MANIPULATING PROPORTION IN FORM: THE FORMAL TECHNIQUES OF SOFIA GUBAIDULINA, WITH TWO MODEL COMPOSITIONS DEMONSTRATING DYNAMIC PROPORTION

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ABSTRACT


The “perfect asymmetry” represented by the golden section has long been a subject of fascination, significantly its appearance in nature, art, and music. Rather than focusing exclusively on the fixed golden section, Sofia Gubaidulina uses dynamic ratios to create both proportional consonance and dissonance within her forms. This dynamic proportion is found in many of Gubaidulina’s works, ranging from simple *Fibonacci*-based relationships, to light absorption ratios that govern both color projection and musical form. Gubaidulina’s 1986 symphony, *Stimmen…Verstummen…*, particularly demonstrates her unique methodology, and serves as an ideal model for manipulating proportion in form. Two original works were composed using similar principles, the first using a basic application of *Fibonacci* numbers, and the second implementing a more complex number structure.
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Chapter 1

INTRODUCTION

The “Symphonic Cosmos” of Sofia Gubaidulina

Since her introduction to the west in the 1980s, Sofia Gubaidulina has emerged as one of the most prominent composers to emanate from the former Soviet Union. Since gaining world recognition with her Violin concerto, Offertorium (1980), Gubaidulina and her music have been commonly described with words like “mysticism,” “spirituality,” and “symbolism.”

Sofia Gubaidulina was born on 24 October 1931 in Chistopol, in what was then the Tatar Autonomous Soviet Republic, now the Republic of Tatartstan. Composing by the age of five, Gubaidulina entered the Kazán Conservatory at the age of fifteen to pursue music. Throughout most of her early life, Gubaidulina received harsh criticism from the Soviet Composers’ Union, claiming her music did not follow the principles of Soviet realism. Other composers, such as Shostakovich, however, encouraged her to continue on her “mistaken path.”1 From 1963 to 1992, Gubaidulina lived in Moscow, earning her living writing for film. The programmatic nature of film allowed her to experiment with style and with compositional devices her music is now widely known for. Since 1992, Gubaidulina has lived in Germany near Hamburg.

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1 Lukomsky, “Sofia Gubaidulina: ‘My Desire is always to Rebel, to Swim against the Stream!’” Perspectives of New Music 36/1 (winter 1998) 15-16.
Sofia Gubaidulina recognizes Gesualdo, Bach, and Webern to be her primary influences, which she has "fused into a deeply personal, emotional style incorporating national tradition, archaic repetition, and aleatoric techniques."\(^2\) As early as the 1960s, Gubaidulina has been attracted to combining opposing ideas within a single piece of music. In her early experiments, Gubaidulina juxtaposed basic musical elements into compositional etudes, such as her cello preludes, in which Gubaidulina contrasts bowings like arco and pizzicato, sul ponticello and sul tasto, etc., creating a narrative-like form. As Gubaidulina’s style continues to evolve, semiotics seem to play an increasingly-larger role in her compositional process. Given her growing fascination with numbers and mysticism, it is not surprising that Gubaidulina became attracted to one of the most studied relationships in numbers: the golden section and its commonly-associated number sequence, the Fibonacci series.

**Fibonacci and the Golden Section**

The “perfect asymmetry” represented by the golden section has long been a subject of fascination, particularly its appearance in nature, art, and music. The golden section (also known as GS, golden mean, golden ratio, extreme and mean ratio, Phi [\(\phi\)], and the Divine Proportion) can be defined as the division of a fixed length in two so that the ratio of the shorter portion to the longer portion equals the ratio of the longer portion to the whole length \([x : y = (x + y) : x].\)\(^3\) The true value of GS is irrational, located approximately between three-fifths and five-eighths (.6180339887…).

![Fig. 1.1. Golden section division of a line \((AB \text{ divided by } C)\).](image.png)


This ratio has been found in most living organisms, such as the human body, as well as in art and architecture (such as the Parthenon in Athens and Leonardo da Vinci’s *The Last Supper*). The golden section has also been discovered in musical works by many composers including Bach, Mozart, Debussy, Bartók, and Stockhausen, although the validity of GS application to time-based art forms such as music is still challenged.

The golden section exhibits a unique property, in that the ratio of any two adjacent members of an additive-automorphological sequence\(^4\) such as the *Fibonacci* series approximates the golden section. Ratios taken from higher pairs are increasingly more accurate than ratios built from initial numbers low in the sequence:

\[
\begin{align*}
\text{Fibonacci series:} & \quad 0 \quad 1 \quad 1 \quad 2 \quad 3 \quad 5 \quad 8 \quad 13 \quad 21 \quad 34 \quad 55 \quad 89 \quad 144 \quad [...] \\
\text{Ratio:} & \quad (\frac{3}{5}) (\frac{5}{8}) (\frac{8}{13}) (\frac{13}{21}) (\frac{21}{34}) (\frac{34}{55}) (\frac{55}{89}) (\frac{89}{144}) [...]
\end{align*}
\]

\[
\text{Decimal:} \quad 0.6 \quad 0.625 \quad 0.615 \ldots \quad 0.619 \ldots \quad 0.617 \ldots \quad 0.618 \ldots \quad 0.618 \ldots \quad [...] 
\]

Fig. 1.2. The *Fibonacci* series, demonstrating golden ratio approximations.

The *Fibonacci* series represents the nearest whole-number accuracy to the golden section, which is especially useful for possible GS applications to predominantly whole-number mediums such as music.\(^5\)

\[^4\] Lukomsky defines an additive-automorphological sequence as a series built from two initial numbers, deriving subsequent numbers from the sum of the two previous numbers. Vera Lukomsky, “Sofia Gubaidulina: ‘My Desire is always to Rebel, to Swim against the Stream!’” *Perspectives of New Music* 36/1 (winter 1998) 40n.

Perspectives on Proportional Analysis

Although it is now generally accepted that golden section proportions are found in many works throughout music history, the legitimacy of cognition of such proportions, as well as in what way proportions are perceived by the listener, is still argued. Attempts to analyze forms can be problematic, specifically in contemporary or large-scale common practice works, because of broad changes in tempo and irregular phrase lengths. Most simple forms from the Classical period and earlier, such as some of Mozart’s sonatas, can be diagramed merely by counting measures. In his article, “Fibonacci and the Gold Mean: Rabbits, Rumbas, and Rondeaux,” Newman Powell applies golden section analysis to medieval and early-renaissance works, measuring proportion using the notated pulse as the unit of length, regardless of tempo variation.\(^6\) Depending on context, the measure or other source of pulse (such as the quarter note) is used as the constant unit of length. The drawback to this method is that significant changes in tempo, as well as unmeasured sections of music (such as a cadenza) are not accounted for properly.

Clive Pascoe alternatively takes a concrete-temporal approach, measuring only elapsed time taken from recorded performances of works.\(^7\) In his study, Pascoe randomly selects fifty recorded works and plots them on a grid containing fourteen interrelated GS divisions (eight graduating GS proportions and their retrogrades, of which two overlap). This graph, henceforth referred to as a Pascoe Grid, is helpful since one can quickly see large-scale GS relationships.

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\(^6\) Ibid.

Fig. 1.3a. The *Pascoe Grid* showing “modules” formed by fourteen GS divisions.⁸

Fig. 1.3b. Pascoe’s “ideal” musical direction, plotted on his grid.⁹

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⁹ Ibid., 63.
Unfortunately, the Pascoe grid does not account for all possible GS proportions, since many works (especially those of Debussy’s) contain smaller GS relationships nested within the form not relating to the fourteen modules. For Powell’s purposes, using recorded durations requires only one grid. However, if a work contains smaller GS relationships not illustrated by the large-scale grid, multiple Pascoe grids should be used to provide detail. Like Powell’s pulse method, Pascoe’s system is also incomplete, in that rhythmic regularity is ignored and recordings vary substantially, ultimately creating an imprecise analysis.

A “Pulse-Duration” Compromise

More recent studies, specifically those by Ernő Lendvai and Roy Howat, combine aspects of both above techniques, linking pulse and time duration. Some authors, such as Jane Perry-Camp and Allan Dorfman, go as far as citing twentieth-century relativity theory to help explain the fusion between “actual, clock time” and the “virtual time” found in music’s pulse:

“… [speaking] of music as occurring in time is reflective of the classical view in which time is portrayed as an empty container. Furthermore, an empty time implies uniformity, that is, every moment is essentially like every other. Only the changing events which fill time may differ.

With the new perspective of twentieth-century physics, particularly as introduced through the special and general theories of relativity, the concept of time as a uniform emptiness is seen as false … that the general theory of relativity demonstrated that space [and time] and its material content are in fact fused.”

This suggests that using either method exclusively is not a complete (or correct) analysis. Howat suggests that different methods have specific applications, depending on the

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character of the piece: “there are cases where it is useful to try various ways of measuring, and the music’s rhythmic character should always be a factor in deciding whether, in a piece with variable meter, the bar line or the beat should be regarded as decisive.” In rhythmically-complex works, multiple structural layers may be present, requiring multiple analytical methods to be applied simultaneously for a clear explanation of a passage, movement, or entire work.

In general, an analytical approach that successfully combines pulse and duration techniques relies on context to both define the units of measurement, and to determine optimal analytical procedures. Acknowledging the influence of “virtual time” created by rhythmic pulse, small variations in tempo (i.e. an *accelerando*) do not need to be adjusted in the analysis since the listener, even if only subconsciously, adjusts with the gradual changes in tempo. In this case, virtual time is perceived stronger than clock time. However, significant changes of tempo are usually calculated into a “common denominator,” suggesting the listener hears sudden tempo changes as polyrhythmic ratios. For example, the first section of a work may consist of 55\(\text{\frac{\text{quarter}}{\text{note}}}\) at \(=120\). The second section contains 17\(\text{\frac{\text{quarter}}{\text{note}}}\), but at a slower pace \(=60\). Although both sections total 72\(\text{\frac{\text{quarter}}{\text{note}}}\), the listener hears an adjusted length of 89\(\text{\frac{\text{quarter}}{\text{note}}}\) (17\(\text{\frac{\text{quarter}}{\text{note}}}\) at \(=60\) is the same as 34\(\text{\frac{\text{quarter}}{\text{note}}}\) at \(=120\), resulting in 55+34=89\(\text{\frac{\text{quarter}}{\text{note}}}\) at \(=120\)). The concept of considering both pulse and duration in analysis is now becoming widely accepted and consequently used in the analyses to follow. Pascoe’s grid is also applied, but only in conjunction with the other analytical methods discussed above.

As for the more general debate regarding aural perception of time-based proportions, it is probable that average listeners (even perhaps all listeners) cannot hear complex proportions, at least with the precision needed to fit within Howat’s somewhat slim

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12 Howat, 71.
2% error allowance. Instead, as composer and musicologist Valeria Tsenova suggests, what the listener can hear is a “beautiful form, harmonically 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.”

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Chapter 2

DYNAMIC PROPORTION IN THE MUSIC OF
SOFIA GUBAIDULINA

Early Experiments in Dynamic Proportion

Sofia Gubaidulina’s fascination with numbers and symbolism initiated what she considers to be the main experiment in her life: the role of rhythmic proportionality in musical form.15 Rather than focusing exclusively on the fixed golden section ratio, however, Gubaidulina started experimenting in the early 1980s with flexible, dynamic ratios to create both proportional consonance and dissonance within her forms. These dynamic ratios are formed by juxtaposing numbers taken from additive-automorphological sequences such as the Fibonacci series. Although many of her proportions resemble those produced using the traditional GS model (in that adjacent numbers taken from any additive-automorphological series approximates true GS), Gubaidulina places greater importance on the numbers creating the proportion, rather than the golden ratio itself. Gubaidulina explains the significance of dynamic proportion found within the Fibonacci series in an interview with Vera Lukomsky for Tempo:

“In the Fibonacci series the ratio between any two neighboring numbers approximates the Golden Section, which I understand as the perfect ratio, representing the universal proportion of life. In the numerical progression of the Fibonacci series, the proportion is getting closer and closer to the absolute

15 Vera Lukomsky, “Hearing the Subconscious: Interview with Sofia Gubaidulina,” Tempo 209 (July 1999), 27.
mathematical point, but never reaches it. Nevertheless, moving farther along this series, we are moving towards perfection.”

Gubaidulina first implemented this process in the twelfth movement of *Perception* (1981, rev. 1983/86). This movement, “Monty’s Tod,” portrays the death of Monty, a black stallion and former racehorse forgotten by the people. As the movement unfolds, the instruments gradually rise higher into their registers, depicting Monty’s spirit ascending into the heavens. Gubaidulina further illustrates this eternal transformation by organizing the movement so that the ratios between sections gradually approach perfection, by use of predominately ascending Fibonacci numbers. The sections are structured so that each contains a number of quarter notes corresponding to the series (21, 13, 34, 55, 89, and 144).  

Fig. 2.1. Gubaidulina’s formal sketch of the twelfth movement of *Perception*.  

When asked if she used the Fibonacci series as a game of numbers, Gubaidulina replied, “Yes, it is a game! I form a certain profile of numbers. But in general, there is a beautiful picture of rhythmic calculation, proportionality, [and] mathematic exactness in the

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17 Ibid., 29.
18 Ibid.
large-scale formal organization—over the absolute freedom of all other musical elements: melody, harmony, and rhythm. I consider this movement to be my masterpiece.19

Lucas and other “1+ n” Sequences

Recalling the consonance–dissonance elasticity found within the Fibonacci series, Gubaidulina suggests the Fibonacci series itself is the most consonant of many sequences having the same additive-automorphological principle. Following the Fibonacci series, Gubaidulina considers the second-most consonant series to be the Lucas series, discovered by François Édouard Anatole Lucas (1842-1891). The Lucas series is started by adding 1+3, and is less perfect than the Fibonacci series because close approximation to true GS occurs later in the Lucas series than in the Fibonacci series. Gubaidulina continues the pattern (1+4, 1+5, etc.) to create new sequences, each creating more interrelated proportional dissonance:

(a) Gubaidulina’s Sketch.20

(b) Categorized, showing horizontal and vertical consonant–dissonant relationships.

Fig. 2.2. Additive-automorphological number sequences.

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19 Ibid., 30.
20 Ibid., 28.
To demonstrate possible uses of this consonance–dissonance principle in musical form, Gubaidulina sketched overlapping formal proportions built on initial numbers of two conflicting sequences, the Fibonacci series (1+2) and the sixth series (1+7):

![Fig. 2.3. Gubaidulina’s formal sketch of conflicting formal proportions 1:2 and 1:7.](image)

Using the above sketch as an example, Gubaidulina explains how such a form can influence her compositional process:

“The extreme tension between these two points [2:1 and 7:1] calls for extraordinary musical events that should happen in this area [denoted by a diamond in the above sketch]. Let’s suppose that there are two different musical layers, and the tension arises between the two layers. And, in the point of their meeting, something should occur: a dialogue, or a conflict, or something else—whatever I can imagine. I built the form in such a way that the musical development moves to the area of tension, and after that, so to speak, steps away. This is my concept of a musical form.”

_The Evangelists’ Series, Bach’s Series, and Mediation… (1993)_

In addition to sequences beginning with the addition of (1+n), Gubaidulina generates other additive-automorphological sequences that contain historically and spiritually significant numbers. Two examples of such sequences are the Evangelists’ series and the Bach series. The Evangelists’ series is based on numbers taken from the biblical account of

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21 Ibid., 28.
22 Ibid., 29.
Jesus feeding the multitude (Matthew 14:17-20; 15:34-38). The four numbers found in the story follow the additive-automorphological principle (2, 5, 7, 12), and Gubaidulina uses the principle to expand the series: 2, 5, 7, 12, 19, 31, 50, 81, 131, etc. It is also interesting to note that each number of the Evangelists’ series is also the sum of numbers from the Fibonacci series and the Lucas series:

Fibonacci series: \[1 \ 2 \ 3 \ 5 \ 8 \ 13 \ 21 \ 34 \ 55 \ 89 \ 144 \ \ldots \ \infty\]

Lucas series: \[+1 \ 3 \ 4 \ 7 \ 11 \ 18 \ 29 \ 47 \ 76 \ 123 \ 199 \ \ldots \ \infty\]

Evangelists’ series: \[2 \ 5 \ 7 \ 12 \ 19 \ 31 \ 50 \ 81 \ 131 \ 212 \ 343 \ \ldots \ \infty\]

Fig. 2.4. The Evangelists’ series as result of summation of the Fibonacci and Lucas series.

The Bach series is especially unique, in that Gubaidulina claims Bach himself used it in his last chorale, *Vor deinen Thron tret ich hiermit*. The series consists of numbers associated with Bach, specifically monograms and spellings of his name and religious labels using a natural-order number alphabet and variations based on friend and poet Christian Friedrich Henrici Picander’s paragram. The series extends along both the positive and negative directions of its center, but is applied musically only as absolute integers. This series also exhibits unusual “digit” symmetry between certain numbers (37…73, 14…41, 23…32):

Fig. 2.5. Bach’s Series, showing mirrored symmetry within digits.

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Bach’s work is in four parts, each part alternating between a contrapuntal section and the chorale tune. Gubaidulina found all of the above numbers in Bach’s work—either as a sum of quarter notes in a phrase, the number of contrapuntal entrances, or as large-scale formal divisions:

“The first half of the piece is the longest (114 quarter notes). And I thought: what if in the second half there are 73 quarter notes? I counted and re-counted many times, and could not get this number. Then my husband noticed: “You haven’t counted the fermata, which represents a doubling.” When I added the rhythmic value of a fermata, I got 73! And I was greatly excited, because it meant that Bach used not only his numbers, but the series! And there is a Golden Mean, because all the additive-automorphological series give the approximate proportion of the Golden Mean.”

![Diagram](image)

Fig. 2.6. Bach, *Vor deinen Thron tret ich hiermit*, Gubaidulina’s sketch of formal proportions.

Upon her discoveries, Gubaidulina devoted a composition to Bach’s series, *Meditation on the Bach Chorale “Vor deinen Thron tret ich hiermit.”*

“I built a musical form according to Bach’s principle: episodes of music embodying my personal reflection alternate with the chorale. Only instead of Bach’s four-section form there is a five-section form (I like the number five and prefer it to four). I dedicated my composition to Bach, in particular to this chorale.”

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27 Ibid., 19.
28 Ibid.
29 Ibid., 19-20.
Not all of Gubaidulina’s proportions originate from additive-automorphological sequences. Gubaidulina became interested in light and color after attending what she considered a failed performance of Scriabin’s *Prometheus*:

“In the Louisville performance, the whole space was lighted and colored. The effect was absolutely staggering. But what happened to me as a listener to this music? For me, music moved from the foreground to the background. I was listening to the music, but I did not like it! I stopped loving it! It became the accompaniment to that actively affecting light, to the magnetic show of colors! The effect of color turns out to be stronger than that of the music! Music is a more difficult language, whereas the visual dimension is more accessible. Its effect is stronger, brighter, and simpler. For this reason, the combination of music and light is very dangerous for music. [...] In my opinion, this failure is due to Scriabin’s system of linking light/color and music: every single sound possesses its individual color: C is red, G is light blue, and so on. This “melodic” interpretation makes the color/light component too mobile and dynamic.”

This negative experience caused Gubaidulina to find a new method of successfully combining color and music. By researching physics treatises on the theory of light, Gubaidulina learned the proportional relationship between light reflection and absorption.

“When [light] falls onto a surface, a portion of the rays is absorbed while another is reflected. Depending on the proportion of the absorbed and reflected rays, we see certain colors.”

Gubaidulina limits the colors to seven by dividing the spectrum into eight equal parts. From this, Gubaidulina plots a scale of colors according to their proportional intensity:

![Color Scale](https://via.placeholder.com/150)

Fig. 2.7a. Colors with light reflection-absorption ratios, arranged by descending intensity.

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30 Ibid., 28.
31 Ibid.
Unlike Scriabin’s melodic system, Gubaidulina applies color proportions to rhythmic form, rather than assigning colors to pitches. In *Alleluja* (1990), Gubaidulina implements this system in two ways. First, Gubaidulina applies color proportion to shape its projection:

“In the first movement of Alleluja, there is no change of color. I used only orange. While the music is moving, the color makes a crescendo. Orange
becomes more and more intense; its crescendo is very powerful. Reaching its climax, the color starts the motion of diminuendo and disappears. The time proportion of crescendo and diminuendo is 6:2, which is a proportion of reflected and absorbed rays in the orange color. This proportion I calculated in quarter notes. Thus, the crescendo lasts three times longer than the diminuendo. The color “breathes,” so to speak; its breath is very long.”

In the second movement, three colors are used (light blue, yellow, and orange). Gradually, color becomes Alleluja's central theme, becoming more and more noticeable as the work unfolds.

Besides linking the projected color with its proportions, Gubaidulina also implements color proportions in the music’s form. The color governs successive formal proportions, so that the “orange” proportion from the first movement is applied to the second movement’s musical structure; the three colors in the second movement likewise determine the form of the third movement. This process continues to the climax in movement six, where Gubaidulina finally links color directly to the music by using imitation between the two media. Movement seven, like the first, is based on only one color, this time violet, using its characteristically-long diminuendo to conclude Alleluja. “I do not want cinematic effects: in Alleluja the striking change of colors occurs only once, in the scene of [the] Apocalypse. Nevertheless, for my music such a long-lasting static color with its crescendos and diminuendos is the best solution: it is exactly what music needs in combination with light.”

32 Ibid., 30.
33 Ibid., 31.
Perhaps the most common work associated with Sofia Gubaidulina’s unique approach to large-scale formal organization is her 1986 symphony, *Stimmen…Verstummen…*. The symphony is Gubaidulina’s earliest work to employ *Fibonacci* numbers to govern formal proportions over multiple movements within the same composition. Like many other works by Gubaidulina, her symphony has a spiritual program: a conflict between the eternal and earthly worlds that builds up to a depiction of the Apocalypse, ultimately resolving into eternal peace. Gubaidulina separates the eternal and earthly worlds into twelve alternating movements:

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Fig. 2.8. *Stimmen…Verstummen…*, Distribution of movements.34

What makes this work especially unique is that Gubaidulina organizes the eternal movements according to the *Fibonacci* series, opposing this symbol of perfection with freely composed earthly movements that avoid any additive-automorphological proportions. The resulting movement lengths vary significantly, ranging from thirty seconds to over eleven minutes (approximately a 1:22 ratio between movements VII and VIII).

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34 Based on Vera Lukomsky’s table, Ibid., 31, ex. 5.
To help listeners delineate between her opposing worlds, Gubaidulina keeps the motivic and harmonic content of the eternal movements very simple, using only a D major triad as a recognizable ritornello (G major in movement X). The triadic motive comprises of two layers: a sustained major triad (usually found in the organ), layered with the same triad rearticulated in a variety of ways for texture and coloration (ricochet bowing in the strings, flutter-tongue articulation in the winds, etc.).

The eternal movements follow a process as the work unfolds. At the beginning of the first movement, the D major triad sounds in the upper registers of the organ, strings, and intermittently in the high winds. Partly through the first movement, the triad begins to gradually “fall” in register and darken in timbre with the addition of lower winds and brass. In the last few measures of the first movement, a D-flat major triad is introduced in the lower brass and low organ, clashing against the harmonically-focused D major triad. After a total of 55 beat units (\( \varpi = 42 \)), the orchestra abruptly cuts off, leaving only the organ quietly reverberating the juxtaposed triads to transition to the second movement.

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35 Sofia Gubaidulina, *Stimmen…Verstummen…, Stufen* (Chandos 9183).
This process of what was a pristine, bright D major triad falling in register and darkening in color continues through the other three eternal movements preceding the Apocalypse (movement VIII). Throughout the first seven movements, eternal movements are proportionally engulfed by the earthly movements, with the triadic motive becoming less and less significant. Gubaidulina uses the Fibonacci series here as a symbol of divine peace being overwhelmed by chaos, so she appropriately moves the “wrong way” along the number sequence, further from perfection: 55, 34, 21, 13, 0 (movement IX).

Following the Apocalypse is a mathematical “zero,”36 in which Gubaidulina starts a reconstruction process from silence, using a conductor’s solo to visually rebuild the Fibonacci series. The conductor uses a mix of static poses and low-level Fibonacci based patterns (1, 2, 3, 5, 8, and 13) to symbolize the reconstruction from silence. Only the percussion, executing small Fibonacci series-based rhythms, and the organ, periodically sounding low, sustained tritone intervals, are audible in the ninth movement.

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36 Lukomsky, “Hearing the Subconscious…,” 30.
Fig. 2.11. *Stimmen...Verstummen...*, movement IX, cadenza for conductor.
*) Dreischlag mit verlängerten Zähleiten / three-beat pattern with elongated beats
Fig. 2.11. (cont.)
At the beginning of the tenth movement, Gubaidulina restores the triadic motive in the organ (this time as a G major triad) to its original high register placement, and proportionally expands the eternal sections to the end of the work.

Although Gubaidulina did not construct the symphony around a traditional GS model, plotting the symphony’s total proportions on a Pascoe Grid can still be beneficial. Two versions are provided below: one grid uses the combined “pulse-duration” method (discussed in chapter 1) using a primary beat unit of $\left( \frac{\text{=84}}{\text{=42}} \right)$ while adjusting all significant tempo changes to that unit, and the other grid uses Pascoe’s method of recorded performance durations.

Fig. 2.12a. *Stimmen…Verstummen…*, Pascoe Grid (using pulse-duration lengths).
The highest point of tension in the symphony, towards the end of the eighth movement, falls within both Pascoe’s and Howat’s given boundaries of an acceptable golden section “hit.” The diagram also brings visual attention to the process of earthly sections engulfing the eternal sections up to the apocalyptic eighth movement. The eighth movement especially stands out, consuming approximately one-third of the total length of the symphony.

Lastly, there seems to be a discrepancy in the score, in which the tempo indication for movement XI is (♩ =28). Other movements using the same percussion motive found in XI, as well as the recorded version of XI (sessions which Gubaidulina attended), use a tempo marking close to (♩ =28/♩ =56), twice as fast as written. In the first Pascoe Grid above (Fig. 2.12a.), measurements are based on the “corrected” tempo marking. However, in addition to the above graphs, a Pascoe Grid containing measurements based on the original tempo marking (♩ =28) is included below as a source for comparison.

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37 Gubaidulina, Stimmen…Verstummen…, Stufen (Chandos 9183).
38 Stimmen…Verstummen…, II/m37: same motive marked at (♩ =52); IV/37 and VI/92, (♩ =54).
Fig. 2.13. *Stimmen…Verstummen…*, Alternate Pascoe Grid (original marked tempo for XI).

Overall, the symphony is a good model for composers to base a primarily form-driven piece, mostly due to Gubaidulina’s conservation of resources. The simplistic nature of *Stimmen…Verstummen…* allows even the most inexperienced listener to distinguish between Gubaidulina’s conflicting sections, due to its wide contrasts in musical language, as well as its accessible returning-form structure. Although less than half of the work is organized according to *Fibonacci* numbers, the symphony successfully demonstrates one unique way in which Gubaidulina manipulates large-scale formal proportions, while maintaining a logical and cohesive form.
APPLICATION OF TECHNIQUES

*Conversations for cello and piano* (2002)

Given the variety of dynamic proportion applications found in the music of Sofia Gubaidulina, it was helpful to compose two models: one using a basic application of Fibonacci numbers similar to Gubaidulina’s first experiments with *Perception*, and a more complex application using multiple structural layers as found in her symphony. In the first model, *Conversations* for cello and piano, Fibonacci numbers are used to govern large-scale formal divisions, using the measure as the beat unit.

*Conversations* is in four parts: an introduction, a dialogue, a conflict, and an extended coda. The four parts contrast stylistically to help the listener delineate the underlying rhythmic structure. In the introduction (34 measures in length) both “characters” are introduced individually—first the cello (lasting 21 measures), then the piano (13 measures). The second part is an unmeasured dialog. Instead of a rhythmic pulse, material freely sounds within a suggested timeframe of 2’30”, formally taking the place of measures 35-72. Part three is the climax section (34 total measures), and is symmetrically balanced on the golden section of the piece (17 measures before GS and 17 after). The strong quarter-note pulse returns, building in the piano to the end of measure 89. After the golden section, the pulse continues, but intermittently, until it is completely dispersed in measure 108. Part four is an extended coda—the cello, static in motion, gradually moves to its extremely-high
register to the end; the piano alternatively pulsates a five-note legato figure that also slowly shifts in range to its extremities. The piece ends with a retrograde of the Fibonacci series in the piano: 13 measures from the end, 8, 5, 3, 2, and ultimately 1.

Fig. 3.1. Conversations for cello and piano, Pascoe grid.
Canvas for Orchestra (2003)

One purpose of Canvas is to somewhat test the strength of Gubaidulina’s system by burying the underlying rhythmic structure within the musical texture so that it might not be noticeable from the outside. In addition, unlike the first model, unmeasured sections are not accounted for in the overall design of Canvas. This omission raises two questions: first, is it cognitively possible to aurally follow multiple levels of form, as Gubaidulina tests in her symphony by linking some sections together, but not all; and second, acknowledging that both elapsed time and pulse work together in the listener’s perception of musical time, which unit is most predominant—absolute time or metered pulse? Calculating the measured sections apart from the unmeasured will either help or hinder listeners, in that separate designs may aid the listener to process the two forms in counterpoint or may unsuccessfully confuse the listener, perceiving only a random juxtaposition of sections. Ultimately, these questions can only be answered by the listener, given the unique nature of aural perception.

Canvas: Formal Design

Canvas is divided into five sections, resembling a rondo-like A-B-A-C-A form. The pitch content is controlled only by an abstract process: a sustained, single pitch blurs into a cluster of pitches (or dense texture), over time gradually gravitating back to focus, each time centering on a new pitch.
Along with this repeated “focus–un-focus” process, other variables are controlled by structural divisions: register placement (low–high), timbre (dull–bright), and texture (static–dense). There are two short cadenza-like pauses in the first half: a modulating percussive pulse followed later by a contrasting, sustained accordion passage. The climax section immediately follows, consisting of four unmeasured cues that build from pianissimo to fortissimo, symmetrically balanced on the primary GS. There are no time indications within the four cues, but given the metered sections on each side provide an approximation of a GS division, the climax section will consequently be perceived as balanced on GS, regardless of varied performance durations. As in the first half, two more pauses occur within in the second half, this time containing only silence. Leading into the coda, the focused unison is restored, and the work closes with the removal of pulse, leaving only a sustained single pitch.

The structural layer most easily recognized uses the measure as the beat unit, and is organized using Fibonacci numbers. The introductory sections consist of bar lengths 13, 21, and 34; which can be broken down further into subgroups of 13 and 8:
Fig. 3.3. *Canvas for Orchestra*, first section’s measure breakdown using Fibonacci numbers.

These relationships continue throughout the composition, although this Fibonacci-based layer is not the primary structure of the form. Instead, the primary beat unit, or model tempo, of *Canvas* is the quarter note (at $\frac{1}{4} = 60$), and follows a series derived from the Lucas series. This series, like the Lucas series and other sequences (with exception of Bach’s series), is symmetrical on the positive-negative continuum, producing the same numbers to the right and left of its center integer. The series is determined by multiplying the Lucas series by 47:

Lucas series: $2 \quad 1 \quad 3 \quad 4 \quad 7 \quad 11 \quad 18 \quad 29 \quad 47 \quad \ldots \quad \infty$

Derived series: $94 \quad 47 \quad 141 \quad 188 \quad 329 \quad 517 \quad 846 \quad 1363 \quad 2209 \quad \ldots \quad \infty$

Fig. 3.4. *Canvas for Orchestra*, number sequence, derived from Lucas.

The following table breaks down the composition into sections, showing actual beat units and adjusted beat units (using $\frac{1}{4} = 60$ as the model tempo).
### Section (mm.)

<table>
<thead>
<tr>
<th>Written Tempo</th>
<th>Relative Beats</th>
<th>Model Tempo ((\frac{\text{mm}}{\text{sec}}))</th>
<th>Absolute Beats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I</strong>&lt;br&gt;(1-13)</td>
<td>((\frac{\text{mm}}{\text{sec}})=60)</td>
<td>(52\downarrow (13\cdot4))</td>
<td>((1:1))</td>
</tr>
<tr>
<td>(14-26)</td>
<td>(\ldots)</td>
<td>(52\downarrow (13\cdot4))</td>
<td>(\ldots)</td>
</tr>
<tr>
<td>(27-34)</td>
<td>(\ldots)</td>
<td>(32\downarrow (8\cdot4))</td>
<td>(\ldots)</td>
</tr>
</tbody>
</table>

| II<br>(35-47) | \((\frac{\text{mm}}{\text{sec}})=60\) | \(52\downarrow (13\cdot4)\) | \((2:1)\) | \(52\downarrow\) |
| (48-59) | \(\ldots\) | \(47\downarrow\) | \(\ldots\) | \(47\downarrow\) |

perc. cad. (60, unmeasured)

Total (I & II): \(235\downarrow (47\cdot5)\)

| III<br>(61-72) | \((\frac{\text{mm}}{\text{sec}})=60\) | \(36\downarrow\) | \((2:2)\) | \(36\downarrow\) |
| (73-86) | \((\frac{\text{mm}}{\text{sec}})=90/\frac{\text{mm}}{\text{sec}}=45\) | \(86\downarrow/43\downarrow\) | \(\ldots\) | \((60:45)\cdot43\downarrow\) | 58\downarrow |

acc. cad. ("87" unmeasured)

Total (III): \(94\downarrow (47\cdot2)\)

<table>
<thead>
<tr>
<th>IV (unmeasured)</th>
<th>←Primary GS Division→</th>
</tr>
</thead>
</table>

| V G.P. (109) | (sec.) | 5\* | (1 sec.=1\*) | \((5\*)\) |
| (110-114) | \((\frac{\text{mm}}{\text{sec}})=60\) | \(20\downarrow\) | \((20\downarrow)\) |
| (115-122) | \((\frac{\text{mm}}{\text{sec}})=120\) | \(32\downarrow\) | \((16\downarrow)\) |
| G.P. (123) | (sec.) | 5\* | \((5\downarrow)\) |
| (124-135) | \((\frac{\text{mm}}{\text{sec}})=60\) | \(48\downarrow\) | \((48\downarrow)\) |
| (136-156) | \((\frac{\text{mm}}{\text{sec}})=60\) | \(94\downarrow (21\cdot4\cdot10)\) | \(94\downarrow (47\cdot2)\) |

Total before GS: \(329\downarrow (47\cdot7)\)
Total after GS: \(188\downarrow (47\cdot4)\)
Total Measured Length: \(517\downarrow (47\cdot11)\)
Ratio Between Primary GS Sections: \(7:4\) \((\text{Lucas GS})\)

Fig. 3.5. *Canvas for Orchestra*, Table of sections (model tempo: \(\frac{\text{mm}}{\text{sec}}=60\)).

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The length of the entire measured portion of *Canvas* is 517\(\frac{1}{2}\) (235\(\frac{1}{2}\) + 188\(\frac{1}{2}\)). Smaller sections also follow the series or other multiples of 47. The Pascoe Grid below illustrates all proportions listed above, indicating the unmeasured sections in blocks.

Fig. 3.6. *Canvas for Orchestra*, Pascoe Grid.
Conclusions

Gubaidulina affirms that the “rhythm of the form” is fundamental in her compositional process, despite her acknowledgement that such formal structures may be unnoticeable from the outside. 40 If a composition is rhythmically coherent, in that it follows some sort of logical pattern as exemplified in chapter 2, Gubaidulina believes the listener will perceive an overall sense of unity. When friend and music theorist Petr Meshchaninov first heard Gubaidulina’s symphony (Stimmen…Verstummen…), his immediate response to her was that the symphony seemed “consonant.” 41 Considering the extensive interaction between formal consonance and dissonance within the symphony, Meshchaninov’s statement suggests a prevailing overall sense of coherency, consistent with Gubaidulina’s concept of the relationship between formal consonance and dissonance: “It is a very vague relationship that nonetheless conforms to certain laws. Looking at it this way, I realized that an instance of dissonance does not simply represent an arbitrary, chaotic relationship, but rather one that is far from resolution.” 42

Regardless of the complexity or logical “beauty” of a composition’s underlying formal structure, form alone cannot produce a successful work. Rather, a work must be built using many other elements in tandem with form—a composite, ultimately not definable by theory. Gubaidulina accomplishes this, successfully balancing the compositional craft with expression: a perfect balance of order and freedom.

42 Ibid., 452-53.
G L O S S A R Y

“1+n” Sequence. In this text, general label for any additive-automorphological series beginning with the addition of one and any other number.

Additive-automorphological Sequence. A series built from any two initial numbers, deriving subsequent numbers from the sum of the two previous numbers.

Bach’s Series. An additive-automorphological series based on numbers associated with J. S. Bach and his music (88, -51, 37, -14, 23, 9, 32, 41, 73, 114, 187). Gubaidulina suggests Bach used the series himself in his last chorale, Vor deinen Thron tret ich heim (July 1750).

Dynamic Proportion, (—Ratio). A variable representing multiple proportions or ratios derived from additive-automorphological sequences. Each ratio varies slightly from the others, creating interrelated tension and release between multiple sections or movements in music.

Evangelists’ Series. An additive-automorphological series beginning with four numbers (2, 5, 7, and 12) derived from the Evangelists’ account in the Bible of Jesus feeding the multitude (from Matthew 14:17-20; Matthew 15:34-38).

Fibonacci Series. The “prime-form” of the additive-automorphological series. Begins with the addition of (1+2): [1, 2, 3, 5, 8, 13, 21, 34, etc.]. Named after discoverer Leonardo Fibonacci.

Golden Section (GS), (—Ratio), (—Number), (True GS). The division of a fixed length in two so that the ratio of the shorter portion to the longer portion equals the ratio of the longer portion to the whole length \[ \frac{x}{y} = \frac{x + y}{x} \].

Lucas Series. An additive-automorphological series beginning with the addition of (1+3): [1, 3, 4, 7, 11, 18, 29, 47, etc.]. Named after discoverer and French mathematician Edouard Lucas.
BIBLIOGRAPHY


Lukomsky, Vera. “Sofia Gubaidulina: ‘My Desire is always to Rebel, to Swim against the Stream!’” *Perspectives of New Music* 36/1 (winter 1998), 5-41.


Appendix A

PAUL COLEMAN

CONVERSATIONS
for cello and piano

score

2002
Appendix B

PAUL COLEMAN

CANVAS
for orchestra

full score

2003
Piccolo
Flute
Oboe
2 Clarinets in B♭
Bass Clarinet
Alto Saxophone

2 Horns in F
2 Trumpets in B♭
3 Trombones
Tuba

Percussion (2 Players)
Glockenspiel, Crotales (both octaves),
Vibraphone, Chimes (2 sets),
Tam-Tams (4), Gongs (4),
Snare Drums (2), Bass Drum,
Bongos, Conga, Claves

Celesta
Accordion

Violin I
Violin II
Viola
Cello
Contrabass
Score in concert pitch
except piccolo, percussion, and double bass

Paul Coleman (2003)
Picc.  
Fl.  
Ob.  
B. Cl. 1  
B. Cl. 2  
B. O.  
A. Se.  
Hn. 1  
Hn. 2  
B-Tpt. 1  
B-Tpt. 2  
Tbn. 1  
Tbn. 2  
Tbn. 3  
Tuba  
Perc. 1  
Perc. 2  
Ct.  
Ae.  
Vla. 1  
Vla. 2  
Vla.  
Vn.  
Cb.  
Acc.  
Vc.  
Vln. I  
Vln. II  

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