

## **Weakening Structures or Structuring Mistakes? Brian Ferneyhough's Manipulation of the Fibonacci Sequence in his Second String Quartet**

by Giacomo Albert

In 1982 Brian Ferneyhough held a series of lectures in Darmstadt, analyzing his string quartets. On this occasion the composer stated that he used the Fibonacci sequence in order to determine the length – i.e. the number of eighth notes per bar – in the first section of his Second String Quartet (mm. 1–56). However, he was unable to precisely analyze what he had done, and thus continued with the analysis of the other dimensions. A few years later Alessandro Melchiorre wrote that in the first section of the Second String Quartet, Ferneyhough might have followed the Fibonacci sequence, but that it was now impossible to retrace what he did because he had reworked it too thoroughly.<sup>2</sup> Thus, when I began to analyze the Second String Quartet, I tried to find it, but obviously failed!

Examining Ferneyhough's sketches at the Paul Sacher Foundation, I found on the first page of the quartet's draft a rather eccentric version of the Fibonacci numbers (from now on labeled "Ferneyhough-Fibonacci"; cf. *Plate 1*):

1/ 1/ 2/ 3/ 5/ 8/ 13/ 21/ 34/ 55/ 89/ 144/ 233/ 311/ 550/ 861/ 1411/ ~~3689~~/ 2212/  
3623/ 5835

That is, from 311 on, the series is incorrect! With this sequence in hand, it is possible to analyze the macrostructure of the entire quartet and some processes situated at the microstructural level. For example, we are now

---

I deeply thank the staff of the Paul Sacher Foundation and Professor Pascal Decroupet for the suggestions and indications they gave me during the discussion of this topic in a Colloquium, which orientated and influenced my work.

- 1 Lecture "Vortrag Brian Ferneyhough" available at the archive of the Internationales Musikinstitut Darmstadt, n. 1552131.
- 2 Alessandro Melchiorre, "I labirinti di Ferneyhough: la forza e la forma, la figura e il gesto nell'opera del compositore inglese," *Brian Ferneyhough*, I Quaderni della Civica Scuola di Musica, ed. Alessandro Melchiorre (Milan: Civica scuola di musica, 1984), pp. 4–41.

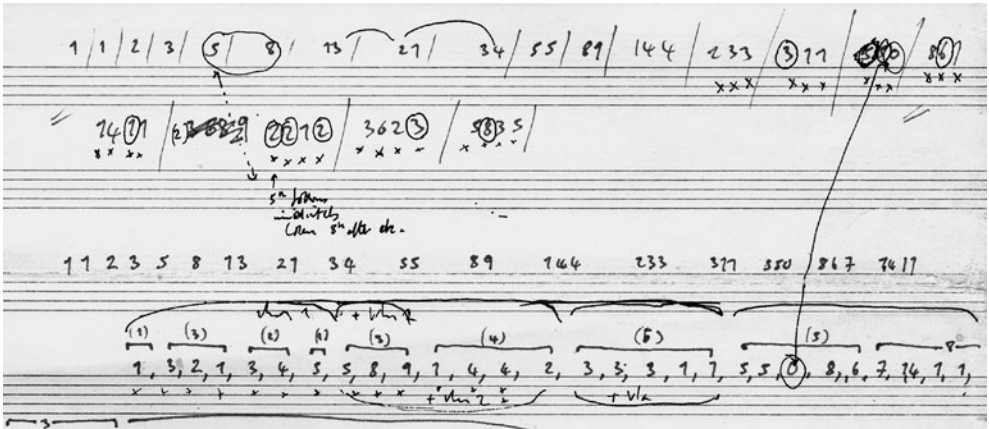


Plate 1: Brian Ferneyhough, Second String Quartet (1983), draft with sketches, p. [1] (Brian Ferneyhough Collection).

able to understand the sequence of eighth-notes per bar in the third section of the piece (mm. 86–105):

5 8 5 3 3 6 3 2 2 2 2 1 1 4 1 1 1 8 5 6

It matches the backwards reading of Ferneyhough-Fibonacci, according to the pattern 1 2 4 3 (so that 5 8 3 5 becomes 5 8 5 3) – except for the last two reversed bars (5 6 instead of 6 5). Moreover, the macro-organization of the material in groups of bars abides by the sequence: six groups of 1, 1, 2, 3, 5, and 8 bars. We can see it in a sketch published by Melchiorre,<sup>3</sup> probably created after the composition of the quartet. Most important, this grouping is mirrored in the creative process, and thus in the organization of the sketches (e.g. bars 90–92 have been developed in a two-page detached sketch).

Each section of the quartet takes advantage of Ferneyhough-Fibonacci in its own way: for example, Ferneyhough used the 1 2 4 3-permuted retrograde of the sequence in the fourth section, this time to determine the number of eighth notes per group.<sup>4</sup> It is possible to deduce that the Ferneyhough-Fibonacci sequence consists of an ordered string of digits, which can be employed to manage different dimensions of the composition and can be set at different levels, even simultaneously. Moreover, it can be read in many ways and directions. Thus, the sequence is a structured reservoir that can be accessed and retrieved according to different algorithms. Further-

<sup>3</sup> Ibid., p. 10.

<sup>4</sup> Cf. the line “Phase length” in the sketch: Brian Ferneyhough, *Collected Writings*, ed. James Boros and Richard Toop (Amsterdam: Harwood, 1995), p. 125. Ferneyhough uses here a longer stretch of the sequence than he did in section 3.

more, there is no central all-embracing structure: the formal play is localized and the composer decides whether or not to apply the modules (either process or structured data), and at which level, according to his needs, thereby creating a decentralized form.<sup>5</sup>

Now let us return to the beginning of the quartet in order to form a deeper understanding of Ferneyhough's treatment of the sequence. Having Ferneyhough-Fibonacci at our disposal, we can investigate the compositional process of the macrostructure of the first two sections of the quartet (1: mm. 1–56; 2: mm. 57–85) by analyzing the score. Ferneyhough interpreted the Ferneyhough-Fibonacci sequence as a succession of digits instead of numbers. Then, he left the first six numbers aside, i.e. those smaller than 10, so as to erase any trace of Fibonacci's numbers and their growth relation. In that way, the Fibonacci sequence loses its original meaning: it does not constitute a mathematical principle anymore, but a way of generating an "almost random" sequence of digits. Then, he left out the zeroes to obtain the following sequence:

~~1 1 2 3 5 8~~ 1 3 2 1 3 4 5 5 8 9 1 4 4 2 3 3 3 1 1 5 5 0 8 6 1 1 4 1 1 2 2 1 2 3 6 2 3 5 8  
3 5

In order to outline the number of eighth-notes per bar (i.e. the form of the quartet's first two sections), the composer intertwined this sequence with its retrograde. Thereafter, he split the sequence into two segments: the first section up to the number 1411, then the second section.

1 5 3 3 2 8 1 5 3 3 4 2 5 6 5 3 8 2 9 1 1 2 4 2 4 1 2 1 3 4 3 1 3 1 1 6 1 8 5 5 5 8 1 6  
1 1 3 1 3 4 3 1 2 1 <1<sup>st</sup> section | 2<sup>nd</sup> section> 4 2 4 2 1 1 9 2 8 3 5 6 5 2 4 3 3 5 1 8 2 3  
3 5

The sections are radically distinct from each other, both from the technical and perceptual point of view: the first one is monophonic, scattered, and contrasting, the second one polyphonic, legato, and continuous. Hence, both the separation between bars and their grouping in macro-bar units (implemented according to Ferneyhough-Fibonacci from 13 to 144) are exploited in different ways among the sections. Therefore, Ferneyhough decided to draw attention to the mirror-structure inside the first section, that is, the digits from position no. 26 until the end of the section. He replaced the first cipher of the retrograde of 1411 with the digit 2, and slid all the successive digits of the retrograded sequence by one position to the end of the first section, concluding with 2. We can see traces of this work in the sketch, where Ferneyhough wrote "(2)" after the number 1411 (which also indicates the start of the second section), and, moreover, marked 233 and the following numbers with a cross. With this slippage, Ferneyhough

5 Pietro Cavallotti, in *Differenzen: Poststrukturalistische Aspekte in der Musik der 1980er Jahre am Beispiel von Helmut Lachenmann, Brian Ferneyhough und Gérard Grisey* (Schliengen: Argus, 2006), relates these qualities to a poststructuralist conception of form.

broke the global mirroring of the whole structure and put the erased zeroes (of 550–055) at the center of the tinier mirror that he engendered. Then, he read a number in two ways: as 867 in the original and 861 in the retrograde (so to avoid two near successions of four sequential bars of a single eighth note).

The following table illustrates the analysis of bars 1–85 (*Table 1*). At the bottom the succession of bars is indicated. Above that is the number of eighth notes per bar in the score, followed above that with the number of eighth notes per bar according to the “exact” Ferneyhough-Fibonacci series. Still above that is the hypothetical sequence generated through Fibonacci numbers, followed by the kinds of materials that Ferneyhough employed in section 1 (H = main, rhythmically complex material; N = secondary, continuous material; P = pause).<sup>6</sup> Then comes the grouping of bars in macro-units, above which is the entrance of the instruments (every twelve bars a lower instrument begins to play). The sectional divisions are shown at the very top.

Is Ferneyhough-Fibonacci a byproduct of a series of mistakes or a deliberate reworking of a sequence? In order to answer this question, let us take a closer look at the sequence itself. It has clearly been created through a complex series of misreadings or permutations of digits 7 and 1: the first “wrong” number of Ferneyhough-Fibonacci is 311, a “misreading” of the “right” 377. But, in order to calculate the next number of the sequence, 550, Ferneyhough has added 233 to a second, different misreading of 377: 317. Thus, he has read 377 both as 311 (in the written sequence) and 317 (in order to generate 550). In the next position of the sequence, we have a double-edged number: 817 (in the retrograde succession) and 811 (in the original), created by adding 550 and 311/317. A similar situation occurs in the continuation of the sequence: in order to calculate the next number, Ferneyhough chose 861, thus obtaining 1411. For the following one, he permuted the “right” 2272 into 2212.

We can deduce another interesting characteristic of Ferneyhough’s creative strategies by examining the erased number 3689 found in the sketch. It has most likely been generated by adding the “right” 2272, which will later be discarded in favor of 2212, to 1417, an unused permutation of 1411. This is fascinating, because 2272 derives from the addition of 1411 and 861. In other words, Ferneyhough has added two numbers from different permutations of the Fibonacci series and used them at the same time for the same calculation – a hybridization of two sequences from different permutations of Fibonacci. That is, for this operation he must have had at his disposal two different versions of the Fibonacci series that he had already computed (perhaps in a missing sketch) – a labyrinthine way of generating

---

6 In the second section I indicate the variants introduced in the draft and in the rhythmic sketch scheme.

Section	First section																												
Subd.	vI														vI & vII														
Grouping	1 3			2											1	3			4										
Pause(P), Main(H), Sec.(N) mat.	H	P	H	P	H	S	H	P	H	S	H	P	H	P	H	P	H	S	H	P	H	N	H	N	H	P	H	P	
Fibonacci	1	5	3	6	2	7	1	6	3	1	4	8	5	1	5	4	8	4	9	8	1	5	4	2	4	7	2	9	
8th notes prev.	1	5	3	3	2	8	1	5	3	3	4	2	5	6	5	3	8	2	9	1	1	2	4	2	4	1	2	1	
8th notes	1	5	3	3	2	8	1	5	3	3	4	2	5	6	5	3	8	2	9	1	1	2	4	2	4	2	2	1	
Bar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	

(First section)																											
vI & vII & vIa														vI & vII & vIa & vC													
5														5 (includes the 0 of 550)   8													
H	N	H	P	H	P	H	P	H	N	H	P	H	N	H	P	H	P	H	P	H	N	H	P	H	P	H	P
3	5	3	1	3	7	7	8	7	9	6	1	1	6	9	7	8	7	7	3	1	3	5	3	9	2	7	
3	4	3	1	3	7	1	6	1	8	5	5	5	5	8	1	6	1	7	3	1	3	4	3	1	2	1	
3	1	3	4	3	1	1	1	1	6	5	8	5	5	8	5	6	1	7	1	1	3	4	3	1	3	1	2
29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56

Second section																																				
9														1 4 4   2 2																						
Draft RhSc Draft 1 RhSc ?																																				
4	2	4	5	1	8	9	4	8	4	5	1	5	8	4	1	3	6	1	7	2	6	3	5	1	6	1	7	2	6	3	5	1				
4	2	4	2	1	1	9	2	8	3	5	6	5	2	4	3	3	5	1	8	2	3	3	5	1	5	1	8	2	3	3	5	1				
4	2	4	2	1	1	7	2	2	4	4	3	2	3	6	5	4	2	3	3	2	5	1	8	2	3	3	5	1	5	1	8	2	3	3	5	1
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	78	79	80	81	82	83	84	85

Table 1

material by playing interactively with structuring procedures and algorithms. It is precisely the interactive nature of the structuring process that gives rise to the germination of the structures and to the bewildering complexity of their forms.

Why did Ferneyhough discard 3689 and choose this specific sequence? We can try to answer this question through a statistical analysis of the distribution of the number of occurrences of each digit among Fibonacci and Ferneyhough-Fibonacci. I have compared them in *Table 2*. *Table 2a* plots the occurrences of the digits within the three forms (Fibonacci, and the two employed Ferneyhough-Fibonacci series, with 861 and 867, respectively); *Table 2b* presents the two Ferneyhough-Fibonacci series in comparison with the original Fibonacci.

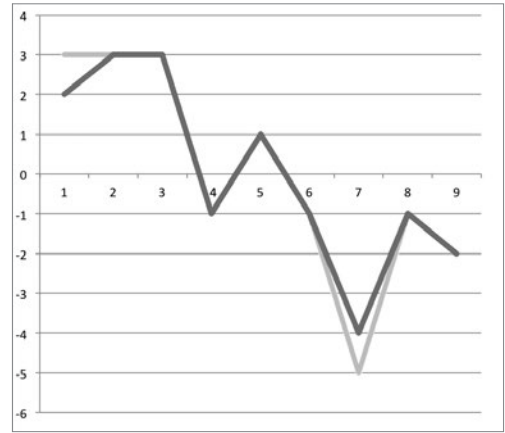
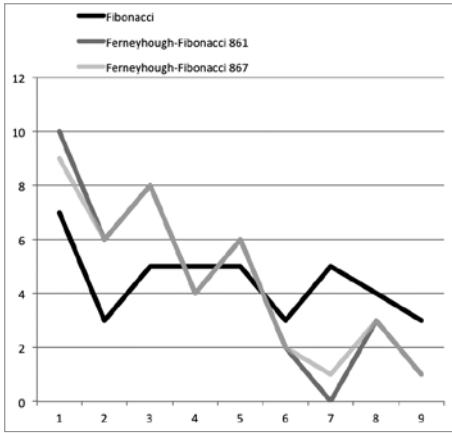


Table 2 a+b

From these graphs we can deduce that Ferneyhough reshaped the Fibonacci numbers and changed a sequence characterized by a fairly plain statistical distribution of digits into a prominently low-digit sequence with only a few occurrences of high digits. This means that he did not want an arithmetic progression, nor a random succession: what he needed was a “quasi-random” sequence of a particular distribution of digits. This is a precise formal choice, which acts on every other dimension of the composition. Moreover, it allowed him on the one hand to emphasize specific passages, such as the entrance of the fourth instrument and the onset of the disintegration of the monophonic structure, and on the other hand to create quick contrastive moments between sound and silence at the beginning and end of the first section, and so on.

So, are we dealing with weakened structures or with structured mistakes? Probably both, but most of all, an interactive game with procedures, algorithms, and structured data, played according to the composer’s own “musical feeling.”