Terrains

for
Orchestra

by

Timothy Sullivan

A thesis submitted in conformity with the requirements for the degree of Doctor of Music
Graduate Department of Music
University of Toronto

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Instrumentation

2 Flutes
Piccolo (Flute 2 doubles Piccolo)
2 Oboes
2 Clarinets (Bb)
Bass Clarinet (Clarinet 2 doubles Bass Clarinet)
2 Bassoons
4 Horns
2 Trumpets in C
2 Trombones
Timpani (1x30" , 2x28", 1x25")
Percussion (one player)
(xylophone, large conga, small conga,
suspended cymbal, toms: large, medium
and small; one large gong).
Harp
Piano
Strings 10, 8, 6, 6, 4 (minimum)

Score in C

Total Duration: 35 minutes

Seating*

Timpani  Percussion
Trumpets  Trombones
Piano  Horns  Harp
Clarinet  Bassoons
Flutes  Oboes
Violas  Celli  Bass
Violin I  Violin II*

Conductor

*The sole change to the conventional orchestral seating is to place Violins II
in the place normally occupied by the celli; this is done to emphasize the stereophonic separation
between Violins I and II.
Terrains

Explanatory Notes

*Terrains* is a work in three movements for orchestra.

In creating *Terrains*, my compositional intentions were threefold:
i) to develop a rigorous methodology for the generation of pitch material, which would allow for a logical connection between vertical and horizontal presentations, as well as surface and deep structure pitch connections, where all pitch material emanates from one central organizing source;
ii) to apply aspects of the method for the notation of multiple tempi (MTN) which I developed in my paper, *Multiple Tempi Notation: A Survey and Method*; and
iii) to explore aspects of the musical techniques which I have derived from my studies of Hindustani and Carnatic musical principles, specifically
1. the *Tal* which is a pattern of metres which repeats throughout a composition; and
2. the Carnatic *Melakarthas*, which are a systematically organized system of seventy-two diatonic modes.

**Pitch Organization**

The two core elements behind the pitch organization in *Terrains* are the numerical matrix and the *Melakartha* applied as a diatonic pitch field.

The numerical matrix is constructed in the same manner as the conventional dodecaphonic matrix, except that numerals substitute for pitch names. To generate a numerical matrix, one need only determine the total pitch set within a given field, number it in ascending order from the lowest to highest note and express the pitch series in the corresponding numerical series. This prime series is arranged from left to right while the inverted series beginning with the prime form’s initial number is arranged from top to bottom. This matrix therefore provides the prime, retrograde, inversion and retrograde inversion of a numerical sequence.
The particular flexibility of the numerical matrix becomes apparent when it is applied to a series of pitch fields. The relations among pitches remain consistent, therefore cells and motives retain the thematic contour of the numerical sequence throughout changes to the content of the pitch field. The result is a technique for thematic development in which there are audible shape-theme connections which are derived from rigorous principles, but yet are remarkably flexible, allowing thematic materials to adjust their intervallic content to reflect their harmonic environment, without sacrificing their audible identity, thus facilitating expressive movement from a reduced chromatic to a total chromatic field.

In *Terrains*, I have chosen to employ seven-note (diatonic) pitch fields. My purpose for doing this was to explore the Melakarthas as pitch field resources. Since each Melakartha consists of seven notes, I developed a seven-number numerical matrix. [See Figure 1].

As will be discussed in detail below, two other matrices have been derived from the original matrix. To avoid confusion, nomenclature appropriate to the compositional technique used in *Terrains* will be introduced as follows:
The original matrix from movement I is designated as M1, the matrix derived for movement II is M2 and the matrix derived for movement III is M3. As there are Prime, Retrograde, Inversion and Retrograde Inversion forms of numerical series within each matrix, the permutation and its first numeral shall act as locators. Thus M1 P3 indicates the prime numerical series beginning on the number three in the original matrix, M1. All matrices are derived from M1, as is illustrated, and are primarily but not exclusively employed in their respective movements. [See Figure 2].

### Background “Macro” Pitch Area Organization

The large-scale pitch areas of each movement are governed by an application of the matrix to the overall formal scheme and its pitch relations. In movement I, the Inversion numerical sequence from the matrix forms the macro harmonic scheme, as follows: 1 7 4 6 5 3 2. When applied to the C transposition of Melakartha 14, the pitches and their corresponding bar numbers are: C (bar 1), B♭ (bar 22), F (bar 38), Ab (expressed as G♯-bar 54) G (bar 70), E (bar 86), Db (expressed as C♯- bar 102), and finally, a return to C (bar 118). [see Figure 3: Pitch Resource for movement I].

<table>
<thead>
<tr>
<th>M2</th>
<th>M3</th>
</tr>
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<tbody>
<tr>
<td>1 2 4 5 3 6 7</td>
<td>1 3 4 5 6 2 7</td>
</tr>
<tr>
<td>7 1 3 4 2 5 6</td>
<td>6 1 2 3 4 7 5</td>
</tr>
<tr>
<td>5 6 1 2 7 3 4</td>
<td>5 7 1 2 3 6 4</td>
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<td>4 5 7 1 6 2 3</td>
<td>4 6 7 1 2 5 3</td>
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<td>6 7 2 3 1 4 5</td>
<td>3 5 6 7 1 4 2</td>
</tr>
<tr>
<td>3 4 6 7 5 1 2</td>
<td>7 2 3 4 5 1 6</td>
</tr>
<tr>
<td>2 3 5 6 4 7 1</td>
<td>2 4 5 6 7 3 1</td>
</tr>
</tbody>
</table>
For movements II and III, variants of the matrix were derived to facilitate a contrast in thematic contour. Matrix 1 (M1) continues to be applied to the creation of material for these subsequent movements. The derived matrix for movement II (M2), is merely a rotation of the parent matrix: line RI 1 becomes line P1 of the new matrix, Matrix 2. The resulting line, its pitches and the corresponding bars are as follows:

1 G (bar 1), 2 A (bar 19), 4 C (bar 37), 5 D (bar 55), (1G [bar 73]), 3 B (bar 91) 6 E (bar 109), and a return to G at bar 127. The central pivotal return at bar 73 to G (the 'minor' mode, or Melakartha 20) in this movement was done to reaffirm the pivotal role of the pitch G, and its relation to the primary pitches of the other two movements, C and F, respectively.
The matrix for movement III (M3) was derived by using the R4 line of Matrix 1 as the P1 line of the new matrix. While the primary pitch centre of movement III is F, D occupies a role whose significance is second only to the that of F. The derived matrix for this movement provides the macro scheme for pitch areas, where F occupies the first section of the movement (bar 1-128). D predominates during its central portion, and matrix numerals form the macro tonal structure:

1D (bar 129-160), 3 F (bar 161-176), 4 G (bar 177-192), 5 A (bar 193-214) 6 Bb (bar 215-222),
7-2 C#-E (bar 223-230). At bar 239, a return to the region of F occurs, where the I 1 numerical sequence is employed which returns to variants of the movement's opening material: 1F (bar 239-246), 6 Db (bar 247-254), 5C (bar 255-270), 4Bb (bar 271-286), 3Ab (bar 287-294), 7E-2G (bar 295-302), 1F (bar 303-355).

**Figure 5 Pitch Resource for Terrains III**

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**Linear Motion**

As in conventional serial technique, Terrains employs the method which applies the four linear permutations (P, R, I and RI) to a single pitch resource for the development of new linear material. As with the macro tonal plan, the numerals of the matrix are used in their fixed order, and are employed at all levels of organization: background, middleground and foreground levels, vertically as well as horizontally.
In *movement I*, an example of a middle ground construction would be the extended horn line from bar 126 to bar 137, where a single statement of its series is stretched out over eleven bars, with each series note connected by ornamental ‘passing-tone’ passages. There are numerous similar passages, such as the bass from bar 102 to bar 119, where a statement of M1 II connects seamlessly to a statement of M1 R1.

There are also numerous examples of the matrix being applied to the foreground (or note-to-note) level, such as the various simultaneous linear statements which occur in the opening bars of *movement I*: b1.-4: four-note cells from P forms: Oboes 1,2, 6 7 3 1; Trbsns. 7 1 4 2 3 5 6, etc.

(vii)
A second example is b. 62 tutti: RI5: 5 6 1 2 7 3 4 moving directly to R2: 2 6 1 5 etc.

Applications of the matrix to linear motion are quite comprehensive in **movement II**, where various forms of both M1 and M2 are combined in multiple tempi with each other. At bar 10, violins I state M1 II, while violins II state M1 P1 in dotted half-note units in counterpoint with each other. Violas state M1 P3 a tenth above the celli’s M2 P1 in undotted half note units while the bass pizz. presents M1 P1 on beat one of each bar in the pattern of metre changes discussed above. Applications of the matrix to contrapuntal statements in multiple tempi will be discussed below. [See ‘Multiple Tempi’].

Interesting examples of thematic construction using the matrix may be seen in **movement III**. The pitch material combines statements of M1 P1 and M1 II applied to Melakartha 20 (the same as the aeolian mode) divided between the two trombones.

A second theme is formed from the same combination of P1 and II at b. 17: P1 in bassoon 1, and II in bassoon 2; this relationship is then inverted at b. 26. Similar examples of the contrapuntal interplay of matrix forms may be found throughout **Terrains**.
Vertical Organization

The matrix is also used as an organizing principle for the vertical aspects of Terrains, which may be summarized as three distinct methods. The first is the ‘pitch field’, where the number of different notes used at any given time is limited to a certain number, in Terrains, this number is seven. The consistency of the presence of these notes creates a stable environment which changes noticeably when the pitch field changes. It takes some time for this consistency to become apparent, therefore the harmonic rhythm of the pitch field method tends towards long durations. This method is applied in movement I, where each pitch field lasts the entire duration of one time cycle, or sixteen bars. Apparent vertical variation occurs within each field, but this is more the function of local linear movement than of conscious vertical disposition.

The second method used in Terrains for harmonic organization employing the matrix, is that of vertical presentations of the numerical series. movement II makes much use of this method, as in the chordal punctuations in the winds at letter B (bar 55) The first ww chord is M1 P1: 1D 2E 5A 3F#; the second chord (bar 56) is M1 P2: 2E 3F# 6B 4G. In this same section, the string material is also comprised of statements of M1 P1 (bar 55): 1D 2E 5A 3F#; M1 P7: 7C# 1D 4G 2E, etc.

![Musical notation](image)

The third method of harmonic organization is the statement of tertial triads drawn from the prevailing Melakartha where the numeral from the matrix provides the root of the triad. This method is widely used in movement III. For example, arpeggiated triadic sequences within the 64 beat sections (two time cycles) beginning at bar 64 and proceeding through to bar 112 are based on the numerical series M1 P1 and M1 I1 within Melakartha 20 (the aeolian mode) in the F transposition.
Rhythmic Organization

Macro Rhythm

The application of the principles of the Ta1 requires an adherence to a predetermined number of beats per cycle, and to assign to each cycle some formal musical significance. In the large-scale organization of each movement, new statements of a time cycle are marked by a change in harmonic field, which take the form of a change in Melakartha and/or transposition of a Melakartha, in addition to the introduction of distinctive change in texture, instrumentation and tempo.

In movement I, each section comprises a 32 beat cycle, which corresponds to two cycles of Adi talam, e.g. bar 6-21: 32 beats; bar 22-37: 32 beats, etc. In movement II, a 36 beat cycle is selected, arranged in a metrical pattern of four nine beat statements expressed as a pattern of nine bars: 5 4 5 4 5 2 2. Each section is comprised of two of these patterns: bar 1-18; bar 19-36, etc. Due to the profusion of parts in multiple tempi, a simple 4 beat bar, nine of which total the same 36 bar beat cycle, is employed from bar 37 to bar 108. When the previous metric groupings return (bar 109), a ostinato figure in the Cello expresses this metrical design and allows the statements in other tempi which are superimposed upon it (e.g. Trombones bar 111-113, Violin I bar 111-114, etc.) to be heard in relief.

A similar principle is applied to movement III, where a 32 beat pattern is arranged as eight bars: 5 4 5 4 5 4 3 2. At bar 17, the beat unit changes from the quarter-note to the eighth-note, but the metric pattern is not altered. At bar 201, the 32 beat pattern is expressed in a contrasting arrangement of metres in order to facilitate the coordination of the melodic line and its supporting instruments.

Multiple Tempi Notation (MTN)

My Method of Multiple Tempi Notation (MTN) is essentially a thorough application of proportional augmentation and diminution. This method uses conventional note values in strictly-adhered-to proportional relationships in order to delineate separate tempi within a common reference tempo. [RT]

If each note of a thematic statement is increased in duration by precisely the same proportions, this statement would actually sound as though it were moving at a slower tempo. Conversely, if this process were reversed, the thematic statement would sound faster. If these thematic statements are then superimposed upon each other, the result would be, in effect, the sounding of these themes in multiple tempi. When such tempi are notated within a single reference tempo, the metric function of this tempo is primarily that of an organizing unit of measurement.

[from Multiple Tempi Notation: A Survey and Method, a research paper by the author, 1996]
The applications of my method for the notation of multiple tempi took two principal forms in Terrains: superimposed metres and superimposed tempi. As defined above, MTN is based on the proportional augmentation or diminution of musical material in relation to the reference tempo (RT).

In the opening three measures of movement 1, the superimposition of tempi is accomplished by taking a simple rhythmic phrase, expressed as decimals and restating it in a variety of tempi within the environment of a single reference tempo (RT). The reference tempo is mm=66, the simple rhythmic phrase in the case of bars 1 to 3 is 1, .5, .5, 1. This is simultaneously presented in nine different tempi as follows:

flutes: \( \frac{3}{4} \) which is 1.33 slower than the RT, therefore the equivalent of a unit tempo of mm=49;

oboos: \( \frac{6}{8} \) which is 2.25 times RT, or mm=29;

clarinets: \( \frac{3}{4} \) which is 1.75 RT, or mm=38;

bassoons: \( \frac{1}{2} \) which is 2 times slower than the RT, or mm=33;
horns 1 and 2: \(\frac{3}{4}\) which is 1.5 times that of the reference tempo, or mm=44;

horns 3 and 4: \(\frac{6}{8}\) which is 2.5 times RT, or mm=26;

trumpets: \(\frac{3}{4}\) which is 1.33 times RT, or mm=50;

trombones: \(\frac{3}{4}\) which is 2.16 times RT, or mm=30;

and finally, cello and bass: \(\frac{3}{4}\) which is 3 times RT or mm=22.
In *movement II*, one of my objectives is to employ multiple tempi in counterpoint within a coherent vertical harmonic environment. In bars 1-36 all the parts share a common duration of the quarter-note, the differences in tempi are the result of a consistent use of contrasting metres. The RT is M.M.=48; violins employ groups of three, therefore moving 3 times slower than the RT or M.M.=16 and the violas and celli employ consistent groupings of two, moving at a tempo 2 times slower than the RT, or M.M.=24.

Another example of the combination of multiple tempi and multiple metres occurs in the violin parts at bar 64. Violin I is divisi. moving in dotted-quarter units (1.5 slower than RT or M.M.=42, where the upper part is grouped into a metre of three and the lower part is grouped into a metre of 4. The same procedure is applied to violin II at the same location, bar 64. Violin II is moving at half-note triplet units (1.33 slower than RT, or M.M.=48) where the upper part is grouped into a metre of fours and the lower part is grouped into a metre of threes. There are numerous other examples of the use of multiple tempi in *movement II*.

There are numerous examples of tempo modulation (also known as *metric modulation*), where a common duration bridges a change in reference tempo. At bar 54 of *movement I*, a tempo modulation occurs where within tempo I, the quarter-triplet duration (.66 of the RT) becomes the new RT, or M.M.=78. Other examples of tempo modulations occur throughout *Terrains*.

Despite the complex detail contained within the technical procedures employed in the creation of *Terrains*, expression, depth and musicality have not been sacrificed. On the contrary, the above procedures have been put at the service of a primarily musical intention. With *Terrains*, I believe I have integrated diverse techniques and aesthetics such as the concept of improvisation on a *raga* theme with Western serial procedure, or the pitch resources of Carnatic music with the rigors of a numerical matrix, or the rhythmic diversity of *tala* procedures with the rhythmic precision of multiple tempi notation. The motivic and "gestural" material in *Terrains* evolves principally from creation within defined materials. All pitch relations in all movements are generated from a single source on a deep structural level, yet appear diverse in presentation due to the variety made possible by the application of the numerical matrix to the pitch field (melakartha) and the rhythmic layers afforded by the use of multiple tempi. The process of researching and composing *Terrains* has been a significant step in the development of my personal style and technique.

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An example of the many layers of technique used in *Terrains* being subsumed into musical expression is the concluding bars of *movement II*, where all four permutations of the M1 P1 cell 1 2 5 3 are presented in four different tempi, and yet result in what could be analysed traditionally as a 4-3 suspension resolving into a G major triad. Here the Technique exists beneath the surface of the Art. I believe that expressive power rests on the foundations of technical integrity.

Timothy Sullivan
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