River Beneath the River

by Lois V Vierk

for string quartet

Commissioned by the Barbican Centre for the Kronos Quartet

Special thanks to the Foundation for Contemporary Arts for additional support

River Beneath the River

All instruments are equal in importance and in volume. The only exception is measures 99-133. In these measures bring out Vin 1 and Vin 2. (Via and Cello are softer and lighter.)

Entire piece is NON VIBRATO!

Use entire note value for each glissando.

Each glissando is on one string. Do not cross strings during glissando.

Play all dynamics exactly where marked.

measured 32nds



articulate each 16th while glissing

Small note indicates end pitch of gliss. Do not articulate in any way.

J_____O

Gliss while playing 32nds. Note in parenthesis marks approx. place in gliss. It is not accented

River Beneath the River requires sound reinforcement with a high-quality stereo sound system. Each instrument must be individually close-miked and carefully mixed by the sound engineer. The object is not volume, but clarity. Each individual part must be clearly heard thoughout the piece, and they should coalesce into a whole.

River Beneath the River

Program notes

Currents of sound made up of string phrases and textures of tremolos, glissandos, sustained sounds, and highly articulated and accented passages flow through this piece. The currents alternately co-exist, separate, and coalesce, in their gradual transformation from a gentle beginning to a dynamic conclusion.

At the beginning of the work, the first violin and cello act together to form what I regard as a "sound shape". This shape interacts with the sound shape produced by the second violin and viola. Throughout the piece two or more instruments always act together to form one shape, one sound.

The music unfolds slowly. The constant transformation and development of the sound shapes and relationships employ principles which I call Exponential Structure, in which rates of change of musical material and of time are controlled mathematically by an exponential equation.

The title *River Beneath the River* comes from the Spanish expression "Rio Abajo Rio", which can refer to the innermost soul, the deepest expression of a human.

This work was commissioned by the Barbican Centre of London for the Kronos Quartet.

Analytical material on *River Beneath the River* can be found at the very end of this document, following the score.

River Benesth the River

Lois V Vierk







(c)1993 Lois V Vierk (ASCAP)

































Bring out Violins 1+2, Viola + cello softer - till m. 133

















İ

274.

上の方法に

285.

293.

312.

July John City

Analytical material on *River Beneath the River* follows. After the written analysis and handwritten sketches there is an explanation of Exponential Structure (which is used in the third section of *River Beneath the River*).

<u>Analysis</u>

River Beneath the River (approx. 13:00) is in one continuous movement but for purposes of analysis can be divided into three sections. The first section is from the beginning through the end of Letter C, the second section is from Letter D through Letter E, the third section is from Letter F to the end. An analysis chart, following, lists the letters, with their harmonic contents on each staff to the left of the curvy line. To the right of each curvy line the musical materials for each letter are listed.

lst section

The piece opens with perfect fifths descending a minor third (F - C to D - A). Musical materials begin with tremolo 32nds glissing down in fifths to begin the phrase (m. 1-3), followed by an upward gliss D to A in the cello without tremolo to end the phrase (m. 4). This idea is repeated and elongated throughout the first section, adding the fifth a minor third above the opening pitches, A-flat - E-flat at m. 13. Two little rhythmic figures are added to the phrase--m. 13 has a dotted quarter and eighth, and m. 15 has two eighths. The eighths develop and become important as the piece proceeds. The opening part ends with the tremolo glisses in contrary motion beginning m. 30. The arrival pitches are the diads D - A and C - F. Vln 1 and cello gliss up and down together, while vln 2 and vla gliss up and down together in contrary motion to the other two instruments. This contrary motion gliss is an important structural element.

Letters A, B and C continue harmonically with parallel fifths descending by thirds. Also Letters B and C add a perfect fourth at the end of the harmonic phrase (which inverted into the perfect fifth would be a third lower than the phrase, again), "landing" on this interval. Phrases continue to develop from the same musical materials, and phrases slightly elongate, through the end of C. At the end of the sections are little canons of the instruments glissing down a fourth, sometimes with the two-eighth-note rhythm added, which first was used in m. 15.

2nd section

Letters D and E are more lyrical. Harmonically the piece is dominated by major thirds. Letter D begins with G - B, and with A - C-sharp fading in and out. Then A - C-sharp is heard against A-flat - C-natural. The range is restricted and there are no pitches doubled at the octave. The tremolos, which had become less frequent especially with the canonic glisses in the down in the previous part, have disappeared completely. At Letter E there are still thirds. The contrary motion gliss between E - G sharp is important as an accompaniment figure in vla and cello. An octave is added to the texture when vln 1 glisses down from the high E at m. 127 and and then from the high G-sharp at m. 129 and continuing. In this section the eighth note rhythmic idea has expanded to 3 or 4 eighths (as in m. 128 in vln 1 and answered with 3 eighths by vln 2). By the end of Letter E the repeated eighth has become extremely important in the cello part, leading to the next large section.

3rd section

At Letter F the drive to the climactic ending begins and does not let up. The 3rd section uses principles of Exponential Structure, with ever-descreasing time segments, to control development of musical materials.

The numbers circled on the analysis chart are the number of beats in each letter. From here to the end the numbers of beats in each letter in general becomes smaller. Now the harmonic material is in fourths, through Letter L, and is changing with each letter. The repeated eighths become an integral part of each phrase. There are short tremolo punctuations. Letter G continues the same idea, expanding the instrumental range as well. At Letter H the repeated eighths start to become arpeggios, sometimes with glisses. And the repeated eighths also start to become sixteenth notes. At Letter I the 16th notes expand in number and they ascend to higher pitches in vlns and vla. The upper voices play in canon. Tremolo punctuations continue. Letter J continues these ideas with an expanding range. At Letter K the 16th notes add accents and grace notes on the 2nd and 4th 16ths. The cello phrase now extends down to low A, glissing up from there. Letter L continues with the vlns spending a greater proportion of their phrases in the very high register, in close canon. At Letter M to the end, harmonies are based on fifths again. Cello plays very low, vlns higher and higher, all the while getting more accented. Letter N continues, getting louder all the time as well. There is more high register for the vlns and there are more accents. At Letter O the harmonies move twice as fast as just before this, going through both G-flat and A-flat in this part. At Letter P the harmonies are back to fourths again and the harmonies move very fast (number of beats on each interval is circled on analysis chart). Finally all leads to Letter Q, the climax. There are lots of accents, volume is high, the range is the widest in the piece. The glisses are tremolo glisses (high energy) and they are in contrary motion, an idea first heard at m. 30.

.

P m. 280 0 3 3 3 0 \bigcirc F etc m.294 Q) 7 7 30 4141 0 1 - -> ý

Page 3

This is an explanation of my Exponential Structure, principles of organization of sound and time which I have used in many of my works. Exponential Structure is clearest in some of my pieces which reach high energy climactic conclusions, such as *Timberline*, *Simoom*, *Manhattan Cascade*, *Red Shift*, *Words Fail Me (2nd movement)*, and *Cirrus* (this last one reaches a high energy conclusion towards the end, then backs down into a lyrical ending). These pieces use Exponential Structure for the entire work or movement. Other compositions, such as *River Beneath the River*, use Exponential Structure for sections of the piece but not for its entirety. Following is a document for people who want to delve just a little into mathematics. I thank David Sulzer PhD, aka Dave Soldier, for helpful comments as I was writing what's below.

2022Aug4

Exponential Structure:

Organizational Principles in some of my Compositions, using *Timberline* as an Example

by Lois V Vierk

In the 1980s I began crafting principles of sound organization using what I call Exponential Structure. The impetus for this came from my interest in sensory perception. I'd been reading about how the body processes sensory stimuli and I had learned that the amount of stimulation that we take in via our senses is measured and described mathematically in exponential terms rather than in arithmetic terms. The one exception is the length of a line: if someone looks at two lines it can easily be judged that one line is, say, about twice as long as the other. The line is perceived as twice as long and it actually is twice as long. However in other situations it is not so simple, as confirmed by many scientific experiments. For example, sensory stimuli (such as loudness of sound, brightness of light, amount of pain, etc.) that are perceived by a human as "twice as much" or "three times as much" or "four times as much" as the reference stimulus, do not have two, three, or four times the amount of energy as the reference. It might rather be some number squared, cubed, to the 4th power, for example, compared with the reference. Explorations of different sensory stimuli have produced a different exponential equation, a different mathematical curve, for each one.

I thought it would be interesting to apply such exponential ideas to time and to rates of development and change of musical material. I did this is various ways in various pieces. The simplest manifestation of Exponential Structure in my music concerns the amount of time in sections of the work as ever-decreasing by a mathematical factor instead of by subtraction. One of my pieces that demonstrates this Exponential Structure is *Timberline*, as discussed below. The result of using such a structural tool in this case is sustained energy over a period of time, with the energy building up gradually to a climactic conclusion as time segments decrease and musical complexity increases. My music, though, does not seek to present an abstract mathematical concept as art. Exponential Structure is one tool of many that I use in the service of composing music.

Timberline was composed in 1991 for the Relâche Ensemble of Philadelphia (flute, clarinet, bassoon, viola, contrabass, piano/synth, percussion). I began work in my usual way, working with players in order to understand as much as I could of the possible instrumental sounds and playing techniques. I made many pages of sketches of musical materials. Based on sketched materials, I determined that the piece would consist of two parts. In the first part, the materials and methods of developing materials would be gentle and lyrical. It would be close to 6 minutes. The second part would be longer, close to 11 minutes, and would be persistent and unrelenting in the way it would unfold. It would gradually develop from simple phrases to a more complex high energy climax. These decisions informed the equations that I then developed.

Timberline uses two different exponential equations to define the two parts of the piece - beginning through Letter J, and then Letter K to the end. The anticipated tempo for the first part

was quarter note = 50 (though later this was changed to quarter note = 60, because the faster tempo worked better with the sounds and phrases). The first part of the piece was imagined to be a little under 6 minutes, actually 353 seconds, or 294 beats at the anticipated tempo. The number of sections in the first part of the piece was defined to be 11, based on my musical materials.

The equation for first section - beginning through Letter J - is below. The mathematical constant for producing the values by which to multiply the number of beats in the previous segment was set at .97, a number which for these purposes can be considered somewhat close to "1". (Setting the constant to "1" itself would produce no change in time of the segments. A number close to "1" would yield a small change.) Solving for "x" in the equation below gives the value 31, the number of beats in the opening section. The time in the rest of the sections, which sections are denoted by Letters and defined by changes of pitch center, are gently decreasing until the end of the first part of the piece.

$$\begin{array}{l} x+.97x+.97^{2}x+.97^{3}x+.974^{x}+.97^{5}x+.97^{6}x+.97^{7}x+.97^{8}x+.97^{9}x+.97^{10}x=294\\ x+.97x+.94x+.91x+.89x+.86x+.83x+.80x+.78x+.76x+.73x=294\\ x\approx 31 \end{array}$$

So the sequence of numbers for beats in each section is approximately:

31, 30, 29, 28, 27, 27, 26, 25, 24, 24, 23

As noted before, the actual tempo was set later to quarter note = 60, but the above equation was basically followed. The length of the first part of the piece at this tempo is about 5 minutes.

The second part of the piece was desired to be close to 11 minutes long. Based on the musical materials, the tempo was set at quarter note = 66. The second part was defined to be 708 beats. The number of sections was defined to be 10. A much smaller multiplier was chosen for this second equation (.85 as opposed to .97) with the result being that the ongoing decrease of the time in the sections (again denoted by Letters and defined by pitch center) is more drastic. The musical changes are propelled at a faster rate as the piece rushes to its conclusion. Again, the numbers serve the music, not vice versa. For example, the equation's numbers are followed fairly closely until letter R, when the piece is nearing its arrival point, at Letter T. From letter R to the end the timing of sections is intuitive.

The equation for the second section, Letter K to Letter T, is below.

$$\begin{array}{l} x+.85x+.85^{2}x+.85^{3}x+.85^{4}x+.85^{5}x+.85^{6}x+.85^{7}x+.85^{8}x+.85^{9}x=708\\ x+.85x+.72x+.61x+.52x+.44x+.38x+.32x+.27x+.23x=708\\ 5.34x=708\\ x\approx 132 \end{array}$$

So the sequence of numbers for beats in each section is approximately:

132, 112, 95, 81, 70, 59, 50, 42, 36, 31

The above equation was basically followed for much of the second part of the piece, with notable exceptions as explained on the next and last page.

| equation number of beats | actual number | comments |
|--------------------------|---------------|---|
| beginning - 31 beats | 33 | From the beginning through Letter J, differences in timing are mainly due to carrying out lengths of phrases. |
| Letter A - 30 beats | 30 | |
| Letter B - 29 | 29 | |
| Letter C - 28 | 28 | |
| Letter D - 27 | 27 | |
| Letter E - 27 | 28 | |
| Letter F - 26 | 24 | |
| Letter G - 25 | 25 | |
| Letter H - 24 | 22.5 | |
| Letter I - 24 | 21 | |
| Letter J - 23 | 18 | |

(So far this is a very gentle decrease in beats from section to section, perhaps not even picked up as ever-decreasing time segments by the human ear/brain. This is in contrast to the second and final part, with time segments decreasing at a faster pace.)

| Letter K - 132 | 159 |
|----------------------------|------|
| Letter L - 112 | 114 |
| Letter M - 95 | 99 |
| Letter N - 81 | 79 |
| Letter O - 70 | 70 |
| Letter P - 59 | 60 |
| Letter Q - 50 | 47 |
| Letter R - 42 | 28 |
| Letter S -36 | 40.5 |
| Letter T - 31 | 18 |
| Letter U - not in equation | 29 |
| Letter V - not in equation | 22.5 |

The musical arrival, climax of the piece, is reached at Letter T. In preparation, the timings of sections Letter R and Letter S are intuitive and not controlled by the equation. Note that the equation itself ends with Letter T. More time was added at the end in order to carry out the development of musical materials and the piece as a whole.

Musically, Letter K, beginning of 2nd part of the piece, needed to be longer than in equation.

Score is available from Frog Peak Music

http://frogpeak.org/

For performance questions please contact the composer

LVVVV@aol.com

www.loisvvierk.com