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Revolutions in Time, Space, and Art: Russian Constructivism

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El Lissitzky opened his essay *Art and Pangeometry* by writing that “in the period between 1918 and 1921, a lot of old rubbish was destroyed.”[1] This quote encapsulates the tumult of the early twentieth-century, when many long-established orders were overturned, not the least of which were both artistic and scientific in nature. Revolutions in the spheres of politics, mathematics, physics, and art combined in the vanguard movement of Russia known as Constructivism. This movement grew in the aftermath of the Bolshevik Revolution in 1917 and thrived in Russia until Stalin took power in 1924. Thereafter, Modernism in general lost favor and was either curtailed or moved elsewhere. Constructivism was influenced by the concurrent debates and developments in modern mathematics and physics, particularly of the fourth dimension and non-Euclidean geometry. Both of these disciplines revolutionized modern conceptions of time and space. There were three primary ways in which artists used these modern studies. First, they were powerful metaphors for the spirit of change and rebellion rampant in the country’s revolutionary atmosphere. Furthermore, they provided artists a new vocabulary of shapes, forms, and spaces which were imbued with that same spirit of revolution. Lastly, artists used these ideas to inform their own artistic theories and to create an art for the new Russian society and its people. They used mathematics and physics for a number of reasons and in a number of ways. This essay discusses this relationship of non-Euclidean geometry and space in a selection of works by Constructivist artists Naum Gabo and Aleksandr Rodchenko.

The Bolshevik revolution was a culmination of many factors that resulted in the proletariat, or working class, overturning Russia’s government. The philosopher Nikolai Berdiaev describes this time as “an epoch of the awakening in Russia of independent philosophical thoughts, the flowering of poetry and the heightening of aesthetic sensitivity, or religious disquiet and searching, of interest in mysticism and occultism. New souls appear, new sources of creative life were discovered, new dawns were seen, feelings of sunset and death combined with the feeling of sunrise and with hope for a transfiguration of life.” [2] For Russia, this was a time of great discovery and innovation. This spurred an efflorescence of culture in various literary and artistic movements. These artists and writers sought to separate themselves from old tradition, going so far as to even deny tradition while simultaneously striving to create a universal culture that could be appreciated and understood by all. Essentially, they wished to create a new tradition for their new Russia.

Constructivism was one of the movements that grew out of this revolutionary atmosphere. The very term "Constructivism" is something to be considered, however; even during the time, the label was controversial. Many artists placed under the moniker disputed being associated with other similarly labeled artists. In the mid-1960s, historian George Rickey defined Constructivism as: "the work of a group of Russians between 1913 and 1922, which include Tatlin, Malevich, Rodchenko, El Lissitzky, Naum Gabo, Antoine Pevsner, and briefly, Wassily Kandinsky. Their work is, in general, geometrical and non-mimetic."[3] This definition leaves something to be desired for many scholars as it limits the movement solely to the art realm. One such scholar, Christina Lodder, states: "In reality it was something much wider: an approach to working with materials, within a certain conception of their potential as active participants in the process as of social and political transformation."[4] Constructivism influenced spheres beyond art and architecture, such as stage design, household objects, and fashion. While the movement can certainly be generally identified by the use of constructed materials and geometric forms, a more important, unifying feature is its goal to create art with social and political purpose.

Constructivism followed the vanguard movement Suprematism and retained many of the same interests and goals. Suprematists, most notably Kazmir Malevich, sought the sublime in non-representational compositions. While both groups were very interested in the study of the fourth dimension, Constructivists were also interested in non-Euclidean geometry, a subject which rarely enters Suprematist writings. The heightened interest between two groups so close in time, location, and goals is due to many factors. Albert Einstein's theories of relativity were a few major catalysts. These caused a stir in many spheres of study. The core idea of these theories was that time was not a constant, as had long been assumed. Rather, time could vary depending on one's speed and gravity. The popular reception of Einstein's work spurred on increased productions of past theories on non-Euclidean geometry and the fourth dimension.[5] With these topics openly debated, publicized, and circulated, the general public, artists included, possessed a basic knowledge and understanding of the studies. In regards to this wealth of common knowledge, artist Naum Gabo stated: "whether many of us knew exactly what was going on in science or not does not really matter. The fact was that it was in the air and an artist, with his sensitivity, acts like a sponge. He may not know it but he sucks in ideas and they work on him."[6] While many artists were neither avid mathematicians nor physicists, they held a general knowledge of the fourth dimension and non-Euclidean geometry as presented to them by popular culture and could employ the studies in their art.

The fourth dimension was controversial even in definition, as there was no universally accepted meaning.[7] For some, it was an idea of pure science fiction purported by authors such as H. G. Wells, wherein the fourth dimension was time itself and something tangible that could be travelled through much in the same way one moves north or south. To others, the fourth dimension was something mystical or spiritual. This was a view supported by many Suprematist artists, including Malevich, who interpreted the fourth dimension as a metaphor for higher enlightenment and thought, a stance which carried on into Constructivism. These are just a few interpretations of the fourth dimension during the time. A number of artists reacted to this idea.

In *Art and Pangeometry*, El Lissitzky cites a few movements such as Cubism, Futurism, and others that consciously reacted to advances in physics.[8] In Constructivism, the fourth dimension was manifested in kinetic sculpture.

Aleksandr Rodchenko's *Spatial Constructions* are prime examples of this. He made many of these throughout his career. One earlier example from 1920, *Spatial Construction no. 12*, is constructed of a series of ellipse-like rings placed within one another. (Collection the Museum of Modern Art, New York. For image see **http://www.moma.org/collection/object.php?object_id=81043**) The sculpture hangs from one point on the outermost ring. As one circles the sculpture, one finds that its form perpetually changes. This ever-changing sculpture illustrates a major fourth dimensional concept which was that the fourth dimension was completely beyond all possible imagination and one could only ever envision fragments of that dimension. This idea is illustrated in the 1884 novella *Flatland* by Edwin A. Abbott, which chronicles the travels of a square from a two dimensional world.[9] The square encounters a sphere but, being a two dimensional being, the square can only perceive it as a circle that constantly keeps changing size. This allegory attempts illustrate why humans, as creatures of the third dimension, are incapable of conceptualizing the fourth dimension and also to illustrate that such a thing is indeed possible. Rodchenko's *Spatial Construction* appears to the viewer the same way the sphere appears to Flatland's square as a series of fragments from another dimension.

Constructivists were also interested in non-Euclidean geometry, a broad study which includes many distinct branches. The diverging point from Euclidean geometry is that they disagree with the fifth of Euclid's self-evident postulates: five rules that are supposed to always be true. The fifth postulate is summarized as: "through a given point can be drawn only one parallel to a given line."[10] Even during Euclid's time, this postulate was doubted as a self-evident truth and many sought to create alternatives. Since these new mathematic branches differed from that of Euclid, they were deemed non-Euclidean geometries. A few mathematicians who made advances in the study include, though are by no means limited to, Nicolai Lobachevskii, J. Bolyai, Bernhard Riemann, and Carl Friedrich Gauss. Some proposed postulates which negated Euclid's fifth postulate, such as spherical geometry proposed by Riemann in which there are no parallel lines, as lines always meet at two points.[11] Other propositions maintained Euclid's fifth postulate in some cases. In Gauss's geometry, space has curvature, and if that curvature equals zero, then Euclid's postulate still holds true.[12] Such studies influenced Constructivist artists in some way by contributing to both the artists' methods of construction and methodology.

Gabo's sculpture *Constructed Head No. 2* is a prime example of the influence of both non-Euclidean geometry and the fourth dimension (Collection Tate Britain. For image see **http://www.tate.org.uk/servlet/ViewWork?workid=4809**) The sculpture is of a figure's upper torso and head with hands clasped before it. When viewed from either side, the figure appears to be slightly slouched and gazing downwards, almost in a prayer-like attitude. In the frontal view, the figure's posture and gaze take on an entirely different air, and it appears to be confronting the viewer. It is constructed from intersecting geometric planes of galvanized

iron**.** Notably, this was a effective method for artists in a country where traditional sculpture materials such as marble or bronze were largely unavailable. More importantly, however, this method of construction was key to the Constructivist movement. By paring down sculpture to flat planes, they were able to evoke a spirit of rebellion against tradition. To Gabo, "older sculpture was created in terms of solids; the new departure was to create in terms of space"**[13]** This is exactly the case in *Constructed Head*. Gabo makes empty space integral to creating the sculptural solidity that a solid material would traditionally create.

This relates to another major impact of modern mathematics and physics: three-point perspective was thrown into doubt as the primary means of representation. If space were curved, the straight parallel lines that define three-point perspective would no longer suffice to represent the world. If there were a dimension higher, the importance placed on representing this three-dimensional world would lessen. Gabo's sculpture references non-Euclidean geometry in the very shape of the planes of iron which consist of elegant curves and rigid lines. Gabo could have easily bent and formed these shapes further in order to create a more lifelike bust of a woman. Instead, he chose to keep the integrity of the shapes so the bust appears more like a conglomeration of lines and shapes. In regards to the fourth dimension, the sculpture uses a similar concept as discussed with Rodchenko's *Hanging Spatial Construction*. By allowing empty space to become as important a material as bronze, Gabo forces the viewer to recognize emptiness as something almost tangible and reconsider what our dimension actually consists of.**[14]** This in turn relates to the sculpture's shifting composure as one circles it. It is as if the viewer becomes the square of Abbot's *Flatland* and the sculpture is the sphere which we can only see as an ever changing dot.

Thus far, this essay has avoided the topic of the direct usage of these modern studies in art. When considering the relationship between mathematics, physics and art, it would be easy to assume that artists simply took an equation or theory that interested them and directly transferred it into their work. This is certainly the case in some art. Later in life, Naum Gabo created sculptures such as his *Construction in Space* (*Crystal).* (Collection Tate Britain. For image see **http://www.tate.org.uk/servlet/ViewWork?workid=21299**) This sculpture, like Gabo's *Constructed Head,* clearly appears mathematical. The key difference between the two is that *Construction in Space* builds literally off of a mathematical equation.**[15]** This is an example of the direct use of mathematics in art. In the case of *Constructed Head No. 2* and other Constructivist art, the artist's goal was to reference and interpret ideas and concepts of mathematics and physics. Their goal was not often to create literal visualizations of these studies. This is due in part to the fact that many of these popular ideas and theories were essentially abstract, with no real means of visualization. Returning to Lissitzky's essay, he states: "Our minds are incapable of visualizing this, but that is precisely the characteristic of mathematics---that it is independent of our powers of visualization," and thus these spaces, "cannot be conceived, cannot be represented; in short, it is impossible to give them material form."**[16]** To have attempted the task of visualizing the concepts of non-Euclidean geometry and the fourth dimension in the same fashion that Gabo did in his later sculptures would have ultimately been a foolish and fruitless goal. Instead, it was far more productive for artists to approach these studies in artistic and poetic manners.

These artists were neither mathematicians nor physicists. Their art was informed by a general, popularized understanding of non-Euclidean geometry and the fourth dimension. Scholar Herbert Read summarizes this translation of mathematics into art: "The creative construction which the artist presents to the world is not scientific, but poetic. It is the poetry of space, the poetry of time, of universal harmony, of physical unity. Art- it is its main function- accepts this universal manifold which science investigates and reveals, and reduces it to the concreteness of a plastic symbol."**[17]** According to Read, an artist's task is to create a tangible object which will aid both in the understanding of abstract concepts and in the rumination of these concepts. Both Rodchenko's *Hanging Spatial Constructions* and Gabo's *Constructed Head no. 2* illustrate the inconceivability of the fourth dimension as well as the possibility of its existence. They employed the curved shapes and planes of non-Euclidean geometry. In Gabo's *Constructed Head*, these planes served to deny both the tradition of solid sculpture as well as that of three-point perspective. The sculptures act as fragments of the fourth dimension and convey our own inability to truly conceptualize this concept. In the end, both Gabo and Rodchenko were able to achieve their primary goal of creating a new art for the Russian people imbued with a spirit of rebellion and change through their use of modern mathematics and physics.

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[1] El Lissitzky, "A. and Pangeometry" in Steven Yates, *Poetics of Space* (Albuquerque: University of New Mexico Press, 1995), 69.
[2] Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton, New Jersey: Princeton University Press, 1983), 239.
[3] Christina Lodder, *Russian Constructivism* (New Haven: Yale University Press, 1983), 1.
[4] Ibid.
[5] Henderson, *The Fourth Dimension*, 10.
[6] Patricia Railing, "The Idea of Construction as the Creative Principle in Russian Avant-Garde Art," *Leonardo* 28, no. 3 (1995): 193.
[7] Henderson, *The Fourth Dimension*, 6.
[8] Lissitzky, *A. and Pangeometry*.
[9] Edwin A. Abbott, *Flatland* (New York: Dover Publications, 1992).
[10] Henderson, *The Fourth Dimension*, 3.
[11] Manuel Corrada, "On Some Vistas Disclosed by Mathematics to the Russian Avant-Garde: Geometry, El Lissitzky, and Gabo," *Leonardo* 25, no. 3/4 (1992): 378.
[12] Ibid., 380.
[13] Ibid., 382.
[14] Naum Gabo, *Of Divers Arts* (New York: Pantheon Books, 1962), 101.
[15] Corrada, "On Some Vistas," 381.
[16] Ibid.
[17] Ibid., 382.

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