

Stuart Greenbaum: *800 Million Heartbeats*

an analysis by the composer

Programmatic Background

Most mammals lives apparently last for around 800 million heartbeats. This was the contention of a recent nature documentary. Birds like the hummingbird have a very rapid wing motion - so fast that it becomes a blur. It also has a correspondingly fast heart rate and metabolism and lives a shorter (and arguably more intense) life. By contrast, the sloth has a very slow heart rate, is given to much sleep and has a relatively long life. If humans had only 800 million heartbeats in a life, we would die young (probably in our twenties). But the actual figure is only nominal. It becomes a heightened metaphor for a life, measured in heartbeats, and the journeys that fill its course.

Instrumentation

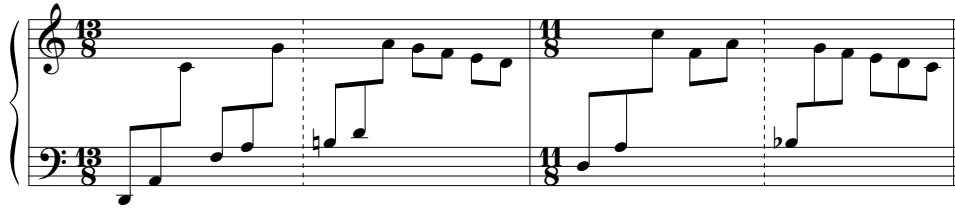
The original version of this piece was written in 1999 for Southbank, a Melbourne quartet consisting of clarinet, bass trombone, piano and percussion. In this version the clarinet represented the hummingbird, with rapid oscillating motives and the bass trombone represented the expansive slow heartbeat of larger mammals. The piano and percussion represented the constant stream of life in which finite individual lives existed. In addition to the ensemble, a prerecorded tape (CD) of birdsong and human breathing opens and closes the work to set the environment upon which the piece is commenting.

The current version (to which this analysis most closely relates) was adapted in 2000 for the Brisbane quintet, Topology, whose line up is soprano saxophone, violin, viola, double bass and piano.

Pattern A

This piece is structured around a two-bar pattern. It provides the basis on which all else is built:

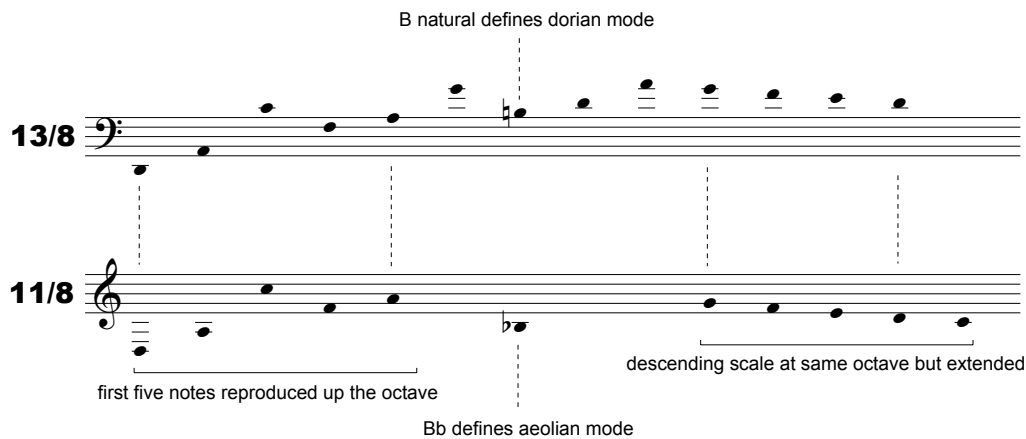
Musical Ex. No. 1



This arpeggiated pattern gradually forms in the piano, by substituting beats for rests and is fully formed by bar 15. It is comprised of two bars: **13/8 + 11/8**

The second bar (11/8) is in essence a reduction of the first bar:

Musical Ex. No. 2



It starts with the same five notes and ends with a similar descending scale. Other than being slightly compressed (two notes shorter), the striking feature is the alteration of B natural in the first bar, to Bb in the second. This modal alternation highlights the antecedent/consequent relationship of the two bar pattern. The first bar outlines the harmonic material in equal proportion of rising and falling intervals. The raised 6th (B natural), which defines the dorian mode, helps to provide a lift for the antecedent. The consequent, in answer, has more falling intervals and the flattened 6th (Bb) reinforces a stronger sense of descent.

The harmonic implication of the opening arpeggios is shown below:

Musical Ex. No. 3

The chordal reduction implies sonorities built around stacked 3rds. In addition, each chord has a pivotal note shared by the following chord. This dominant note, A, provides the first two pivots and the final one is provided by D, the tonic.

The opening pattern provides further clues to the rhythmic structure of the work by examining its 24-quaver cycle:

Musical Ex. No. 4

It is divided into two bars, as already noted, but the dotted barlines show a further rhythmic subdivision:

$$6/8 + 7/8 (= 13/8) + 5/8 + 6/8 (= 11/8)$$

Finally, this is broken down into cells of either two or three quavers:

$$3 + 3 + 3 + 2 + 2 + 3 + 2 + 3 + 3 (= 24 \text{ quavers})$$

This cell structure is highlighted by triangles (3) and lines (2) which denote a conducting pattern if required. The ratio of triple versus duple cells within the 13 + 11 phrase is 3:1, triple cells accounting for 75% of that pattern. There are never more than two duple cells in a row within the pattern, but as it loops, there are up to five triple cells in a row. This makes the feel of compound metre seem dominant, while the duple feel provides variation.

While it would be possible to write the majority of the piece out in conventional compound metre, this would not adequately convey the tonic strong beat of the start at the 11/8 phrase. The 24-quaver length, however, is not incidental. As the piece progresses, it means that the material, if desirable, can re-grouped within an accent pattern that follows three bars of 4/4 or two bars of 12/8 – particularly the latter. The possibilities therefore of creating rhythmic ambiguity are enhanced.

Sub-pattern and melodic content

A sub-pattern is used in conjunction with the main pattern and later by itself. It is a motoric rhythm based entirely on repeated semi-quavers and first appears in the viola leading into bar 28:

Musical Ex. No. 5

Musical Ex. No. 5 shows a 24-quaver pattern in 13/8 time. The notation includes accents (>) and a beam group. Annotations include "accent against beam group" and "implication of 2/4 syncopation".

It drives the pulse more insistently than the quaver pattern and also has its own ‘turnaround’ figure of 8 semi-quavers at the end of each 24-quaver cycle. Unlike the main pattern, it does not thread throughout the whole work. It is used more sparingly, in three appearances. The third appearance, however is crucial to the buildup towards the main climax and will be discussed further under the area of orchestration and variation.

As noted earlier, there are two melodic themes representing creatures with slow or fast heartbeats. The slow heartbeat is represented here by the double bass at bar 28:

Musical Ex. No. 6

Musical Ex. No. 6 shows a melodic theme for Violin (Vln.) and Double Bass (Cb.) in 13/8 time. The notation includes glissando markings (gliss.), dynamics (ppp, mf), and duplet markings (2).

The violin doubles the second half of the phrase two octaves higher. The main feature of this melody is the presence of duplets, which add an extra layer of hemiola complexity to the already variable metric structure. The intervals used in the melodic contour can be seen to relate to the contour of the main 24-quaver pattern. The melody is intended to be melancholy and representative of time passing slowly.

By contrast, the melody leading into bar 52 in the soprano saxophone, represents the rapid heartbeat, always oscillating and fluttering like the wings of a hummingbird:

Musical Ex. No. 7

Bb Sop. *pp* *p* *grad.* *Fiz* *mf* *growl tone*

This material is slightly more chromatic and always varied, representing more rapid development.

These two melodic ideas are at first presented separately and then later superimposed.

Pattern B

A third, less overt melody can be found in the piano texture within the cadential 'B' pattern:

Musical Ex. No. 8

Lea *Lea* *implication of 3/4 metre*

The entirely conjunct melodic contour found in the right hand of the second bar recurs periodically, but towards the end of the piece this is developed beyond its general undercurrent status to become the main climactic melody from bar 196. This cadential motive exploits pure compound metre in the form of 12/8 or 6/8 and its importance is highlighted by the metrical structure.

Metrical structure

The metrical scheme alternates between 13/8 and 11/8, occasionally with regular compound metre. This generally follows the following paradigm:

Chart No. 1

(reads left to right)

		Main pattern (A)			cadential motive (B)
(13	11)	13 + 11	13 + 11	13 + 11	6 (B¹)
		13 + 11	13 + 11	13 + 11	12 (B²)
			13 + 11	13 + 11	12+6 (B³)
			13 + 11	13 + 11	12+12 (B⁴)

The repetitions of Pattern A get reduced as Pattern B is expanded. This cycle of 300 quavers is repeated about five times. The extra 13 + 11 in brackets at the start of the cycle applies to only the 3rd and 4th cycles, which are elongated. The 4th cycle is also interrupted by the interpolation of a section of extended compound metre for the climax. In general, though, the cadential Pattern B (see ex. No. 8) accounts for 20% of the 300-quaver cycle.

While structured in mixed metre, the 13 + 11 obviously add up to 24, which is the pivotal connection between the regular compound metres of 6/8 and 12/8. In essence, the 6/8 and 12/8 bars are cadential, the full cadence (two bars of 12/8) occurring at the end of the 300-quaver cycle.

Harmonic structure

The harmonic scheme is relatively independent of the metrical scheme and modulates modally by increasingly wide intervals as follows:

Musical Ex. No. 9

Musical Ex. No. 9 shows a melodic line on a treble clef staff. The notes are G4, A4, B4, C5, B4, A4, G4, F4, E4, D4, C4. The intervals between notes are labeled as follows:

- min 3rd (G4 to A4)
- P 4th (A4 to B4)
- P 5th (B4 to C5)
- maj 6th (C5 to B4)
- maj 7th (B4 to A4)

Below the staff, the intervals are further labeled:

- implied only (G4 to A4)
- maj 3rd (A4 to G4)
- tritone (B4 to F4)
- min 6th (F4 to B4)
- min 7th (enharmonically) (B4 to F4)
- cadence (F4 to C4)

These key centres are modal and usually dorian (13/8) followed by aeolian (11/8). This structure is intended to represent a journey through a 'life', and unlike the metrical scheme, which is highly systematic, the duration of these keys is irregular and instinctual. Some patterns, however, can be observed. The opening D minor modality is given a full 300-quaver cycle to establish that pattern. Once set, however, the ensuing key changes last for increasingly shorter periods and then grow longer, shorter and then longer again. This contraction and expansion of time is programmatically linked to the idea of life cycles, which might also be seen to expand and contract. This pattern is revealed in the following table:

Chart No. 2

Paradigmatic construction of key centres
in *800 Million Heartbeats*
(reads left to right)

Key															
D min	A	A	A	B1	A	A	A	B2	A	A	B3	A	A	B4	A
F min	A	A	A	B1	A	A	A	B2							
C# min									A	A	B3	A			
F# min													A	B4	
C min															A
G min	A	A													
B min			A	B1	A	A									
G# min							A	B2	A	A	B3	A			
Bb min													A	B4	A
A min	A	A	A	B1											
A min/G					A	A	A	B2	A	A	B3	A	A	B4	
											B3				
								B2							
				B1											
D min	A	A	A	B1	A	A	A	B2	A	A	B3	A	A	B4	A

In this chart, 'A' represents the main pattern (refer back to ex no. 1), whereas 'B' represents the cadential pattern (ex no. 8). B1-B4 represents how much of the cadential pattern is used. B1 is just the first 6 quavers, whereas B4 represents the full two bars of 12/8 (see chart no.1)

The prevalence of minor modes is altered at the climax of the piece with a dominant or mixolydian mode (over a 'G' bass), which is coupled with the extension of compound time to create a heightened sense of arrival. The saxophone, in particular, extends outside of that modal framework, notably including the tritone, which serves more of a colouristic blues function than of actually de-stabilising the given mode.

Orchestration and techniques of variation

Once the metrical scheme is set in motion, it follows a reasonably strict pattern which, if merely repeated over five cycles may lose interest. Two agents keep the musical discourse moving forward. One is the harmonic scheme which, as noted, modulates according to a different schedule to the metrical scheme. The other factor is the use of varied orchestration. As an example of this, at bar 65, the piano ceases to play the main pattern and this material is transferred into pizzicato strings. The strings inside the piano are strummed like an autoharp, creating a different texture and distribution of material:

Musical Ex. No. 10

The musical score for Musical Ex. No. 10 is written for Violin, Viola, Double Bass, and Piano. The time signature is 13/8. The score is divided into two systems. The first system shows the Violin, Viola, and Double Bass parts, all marked **Pizz** and *p*. The second system shows the Piano part, marked **Inside of Piano** (strumming - like autoharp) and *p*. The score includes a legend for the piano part: *

- silently depress keys with LH
- strum with nails of RH
- (NB: keys do not need to be fully depressed)

There is no modulation at this point. The change in texture is sufficient to keep the musical discourse moving forward. The pizzicato strings distribute the main pattern in close hocket, and this is a technique that is also used on the sub-pattern in the leadup to the climax:

Musical Ex. No. 11

Musical score for Musical Ex. No. 11, featuring Soprano Saxophone, Violin, Viola, Double Bass, and Piano. The score shows a progression of dynamics from piano (*p*) to very gradually getting louder across five staves.

The hocketed return of the sub-pattern into bar 177 also coincides with the introduction of the note 'G' as an extended dominant pedal to help build the tension towards the climactic arrival at bar 196. This then cadentially resolves back to the modal centre of 'D' and the recapitulation of the main pattern. Before it completes a full 300-quaver cycle, however, a process of liquidation commences, marked also by the use of hocket, but primarily by a reduction of quaver beats within the length of the repeated pattern. This can be seen clearly in the progressive time signature reductions:

Musical Ex. No. 12

Musical score for Musical Ex. No. 12, featuring Violin, Viola, Double Bass, and Piano. The score shows a progression of dynamics from *ppp* to *p*, with time signature changes and performance instructions like *Pizz* and *Arco*.

As the pattern liquidates, so too does the material gradually transfer from the piano over to the strings, until all that is left is a repeating 6/8 figure in the violin, which in turns crossfades into the sound of taped bird song and humanly breathing to end the piece.