

Number and Proportion in the Music of Sofia Gubaidulina

by Valeria Tsenova

The Sofia Gubaidulina Collection at the Paul Sacher Foundation includes some remarkable sketches for her works from the 1990s. The most valuable for researchers are working materials relating to Gubaidulina's compositional techniques: formal plans, timbral schemes, and – numbers. Many pages of the drafts are filled with formulas and calculations that refer to the temporal proportions of the form on different levels. Gubaidulina's interest in both the numerical aspect of composition and in numerical symbolism has been known for a long time, but only the drafts at the Basel archive give us concrete evidence of this fact.

In a letter to the composer Viktor Suslin, Gubaidulina expressed a very important idea. Although she writes about the work of one of her Moscow colleagues, her formulation pertains as well to her own creative principle:

[...] sehr angenehmes Stück im sogenannten "entspannten" Stil. Höchst angenehm zu hören, wenngleich ich die ganze Zeit über dachte, daß es gut wäre, in einem Stück derartigen Stils etwas Festes im Inneren zu haben, sei es eine strenge Konstruktion oder irgendeine kompositorische Idee. Und wenn dies dabei gleichzeitig noch Symbol für etwas Anderes wäre ... dann ... was dann? Dann wäre ich begeistert.¹

In this letter, written in 1982, it is evident that Gubaidulina values two important elements in the compositional process: the constructive principle and its symbolic meaning. In her works from the beginning of the 1980s, Gubaidulina consciously uses numerical structures with sacral-mystical meanings. Ontologically, the numerical aesthetics of her music is based on the interlacing of Eastern mysticism and Orthodox symbolism.

Gubaidulina uses different types of numerical structures. The deepest stratum of her numerical aesthetics is the most valuable. Hidden from the eye, it lies at the very foundation of the musical composition and is organized as a complicated system of numerical ratios.

In various interviews Gubaidulina has commented on the basis of the compositional techniques in the sonic space of contemporary music. She is convinced that rhythm is the most important foundation. However, Gubaidulina understands rhythm not only in the general sense as a series of durations. From 1984, she began working on the "rhythm of the form,"

which means a special temporal structure of the work produced by the proportionality between sections of its form. Surely, this problem is not new and in all times has been of special interest to any creator of music. But in the twentieth century the “rhythm of the form” became an important aspect of contemporary compositional technique that is brilliantly demonstrated by Gubaidulina, who creates individual “numerical plots” in almost every work. The expression “numerical plot” was found in her sketches for the cycle *Jetzt immer Schnee* (1993) and for our purposes can be used as a special term for the compositional technique that guides the proportional calculation of the whole form.

The proportions of the “Fibonacci series”² have been the foundation for the majority of Gubaidulina’s works since the middle of the 1980s (*Perception*, 1981, rev. 1983/1986; *Im Anfang war der Rhythmus*, 1984; *Stimmen ... Verstummen*, 1986). In her works one can also find other sequences, derived from the Fibonacci principle, for example the “Lucas” and “Evangelists’ series”:³

Basic Fibonacci series:	1	2	3	5	8	13	21	34	55	89	144	
Lucas series:		1	3	4	7	11	18	29	47	76	123	199
Evangelists’ series:		2	5	7	12	19	31	50	81	131	212	343

As an organic, natural phenomenon, the Fibonacci series has an important semantic meaning for Gubaidulina. Its numbers break away from a mechanical regularity, approach the ideal golden section, and give the form an ability to breathe. Fibonacci numbers were frequently used in works by such composers as Debussy, Bartók, Stockhausen, and Nono, but it is difficult to find in these composers’ works such a diverse treatment as in Gubaidulina’s music.

At first Gubaidulina was attracted by the logical beauty of the Fibonacci numbers; they exerted a fascinating and in some sense mystical influence on her. It was only later that this numerical series became the constructive basis of her works. She found various ways of using it. In *Jetzt immer Schnee*, for example, one can find a complicated rhythmical structure underlying the entire five-movement cycle, and in the Fourth Quartet (1993) the purely musical proportions are accompanied by light projections.

Such a pervasive treatment of rhythm can be found in a piece with the poetic title “... *Heute früh, kurz vor dem Aufwachen ...*,” written for seven Japanese Kotos (1992–93). The whole piece is based upon two series: Fibonacci and Lucas numbers. A key role is played here by the Lucas sequence.

It is interesting to follow Gubaidulina’s compositional process by studying three sketches made within a short period of time. There are three fi-

nal ones among them: “final sketch,” “last variant,” and “final variant,” all of which vary in length. Why did Gubaidulina keep changing the number of bars? She wanted to achieve a precise construction in which all numerical proportions were related to the principal numerical sequence. At first she chose 209 bars, then 212 and finally 217.

What is the significance of the number 217? It can easily be divided into several components derived from the Lucas numbers: 217 bars = 199 bars of music + 18 bars of silences.

Such a division is not connected with the internal formal proportions; it explains only the general duration of the piece. However, the Lucas numbers determine the length of each of the eleven formal sections (in bars). In the following scheme one can examine the “numerical plot” of the whole piece:

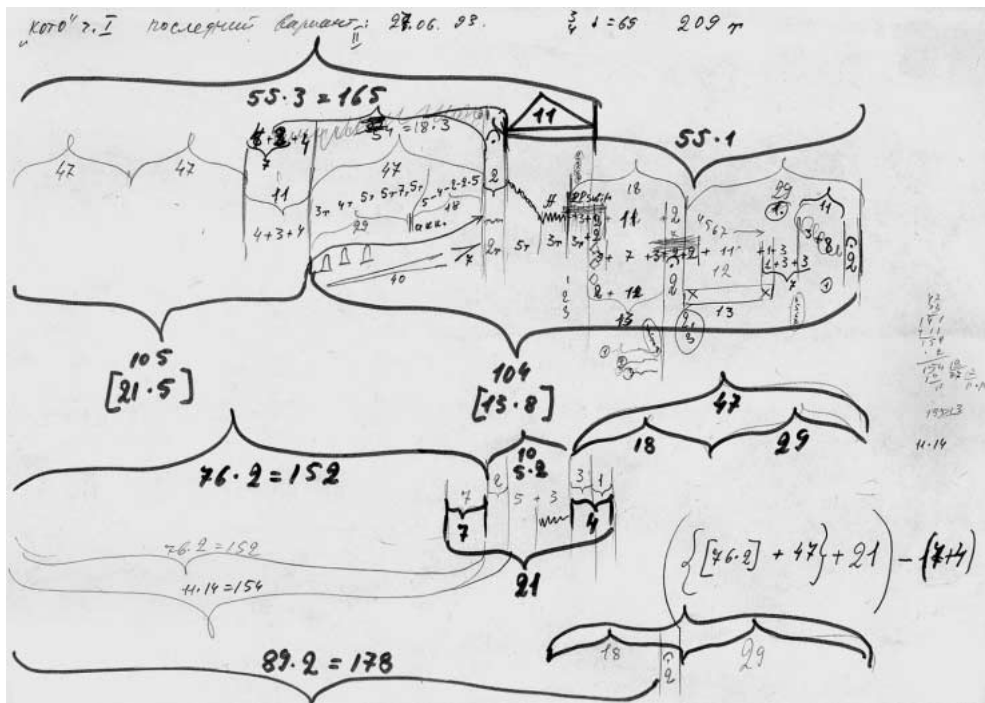
sections:											
1	2	3	4	5	6	7	8	9	10	11	
bars:											
47 ┌11 18 11 7┐				47 ┌18 29┐ 11			47 ┌29 18┐ (11+7)		climax 18	47 ┌18 29┐	
golden section: 47 + 47 + 11 + 29							18	+ 18 +	47		
= 134							= 83				
							in all: 217				

As we can see, the numbers 11 and 18 twice interrupt the sequence of the number 47:

before the climax: 47+47+11+47
after the climax: 18+47

Thus, the number 217 is achieved by the formula with several Lucas numbers: $([47 \times 3] + 11) + ([47 \times 1] + 18) = 217$.

This formula is based on beautiful numerical proportions, but the problem is that they are not easy to find in the score. Instead the numbers are buried in the musical texture. It is easy to count bars if the piece has bars. In a work such as *Heute früh* there are both measured and unmeasured sections. In such a case, the process of calculating proportions becomes significantly more complicated. To solve this problem both sections may be reduced to a common denominator with the help of an “absolute temporal unit” (microbeat). In other words one needs to find the number of beats in the unmeasured sections where only the duration is indicated. For exam-



Example 1: Sofia Gubaidulina, "... Heute früh, kurz vor dem Aufwachen ..." (1992–93), sketch, "last variant".

ple, there are two bars in $3/4$ time (six beats). Immediately after these bars there is an unmeasured section and an indication of its duration (eight seconds). How many beats are there in these eight seconds at the given tempo (crotchet is 69)? In order to calculate it, two mathematical operations must be performed:

1. Calculate the absolute length of the microbeat by dividing the number of seconds in a minute (60) by the number of beats per minute (here 69): $60 : 69 = 0.869$. This is the value of the microbeat in absolute time.
2. Calculate how many such microbeats (0.869) are contained within the unmeasured section whose duration is eight seconds. We divide the time in seconds by value of the microbeat: $8 : 0.869 = 9.2$. Thus, in eight seconds there are nine microbeats and three bars in $3/4$ time.

These mathematical operations allow us to determine a correlation between the time in seconds, the number of beats and the number of bars. But what is the purpose of these calculations? The point is that only this operation gives us an opportunity to quantify the entire work from beginning to end with the help of one absolute unit and to see those numbers and proportions upon which the general "numerical plot" is based.

Thus, the following parameters are determined by numbers in the piece "... Heute früh, kurz vor dem Aufwachen ...":

казче Sawaz

София Губаидуллина

„... *Сегодня утром,*
перед самым пробуждением...”

gliss. краем атакача врозь струн. x)

а 4 а м со xx) xxx)

3 4 1=69

3 4 pp

2

3 21"

5"

18"

4 8"

3 4

x) *нажимать приблизительно в середине струн, т.е. там, где звучат октавные фразы жолеты.*

xx) *слычки для контрабаса*

xxx) *При игре слышком желательны шиплящие звуки, капающие дыхание.*

Example 2: Sofia Gubaidulina, "... Heute früh, kurz vor dem Aufwachen ..." (1992–93), full score, p. 1.

- the overall number of bars (199+18),
- the length of each section (7, 11, 18, 29, 47),
- the number of sections (11),
- the length of unmeasured sections,
- the general rhythmic structure.

The question can be raised: is it possible to hear this large-scale formal rhythm? Of course, most listeners would not be able to grasp it rationally. What one can hear, however, is a beautiful form, harmoniously constructed, with numerical proportions as its basis. In this sense the rhythm of the form is perceived as the surface beauty of the musical construction.

Gubaidulina has consistently spoken with great enthusiasm about the beauty of numbers. The following words are a prime example: "I am inspired by this working method: 'the dance of the numbers' and pure intuition. Music is developing in two opposite directions: according to the numerical plot and by intuition. And when these two approaches intersect the unanticipated outcome is beautiful."⁴

¹ Letter to Viktor Suslin, 13 October 1982 (Sofia Gubaidulina Collection).

² The sequence of numbers each of which, after the second, is the sum of the two preceding numbers was named after the thirteenth-century Italian mathematician Leonardo Fibonacci.

³ The "Lucas series" was named after the French mathematician Edouard Lucas. The name "Evangelists' series" derives from the Holy Scripture. The first four numbers of the sequence appear in the Evangelists' account of Jesus feeding the multitude (Matthew 14:17–20; 15:34–38).

⁴ Sofia Gubaidulina, conversation with the author, 7 February 2000.