



Reflection

The Golden Ratio of Creativity. Unity in Diversity: The Mathematics of the Soul and the Art of Truth

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Abstract:

We reflect on the profound relationship between art and mathematics, focusing on their mutual search for truth. Art, often perceived as an emotional and subjective expression, delves into deep societal and personal truths, while mathematics serves as the logical language through which we understand the universe's fundamental principles. We argue that these two fields are not opposing, but complementary in their quest to uncover meaning and order. By balancing emotion and reason, both art and science contribute to the discovery of universal truths. As an example, we discuss Bach's *Kunst der Fuge* (The Art of Fugue), where the mathematical structure and artistic expression harmonize. Also we examine how the golden ratio and the Fibonacci sequence, both present in nature and art, represent harmony and guide the creation of aesthetically pleasing works. The connection between art, mathematics, and nature reveals that the search for balance is essential in understanding the world and seeking deeper truths.

Keywords: Art; Mathematics; Golden ratio; Fibonacci sequence, Bach, Universal understanding



1. Introduction

Defining art and clinging to a single explanation of its existence or understanding of its purpose seems meaningless. The number of perspectives and roles that art plays in society probably corresponds to the number of human experiences. According to the Slovene Dictionary (SSKJ), art is defined as an activity "whose purpose is the creation and formation of works of aesthetic value." However, besides creating aesthetic value, art can also be a means of expressing the full spectrum of emotions that humans are capable of experiencing and feeling. Art can be an escape, a detachment from reality, a journey into fantasy, imagination, and dreams... It can hold up a mirror to society and address current issues, or it can accompany the individual on a spiritual journey toward transcendence – a search for higher truth and the essence of humanity. In contrast to this deeper perspective, art can also be expressed through play, emerging from spontaneity and curiosity, thereby creating a space not so much for answers as for questions and new perspectives. As we often hear in life: the purpose of art may simply be art itself. Yet, often – especially within society (which, in our opinion, could not survive without art) – it also carries a connecting element: a universal language that crosses borders, time, and linguistic barriers. It is the language of the universe; at its core, it touches the darkest and brightest particles of our souls, and its power resonates all the way into the infinity of the cosmos. This is where a surprisingly deep connection with mathematics arises – not as the opposite of art, but as its silent ally in the search for universal order. Italian physicist, astronomer, mathematician, and philosopher Galileo Galilei believed that mathematics was the language in which the universe was written, and that only through it could we understand its order and laws (Galilei, 1623). In our opinion, mathematics is the language of patterns and structures, a way of modeling and understanding reality. Mathematics too seeks the truth – but it does so through proof.

2. Emotion and Reason:

2.1. *A Philosophical Exploration*

In a superficial, simplified comparison, today we would associate art with emotion, and mathematics with reason. These two opposing poles have sparked philosophical debates since the time of the ancient thinkers of Western tradition. The roots of these discussions can be traced back to ancient philosophy, where Plato placed reason above art. Reason – that is, structure and form – he described as eternal and perfect, while art, which was of secondary importance to him, was merely an imitation of the real world (Badiou 2016). He indicated that art could only progress if guided by a didactic principle – that is, mathematics. In contrast, Nietzsche, the 19th-century German philosopher, proposed that the human connection to truth was most directly expressed through art, not mathematics. He criticized rationalism and idealism by stating that life, emotions, and instincts were more important than "cold reason." (Badiou, 2016). He attributed an existential role to art indicating that it helps us to survive and makes suffering meaningful (Badiou, 2016). My own view on the role of art and science (mathematics) is close to my reflection on the legacy of Aristotle. It seems that Aristotle understood both, art and science, as explorations of reality – but each in its own way. We may understand that for him, mathematics was not separate from sensory experience, but rather a logical language that could also be beautiful and harmonious: human beings learn and explore reality through experience, observation, and systematic explanation; mathematics, therefore, coexists with art. (Badiou, 2016).

2.2. *The Coherence of Structure and Creativity*

The connection between reason and emotion, often projected onto the relationship between mathematics and art – or between the intuitive, sensory creator and the logical thinker – is, in its duality, rather narrow. We think that masterful art does not exist without rational structure – architecture, composition, form, even poetry, all involve order, logic, structure, and rules. Conversely, mathematics also seem to require aesthetics, imagination, and an experimental moment. Many mathematicians speak of the beauty of equations, the elegance of proofs, and even moments of experimentation, curiosity, and creativity (Penrose, 2004). Both fields carry with them ratio and emotio – and we suggest



that it is in the intersection and right balance of both, where the greatest masterpieces have the potential to be created. Why is this so? We believe that this is in accordance with nature, which is our greatest teacher, and that the greatest artistic and scientific works are born in the perfect balance and ratio between emotion and reason. The concept of duality continuously teaches us through nature, from which everything we know, do, and live today was born. Nature also teaches us that we cannot define the existence of something without its opposite – therefore, the balance between two concepts is all the more important. We believe that opposites, such as light and darkness, life and death, joy and sorrow, cannot be properly defined without recognizing their counterpart. Nature teaches us that everything exists in a balance of opposites, which together form a complete understanding of the world. Without darkness, there is no light; without death, there is no life; without sorrow, there is no joy. This dialectical nature of opposites is fundamental to understanding our existence and encourages us to seek balance. As Hegel presented in his *Science of Logic*, opposites do not exist independently but continuously define and complement each other through their interaction. Similarly, Heraclitus taught that everything is in constant flux, where opposites cannot be considered in isolation, as they form a dynamic balance that enables life as we know it. We think balance is what nature strives for – and with it, humanity. Balance brings peace, which is often the goal. We believe, however, that the greatest masterpieces are born when we push the extremes – when we move beyond our limits, stepping outside our comfort zone. But these are only moments in the trajectory of life, which, in its overall average, tends toward balance. Structure and emotion, then, complement each other and create the highest form of interdisciplinarity, which creates space for mastery.

3. The Convergence of Art and Mathematics

3.1. *Bach's Kunst der Fuge*

If art and mathematics, or science – or more broadly, emotion and reason – are not separate worlds, but merely different expressions of the same search for truth, the question arises: what is within the common denominator of the intersection of these two fields? In which human creations do structure and sensibility, order and imagination, proof and abstraction intertwine? The answer may lie precisely in that which is most natural to humans: in rhythm, in patterns, in harmony, in analysis – perhaps in music, mathematically one of the most precise forms of art. Since I myself come from a musical background, I will begin by touching upon this subject. As an example of mastery or the intersection of mathematics and art, I will present the work *Kunst der Fuge* (The Art of Fugue) by Johann Sebastian Bach – one of the greatest composers of all time, a source of inspiration for numerous generations of artists, and undoubtedly a symbol of creative synthesis between strict structure, mathematical logic, and deeply spiritual artistic expression. Bach is often referred to as the greatest master of the musical form of the fugue. In his lifetime, he wrote more than a hundred fugues, both as part of larger works and as independent compositions. But what exactly is a fugue as a musical form? It is an instrumental, orchestral, or choral polyphonic composition in which the main theme appears successively in all voices. A fugue is an extraordinarily strict and structured form that uses specific rules for how the theme develops in different voices – for example, in retrograde form, inversion, augmentation, diminution, crab progression, in various tonalities and modulations, through contrapuntal, rhythmic, melodic, and harmonic changes. *Kunst der Fuge* is one of Bach's most complex, intellectually remarkable, and symbolically rich works, often cited as the pinnacle of his polyphonic art. Undoubtedly, it is his most mathematical, analytical, and philosophical creation. The entire work, lasting approximately an hour and a half, consists of fourteen fugues, each derived from a single musical theme, developed and broken down through various contrapuntal techniques. It is designed with extraordinary mathematical precision; each fugue follows a logic that can be analyzed almost like a mathematical proof. Yet despite the strictness of the rules, the listener or performer, when in contact with the music, feels depth, peace, transcendence – a sensation that could perhaps be defined as a spiritual experience or even a form of meditative state, of prayer. Bach's *Kunst der Fuge* is one of those rare masterpieces where art and science not only meet but align in perfection. It represents a bridge between two seemingly opposing

yet actually complementary worlds – and for this reason, it has become the subject of study not only by musicians but also by mathematicians, philosophers, and theologians.

3.2. *The Golden Ratio: A Universal Principle in Art and Nature*

Musical compositions, in general – and not just in the fugue form – require a great deal of structure. The communicative power of music is most effectively expressed when supported by substantial knowledge of the rules of harmony, melody, music form analysis, music history, dramaturgical arcs, and contextual placement in time. Alongside this, it also requires contemplation of its purpose, its idea, and its expression. This holds true for composers as well as performers, who, through their own development and process of musical expression and the shaping of their artistic personalities, touch upon the most diverse extremes and possibilities, within the space, time, and period, as well as within their own compass of individual paths. As in life and the universe, so too in art and science – meanings are often layered, and interpretations, answers, and paths may be multiple rather than singular. The interplay between mathematics and art thus reveals itself on many levels, including within visual art.

One of the most well-known examples of this connection is the Golden Ratio – a proportion found both in nature and in numerous artistic masterpieces. Often regarded as the most perfect compositional law in nature, the golden ratio appeals to the human eye as innately beautiful, as it embodies a harmony between linear precision and apparent irregularity or imperfection. Mathematically, it refers to a relationship in which the ratio of the smaller part to the larger is the same as the ratio of the larger part to the whole. This proportion approximates 1.618:1, and the point dividing a whole according to this ratio is known as the golden point. It can be expressed with the equation: $A : B = (A + B) : A$. The Golden Ratio has been known since the time of the ancient Greeks, but it experienced a profound revival during the Renaissance (World History Edu, n.d.). Artists, architects, and sculptors of that period deliberately employed it as a tool to achieve visual balance and aesthetic harmony. Leonardo da Vinci—Italian Renaissance architect, inventor, scientist, engineer, sculptor, and painter—is often linked to the golden ratio, particularly in works like the *Vitruvian Man* and the *Mona Lisa*. While many scholars and art historians speculate that elements of the golden ratio are present in these compositions, it remains uncertain whether Leonardo intentionally applied this principle, and such interpretations are still subject to debate (World History Edu, n.d.). In this way, the golden ratio functions as an unwritten law of universal order, flowing seamlessly through nature and art—as though inscribed in the very fabric of existence. This recurring tendency toward balance, symmetry, and formal coherence appears to be inherently inscribed in the human psyche—precisely because it is inscribed in nature itself.

3.3. *Fibonacci's Sequence: The Blueprint of Nature's Order*

Closely tied to the golden ratio is the Fibonacci sequence—a mathematical series of numbers in which each number is the sum of the two preceding it (1, 1, 2, 3, 5, 8, 13, 21 ...). As the values increase, the ratio between consecutive numbers increasingly approximates the golden mean, or 1.618. This link between numerical order and natural harmony is not merely a theoretical curiosity—it has numerous practical applications in art, architecture, and the natural world. Fibonacci sequences and the golden ratio provide artists and architects with tools to create works that convey not only aesthetic appeal but also inner balance and order. From ancient structures to modern architecture, proportions based on these principles often evoke a sense of coherence and natural beauty. A classic example could be *St. Peter's Basilica* in the Vatican, where some scholars suggest that numerous elements may follow proportions aligned with the Fibonacci sequence (World History Edu, n.d.). Traces of these two fascinations can also be found in the *Parthenon* in Athens, where architectural proportions and relationships in structures such as columns and windows appear consistent with the golden ratio (Finch, 2017). In sculpture – for example – some scholars argue that Michelangelo used elements aligned with mathematical principles, including the golden ratio, when creating works like the *Sistine Chapel* (Huntley, 1970). The architectural and artistic work he designed for the chapel's ceiling contains compositions where the ratios between individual paintings and body segments appear to



reflect this mathematical ideal. Some interpretations of Michelangelo's *David* suggest that its proportions may reflect an intuitive sense of mathematical harmony, often associated with the golden ratio – a concept long admired for its aesthetic appeal (World History Edu, n.d.).

3.4. *The Sound of Numbers: Mathematical Beauty in Music*

The Fibonacci sequence and the golden ratio are also present in music. In many of Mozart's works—such as sonatas and symphonies—musical structures follow rhythmic and harmonic patterns that align with Fibonacci numbers (BBC, 2023.). It is said that numerous phrases and sections in his compositions end after a specific number of bars corresponding to consecutive Fibonacci values. A similar principle can be observed in the works of French Impressionist Claude Debussy, whose rhythmic cycles and harmonic progressions often convey not only aesthetic sensibility but also a deeper coherence that can be linked to the golden ratio and Fibonacci sequence (Frey, 2015). We believe there are quite a few more of these examples in music.

3.5. *The Mathematical Language of Nature*

The fascination with the golden ratio and Fibonacci sequence is also found in natural structures such as flowers, leaves, shells, and even galaxies – and while humans may not be consciously aware of it, we often experience it as aesthetically pleasing. A few examples: the spiral shape of snail shells follows a mathematical structure based on golden ratios. The family tree of bees intriguingly reflects the Fibonacci sequence. A male bee (drone) is born from an unfertilized egg and thus has only one parent – the queen. The queen, however, has two parents – a drone and another queen. If we continue tracing the lineage backwards, we see that the number of ancestors in each generation follows the Fibonacci pattern: 1 (drone), 2 (queen), 3, 5, 8, 13 ... and so on (The Math Learning Centrum, 2024). In the plant kingdom, this ratio is frequently observed: daisies, chrysanthemums, and primroses often have 34, 55, or even 89 petals, numbers that are consecutive Fibonacci values. Sunflower seeds are arranged in spiral patterns, typically 34 in one direction and 21 in the other—again, two consecutive Fibonacci numbers (Liu, 2024). This arrangement is not only visually appealing but also biologically optimal, facilitating the densest possible packing of seeds. A similar pattern is evident in the arrangement of leaves on a stem or branch—known as phyllotaxis—which often reflects this mathematical order (Liu, 2024). In the human body, proportions approximating the golden ratio are frequently found: distances between joints, limb lengths, or facial features. Although not every body is perfectly proportioned, idealized representations, such as Leonardo da Vinci's *Vitruvian Man*, are based on ratios close to this ideal (Liu, 2024). This may explain why the human form appears so naturally harmonious.

5. **Conclusion: Echoes of Unity: A Path to Universal Understanding**

There are likely as many examples of the indispensable reciprocity between mathematics (science), art, and nature as there are ways to connect creative imagination with the logical-mathematical component, all with the common aim of shaping, understanding, and making sense of the world in which we live. The intersections between mathematics and art reveal numerous shared foundations. We may view them as the ones seeking order, structure, and essence – in time, space, and existence. Both transcend functionality and open up as expressions of an inner necessity. They explore form, harmony, contrast, and experiment – and most importantly, both create space for the new: new theories, new artistic forms, fresh thought processes, and unpredictable paths of understanding. It is at this intersection that ideas are born which push the boundaries of the known – and in doing so, also push us forward.

If we resist structure and order within art, or if we deny freedom, exploration, and creativity in mathematics or other scientific fields, we are, in fact, resisting nature itself.



And if we resist nature, we resist humanity, human life, and ultimately, existence itself. I envisage that being is a shared consciousness from which we all emerge and in which the truth is hidden. This truth, in its purest form, is a space where there are no longer divisions between "I" and "you"; there, we are all one. And it is from this state of oneness that the greatest masterpieces are born: in art, science, architecture, sport, and beyond... wherever a person surpasses oneself and touches something greater. Sometimes, we can feel the essence of life inside the Sagrada Familia in Barcelona, other times while listening to Bach's Mass in B minor. If something within us moves, if for a moment we better understand the universe, the human experience, or if it encourages us to look into the darker parts of our soul that we haven't dared approach until now, then it has fulfilled its purpose. In the end, we are left with a single, long or surprisingly short, trajectory of life, to which each of us may - or may not - add our own mark. The choice is ours. In reality, everything belongs to the same fabric – tone, number, colour, breath, human, question, answer. And this awareness may be the first step toward understanding what it means to exist. For when we recognize that we are not separate from creation, but part of it, then art, science, and life finally meet in the same breath.

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