm. 1-8

Continuing this pattern, Gerhard provides a formal framework by arranging each pair of inversionally related combinatorial rows in such a way that they are also governed by the predetermined pitch collection. Thus, the pitch material for the entire movement is serialized by ordering the row transpositions according to the row itself. Gerhard exploits these combinatorial relations in the manner shown in Figure 6.

As illustrated in Figure 6, the order created by the arrangement of each pair, beginning with its prime or retrograde realization, is <9-7-11-10-5-3-4-8-2-1-6-0>. If the final pair of rows in Figure 6, P0 and I11, were actually placed between the pairs beginning with R4 and P8, the order of rows in the movement would follow the permutation R6 (according to each row's *identifying* pitches), which is the retrograde of the original row first presented in movement I of the quartet. Additionally, the row created by the arrangement of the I/RI transformational pairs produces R5. Hence, Gerhard serializes the pitches based on the twelve-tone row, but also the approximate order in which the rows appear throughout the movement.

m. #	P/R	P/R row forms	I/RI row forms	I/RI
m. 1	R9	0-10-2-1-8-6-7-3-11-5-4-**9**	**8**-1-0-6-2-10-11-9-4-3-7-5	I8
m. 9	P7	**7**-2-3-9-1-5-4-6-11-0-8-10	3-5-1-2-7-9-8-0-4-10-11-**6**	RI6
m. 12	R11	2-0-4-3-10-8-9-5-1-7-6-**11**	**10**-3-2-8-4-0-1-11-6-5-9-7	I10
m. 18	P10	**10**-5-6-0-4-8-7-9-2-3-11-1	**9**-2-1-7-3-11-0-10-5-4-8-6	I9
m. 21	P5	**5**-0-1-7-11-3-2-4-9-10-6-8	1-3-11-0-5-7-6-10-2-8-9-**4**	RI4
m. 23	P3	**3**-10-11-5-9-1-0-2-7-8-4-6	**2**-7-6-0-8-4-5-3-10-9-1-11	I2
m. 26	R4	7-5-9-8-3-1-2-10-6-0-11-**4**	0-2-10-11-4-6-5-9-1-7-8-**3**	RI3
m. 28	P8	**8**-3-4-10-2-6-5-7-0-1-9-11	**7**-0-11-5-1-9-10-8-3-2-6-4	I7
m. 31	P2	**2**-9-10-4-8-0-11-1-6-7-3-5	10-0-8-9-2-4-3-7-11-5-6-**1**	RI1
m. 34	R1	4-2-6-5-0-10-11-7-3-9-8-**1**	**0**-5-4-10-6-2-3-1-8-7-11-9	I0
m. 38	P6	**6**-1-2-8-0-4-3-5-10-11-7-9	**5**-10-9-3-11-7-8-6-1-0-4-2	I5
m. 41	P0	**0**-7-8-2-6-10-9-11-4-5-1-3	**11**-4-3-9-5-1-2-0-7-6-10-8	I11

Figure 6. Serial structure based on inversionally combinatorial relationships – String Quartet no. 1, movement III. The identifying pcs of the row forms resulting from reading down the P/R (R6) and I/RI (R5) columns are shown on the example in bold typeface. P/R column = R6 <9-7-11-10-5-3-4-0-8-2-1-6> (Note that pc0 is out of order.) I/RI column = R5 <8-6-10-9-4-2-3-11-7-1-0-5> (Note that pc11 is out of order.)

4. ON SERIALIZING TEMPORAL DURATIONS IN STRING QUARTET NO. 1, MOVEMENT III

Gerhard's time series for the third movement is derived from the P6 tone row. This row is first presented in the opening movement of the quartet, as seen in Figure 7(a). Figure 7(b) provides a reproduction of this same row as it appears in Gerhard's article "Developments in Twelve-Tone Technique," in which he first introduces his theory of time sets. The second line of part (b) shows the row divided into two hexachords and arranged in their closest packing (in terms of pcs, not pitches). [12]

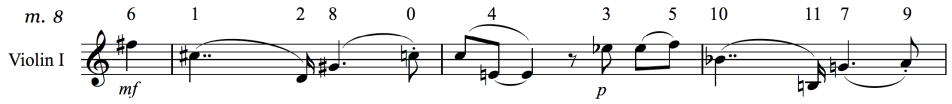

Figure 7(a). First appearance of the row in its original order in String Quartet no. 1, movement I, mm. 8-11. © Copyright 1958 Boosey & Hawkes Music Publishers Ltd. Reprinted by permission.

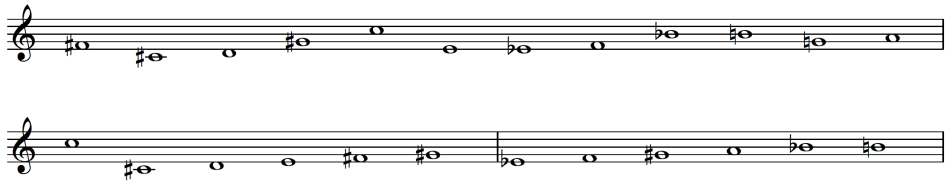

Figure 7(b). Reproduction of musical figures in Gerhard's "Developments in Twelve-Tone Technique" (1956)

Based on this close packing, Gerhard chose C5 (pc0) as his horizon tone. [13] As illustrated in Figure B, this set matches the pc-row, illustrating more forcefully than ever that Gerhard's

manipulations have more to do with addressing a conceptual need rather than a practical one. [14] After manipulating the P6 transformation by subtracting the horizon tone from it, Gerhard adds the pcs of each hexachord to produce a ruling proportion for this movement of his string quartet. The resulting proportion, as noted in Figure 8, is 33:45, which may be reduced to 11:15. [15, 16]

6	1	2	8	0	4		3	5	10	11	7	9
0	0	0	0	0	0		0	0	0	0	0	0
6	1	2	8	12	4		3	5	10	11	7	9
33							45					

Figure 8. Explanation of proportions based on ordering and employment of the horizon tone derived from row form P6

Gerhard's time sets and theory of proportions are clearly articulated in the final movements of his first string quartet. Beginning with the opening bars of the third movement, Gerhard introduces the pitch series in conjunction with the time series. Unlike the polymetric fourth movement, which shifts among various simple and compound meters, the third movement of the first string quartet is unmeasured. Gerhard's use of durations in the third movement governs, not individual note values, but the values of beats per bar. This particular serialization of durations allows Gerhard to manipulate rhythmic content freely, rather than commit to a series of rhythmic durations. Figure 9, illustrates how the length of each bar is based on the number of quavers it contains.

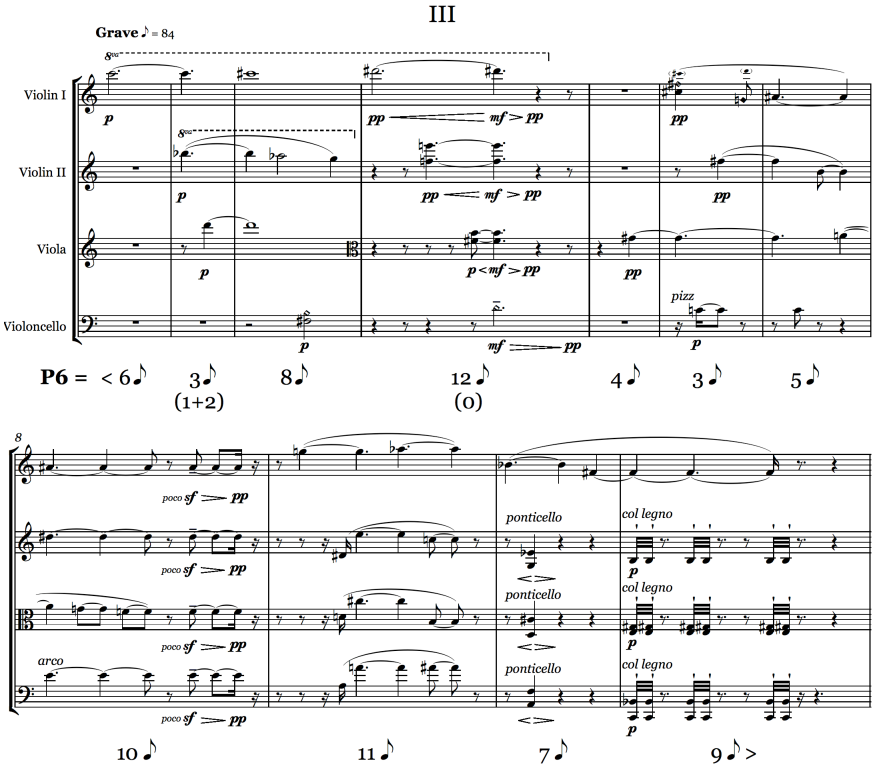

Figure 9. Serialized number of beats – String Quartet no. 1, movement III, mm. 1-11. © Copyright 1958 Boosey & Hawkes Music Publishers Ltd. Reprinted by permission.

The time series is determined by counting the number of quavers in each bar, creating the ordering <6-3-8-12-4-3-5-10-11-7-9>. As shown in Figure 9, the second bar of three beats is divided arbitrarily into a one-plus-two quaver pattern in accordance with the order of the time series. The order of the time series is derived from the original tone row of the quartet and may be labelled P6.

This temporal series has large-scale formal implications as well. For Gerhard, the 33:45 (or 11:15) proportion derived from the series becomes a controlling feature for the overall form of the movement. The entire third movement is forty-five bars in length. The movement is further divided into four sections: three sections of 11 bars each (arrived at by dividing 33 by 11) and a final section of twelve bars (arrived at by subtracting 33 from 45).

This division of the movement into four sections is illustrated in Figure 10. As seen in Figure 10, a new time series derived from the 33:45 proportion begins every eleven bars. Note that Gerhard further exploits this idea by not only implementing all four types of transformations, but by limiting himself to only transpositions at T6. Thus, as noted in Figure 10, he bases the specific temporal durations of the entire third movement on the transformations P6, RI6, R6, and I6.

bars 1-11	P6	6-3(1+2)-8-12-4-3-5-10-11-7-9
bars 12-22	RI6	3-5-3(1+2)-7-9-8-12-4-10-11-6
bars 23-33	R6	9-7-11-10-5-3-4-12-8-3(2+1)-6
bars 34-45	I6	6-11-10-4-12-8-9-7-3(2+1)-5-3

Figure 10. Metric proportions – String Quartet no. 1, movement III

So how does Gerhard combine the pitch and time transformations to create the formal framework of the movement? Each temporal transformation of the series is eleven bars in length with the exception of the fourth I6 transformation, which extends to twelve bars only because the final chord is held over for an extra six quavers.

It will soon become apparent that Gerhard's coordination of tone and temporal elements creates an isorhythmic structure. Each tone row is paired with its inversionally related complement, but these pairings do not necessarily match up with the four eleven-bar time series realizations.

Figure 11 illustrates this lack of coordination between pitch and time. Gerhard synchronizes both series at the starting point of each time series, but within each time series, two, three, or four inversionally related pitch pairs may occur. In Figure 11, the first column shows the four time series and their T6 realizations. The second column shows the P/R and I/RI pairs that occur within the eleven bars of each time series.

Time Series	**Pitch Series**			
bars 1-11 [P6]	1-8 [R9/I8]	9-11 [P7/RI6]		
bars 12-22 [RI6]	12-17 [R11/I10]	18-20 [P10/I9]	21-22 [P5/RI4]	
bars 23-33 [R6]	23-25 [P3/I2]	26-27 [R4/RI3]	28-30 [P8/I7]	31-33 [P2/RI1]
bars 34-45 [RI6]	34-37 [R1/I0]	38-40 [P6/I5]	41-45 [P0/I1]	

Figure 11. Isorhythmic coordination of pitch and time elements – String Quartet no. 1, movement III

5. CONCLUSION

Gerhard's manipulation of form in his first string quartet is a unique blend of old and new. The first movement follows the classical sonata form structure yet utilizes fresh ways to implement twelve-tone harmonic language. The third movement is reminiscent of an isorhythmic structure, yet at the same time is constructed in a serial manner and showcases Gerhard's innovative theory of serially controlled proportions.

Thus, Gerhard's first string quartet is noteworthy because: 1) it functioned as a blank canvas and became a springboard for his future compositional innovations during this period, and 2) it marked his return to the twelve-note method following a period of reflection lasting more than twenty years. Gerhard's String Quartet no. 1 provided the theoretical framework for the numerous compositional innovations he developed during the early 1950s. He fleshed out many of these ideas in a series of articles he wrote during this same time period. Gerhard, ever the practical composer, did not simply write of these ideas; he incorporated them into his own compositions. As a result, his String Quartet no. 1 is not merely one of his first large-scale explorations in twelve-note composition; it also sheds light on his somewhat abstract philosophical musings about twelve-tone tonality. Gerhard's idiosyncratic approach to twelve-note composition resulted in a string quartet that contradicts the norm, yet maintains the structural integrity of the twelve-tone system.

6. NOTES

[1] Caplin refers to this view as the "tonal-polarity model." CAPLIN, W. (1998) *Classical Form: A Theory of Formal Functions for the Instrumental Music of Haydn, Mozart, and Beethoven*. Oxford: Oxford University Press, p. 257.

[2] STRAUS, J. (1990) *Remaking the Past: Musical Modernism and the Influence of the Tonal Tradition.* Cambridge, Mass.: Harvard University Press.

[3] Caplin refers to the reversed recapitulation in *Classical Form*, 173-74. Hepokoski and Darcy do not recognize this type of recapitulation with a label, instead opting for the term "deformed." See HEPOKOSKI, J. and DARCY, D. (2006) *Elements of Sonata Theory: Norms, Types, and Deformations in the Late Eighteenth-Century Sonata*. Oxford and New York: Oxford University Press, p. 232.

[4] This five-tone invariance occurs at two transformations: SC 5-15 (01268) becomes a literal subset of the hexachord 6-22 (012468) under T_2I and SC 5-33 (02468) also becomes a literal subset under T_8I. Because Gerhard exploits this relationship exclusively in the first movement of his String Quartet no. 1, I will refer to hexachords exhibiting this relationship as being closely related. Thus, closely related hexachords are those hexachords (specifically SC 6-22) that share the inclusion of either SC 5-15 or SC 5-33.

[5] It must be noted that this was a compositional decision that contradicted the teachings of his mentor, Arnold Schoenberg, who was against combining the "complicated" and "academic" twelve-tone technique with the "primitive" ideas of folk music.

[6] I use "tonic-like" in this sense to suggest that the listener may recognize the pitch (or pitch-class) material from primary theme as it is re-introduced with material from the subordinate theme.

[7] All of this apparent symmetry and balance is reminiscent of Schoenberg's Third String Quartet, of which Gerhard would have most likely been aware.

[8] HOMS, J. (2000) *Roberto Gerhard and his Music*, trans. and ed., Meirion Bowen. Sheffield, UK: Hallamshire Press, Anglo-Catalan Society, pp. 62-63.

[9] VLAD, R. (1956) "My First Impressions of Roberto Gerhard's Music," *The Score* 17 (September), p. 33.

[10] The third movement provides a very abbreviated study of Gerhard's proportion theory. The movement is 45 bars in length. By contrast, the same proportions are also in play in the final movement as well, but evolve over the course of 395 (419 bars counting the repeated section) bars.

[11] WHITE, J. (1999) "Roberto Gerhard String Quartets 1 and 2," liner notes for *Roberto Gerhard String Quartets 1 and 2* (Metier MSV CD92032), par. 1.

[12] It should be noted that though this particular tone row was taken directly from his String Quartet no. 1, which, as usual for Gerhard, he did not disclose this detail in the article.

[13] The horizon tone is "a purely theoretical concept" in that Gerhard may choose any note of a given row, label it as such, and then subtract its pitch-class number from all of the remaining row members to create a "new" series that may be used to govern the temporal dimension of a particular composition. While Gerhard typically chooses the lowest sounding tone in p-space, he does on some occasions select the smallest number in pc-space. Fore example, note how C5 in this case is not the lowest pitch of the first hexachord in p-space. Instead, it is the first note of the hexachord when arranged in normal order.

[14] Only because the horizon tone in the above figure is pc0 does the resulting string of integers resemble the original P6 ordering. As seen in the aforementioned Figure 5.2, this may not always be the case.

[15] Recall that Gerhard used the same ruling proportion 11:15 to control temporal parameters in his *Metamorphoses (Symphony no. 2)* as well.

[16] A different time series, however, governs the fourth movement of the String Quartet no. 1. In movement IV, Gerhard employs the P0 transposition of the original twelve-tone row, which is <0-7-8-2-6-10-9-11-4-5-1-3>. When this row is divided into two hexachords and arranged in normal order, Gerhard chooses pc6 as the horizon tone. Subtracting this number from the P0 row form to generates a new ordering, but not one that is unique. This resulting string of integers produces P6, or <6-1-2-8-12-4-3-5-10-11-7-9>. Nevertheless, Gerhard divides this resulting row of numbers into two time sets and adds the integers together to create the same 33:45 proportion used earlier in movement III.

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