ROMANTICISM, IM- AND EXPRESSIONISM, CONSTRUCTIVISM, AND MATHEMATICS

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Abstract: *The present paper proposes parallels between mathematics and the art movements of romanticism, impressionism, constructivism and expressionism. It seems a contradiction: these currents emphasize emotion, while mathematics is supposed to be uncontaminated by subjective matters. Admittedly, the present focus is more about the history of mathematics, but (modern) art too often comes to live especially when some (historical or formal) background is known.*

1 EMOTIONAL MATHEMATICS?

It is proposed to extend Douglas Hofstadter's "Gödel, Escher, Bach, an eternal golden braid" idea to four more emotional art movements. Strangely enough, mathematics with emotion seems a greater contradiction than art without emotion (at least, the description of their history). We start by a paragraph summarizing descriptions of these visual and musical currents, as they can be found in popular encyclopedia. Next, we provide a comparison inspired by the history of mathematics, yet delimited to just a few paragraphs. This is not only caused by the reduced space and allotted time, but also because we do not want to overdo it and stumble into a sophist's stretching of comparisons.

2 ROMANTICISM

The French Revolution is seen as a key moment for romanticism in some regions, though (writers) Goethe, Pushkin and Byron show it was not but a French movement. It questions the rational approach of nature from the "Age of Enlightenment". Painters Théodore Géricault and Eugène Delacroix preferred "emotion" as their prime source of inspiration, while Beethoven's third symphony is known as an example of the "good romantic style". Beethoven's refusal to dedicate his heroic to Napoleon illustrated the romantic ideal of the artist as hero. Longer musical forms, such as the symphony, became common, as Berlioz' fantastic symphony demonstrated.
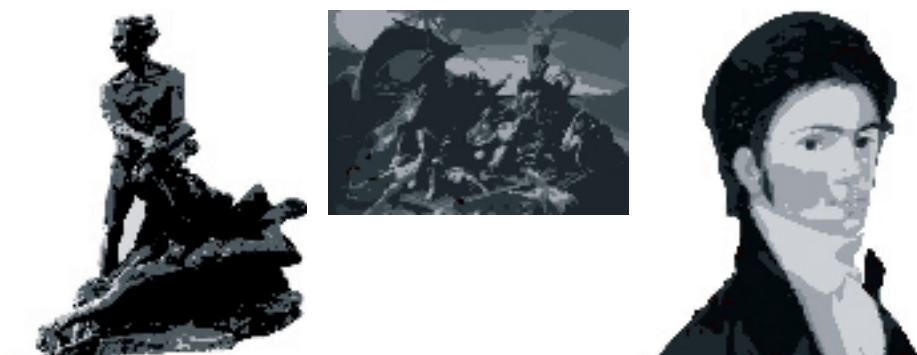

Fig. 1: Abel in Oslo; Géricault's Raft of the Medusa; young van Beethoven.

Supposedly, the irrationality of some romanticists can hardly be extended to mathematicians. Still, the very short turbulent life of the Norwegian mathematician Abel and the French Galois could have been suitable for a rightful romantic biography. Just as romantic painters and musicians, they made their mathematics for the good of society, and not for the pleasure or prestige of a king or a religious authority (as was often the case in the past). Their work too tackled imposing questions, which had remained open since centuries - and they solved it.

Just as Géricault suggested there was no divinity watching over the victims of the shipwreck, Abel proved there is no heavenly formula for solving polynomial equations of degree five and higher using algebraic methods with so-called "elementary" functions. In other words, a recipe as for the quadratics $ax^2+bx+c=0$, "add b to plus or minus the square root of b^2-4ac, and divide by a" is not possible. Using Galois' work, other mathematicians would show the trisection of an angle and the construction of a square with the same area as a circle are impossible if only ruler and compass and a finite number of steps may be used. Together with problem of doubling the volume of a cube, "group theory" (as it would later be called) all classical problems were thus finally solved, after about 2000 years.

3 IMPRESSIONISM

Impressionism began around 1860, with Claude Monet's "Impression, soleil levant" ("Sunrise"). The original way of looking at reality, presented as a personal interpretation by the painter, tried to convey a mental state more than a sudden emotional astonishment. In music, nocturnes, arabesques and preludes became fashionable: think of Claude Debussy or Maurice Ravel.

Fig. 2: A Euclidian, a hyperbolic and an elliptic approach to geometry; Monet's Sunset (in changing to grey values, the disk of the sun had to be added); Debussy.

Some mathematicians too began to deviate from the goal of a perfect representation of reality. The fact one exactly one parallel goes through a given point outside a given line seems obvious, but Nikolai Lobachevsky and Janos Bolyai independently discovered hyperbolic geometry, while Bernhard Riemann designed his elliptic geometry where no such parallels would exist. The prior preference for Euclidean geometry out to be but an … impression, as the elliptic geometry would turn out more adequate in representing reality, as described in Einstein's relativity.

4 CONSTRUCTIVISM

The art movement originated in Russia, after the October revolution. Pure art "for the sake of art", lacking a social implication, or, better, without benefit for the (communist) system, was disregarded. Naum Gabo, who forwarded the appellation in his 1920 Manifest, and Kazimir Malevich, who influenced Lissitzky, are well known until today (especially in mathematical circles). As for music, there is Alexander Mosolov's "Steel Foundry" which introduced mechanical sounds.

Fig. 3: Brouwer's grave; Tatlin's and Mosolov's tributes to the working class.

In mathematics too, a movement existed named "constructivism". It stated a mathematical element should be "constructible" in order to prove its existence. Proofs by contradiction, "ad absurdum", were judged … absurd. One of the most important forms was intuitionism, founded by L. E. J. Brouwer. It is harder to decide if the mathematical subfield actually had something in common with constructivism a part from its name. One could pretend it was opposed to the concept of Poincaré who stated the bases of mathematics are to be found in human intuition. The Brouwer constructivists disliked this subjective criterion as well as vague considerations about the essence of mathematics, just as the artistic constructivists rejected spare-time recreational pursuits without any objective impact on (the socialist) society. Another striking similarity is that mathematical and artistic constructivism both became obsolete. Regrettably, important theorems hardly arose. Similarly, some artists may regret art is no longer at the service of society as it used to be in constructivists' times.

5 EXPRESSIONISM

Expressionism stands for the tendency of transforming reality for an emotional effect (often not joyful), the primary goal of the painting. Of course, most artists envisage an emotional effect but expressionists even omit secondary attributes to stress shapes and colours to emphasize emotion. Edvard Munch's painting "Scream" is a typical example. As for music, the "screaming emotions" lead right away to the main character of Arnold Schoenberg's short opera "Erwartung" (1909), written in his atonal period (before his focus on the twelve tone system). A painting by Schoenberg, called "Der Rote Blick" (Red Gaze) seemed to confirm this. He shared the (interdisciplinary) view with his friend painter Wassily Kandinsky that an artist should express the unconsciousness. This interdisciplinarity is another feature of expressionism.

Fig. 4: Letters a-b, and c-are topologically identical; painting by Schoenberg's friend Kandinsky and a work of Schoenberg himself.

Likewise, topology explicitly omits certain mathematical properties such as distances and angles, in favor of the study the shape of surfaces and volumes. For a topologist, letters a and b have the same shape, while the border of a Möbius strip is nothing more but a circle, and a donut or a cup of coffee can be identified by a "smooth" transformation. Remarkably enough, the interdisciplinary outreach to psycho-analysis is confirmed for topology. Psychoanalist Jacques Lacan had a weakness for Freud, and used topological comparisons to explain his theories. Unlike artists, scientists such as physicists Alan Sokal and Jean Bricmont, opposed to what they called an abuse of their work. Because if the prime subject of expressionisem, it is not surprising a connection could be made to times of social uprisal or war. Anecdotically, when Jean Leray led his university in the Edelbach concentration camp, he turned to … topology.