The Cosmos and Four-Dimensional Geometry as seen in the Visionary Architecture of the Russian Avant-Garde

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

From four-dimensional geometry and philosophy to a connection with the cosmos, the intellectual tradition of the Russian avant-garde is understudied and misinterpreted in the West. This thesis reflects upon the theory of visionary architecture to explore the mystical philosophical culture that was present during the Russian avant-garde movement. My aim is to examine the following: how can visionary architecture help us understand the cultural connection between the cosmos and geometry during the Russian avant-garde period? Although there is individual research on the different disciplines in Russia, there is less research on the interconnectedness of these disciplines. Russian intellectual circles in the 19th and 20th century were very intermingled, and this thesis aims to add another voice to interdisciplinary research while understanding the broader cultural context, focusing on architecture. This thesis provides a background of Russia's intellectual history – from philosophy to mathematics – that influenced the Modern Art movement. Afterwards, visionary architecture from different groups of architects is examined to recognize where and how impacts of this diverse intellectual culture are embedded within their designs. Lastly, I use drawing as a form of active research to understand the thinking behind several visionary architectural pieces from several architects so that the additions are in dialogue with the originals. Overall, the visionary architecture from a century ago expressed the cosmic mysticism that pervaded Russia's intellectual circles, very different from the Western rationalism of Russia's neighbours and subsequently misunderstood. With this in mind, along with the heavy interdisciplinary way of approaching various subjects in 19th and early 20th century Russia, there is merit in re-examining some of the ideas offered from that time in today's modern world.

Keywords:

Architectural Theory, Architecture, Art Theory, Constructivism, Cosmos, Esotericism, Fourth Dimension, Four-Dimensional Geometry, Geometry, Hypergeometry, Hyperphilosophy, Hyperspace, Imaginary Space, Mathematics, Mystical Philosophical Culture, Mysticism, Orthodoxy, Outer Space, Philosophy, Rationalism, Russian Avant-garde, Science in Art, Space, Spirituality, Suprematism, Theosophy, Visionary Architecture

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0 Introduction

Visionary Architecture and the Visions of the Modern Movement

The Emergence of Cosmos and Geometry in the Russian Avant-garde

The Cosmos and Geometry as seen in Russian Visionary Architecture and Speculative Drawings

Four-Dimensional Geometry as a tool to explore Russian Avant-Garde Visionary Architecture

Conclusion

0. Introduction

Visionary architecture has always been an outlet for architects to express their desires, drawing upon their environment to put pen to paper and imagine something new. I was origin ally drawn to visionary architecture from Etienne Boullée's Cenotaph for Sir Isaac Newton, as I was inspired by his vision to capture the cosmos through an architectural subject. While looking into the Cenotaph and researching the Enlightenment age of reason, I connected geometry and the cosmos together. But something did not sit right with me because I felt somewhere that this "age of reason" could not be the only explanation. Even now, with all the scientific discoveries since, we still don't have all the "answers" to the natural world.

Working with my supervisor Dr. Elizabeth English introduced me to Slavophilism. In the 19th century, groups of Russian thinkers debated on how to best solve Russia's social issues. The Slavophiles were one such group. They believed that Russia could unify the world through the Russian Church by focusing on freedom, faith, love, and community (see section 2.3.1). Researching this group introduced me to the world of religious mystical philosophy. The Slavophiles opposed Western sentiments by nature of their ideals, and architectural theories based on their philosophies arose in the early 20th century. From four-dimensional geometry and philosophy to a connection with the cosmos, I found the intellectual tradition of the Russian avant-garde fascinating. Overall, Russian thought promoted the idea that rational thought derived from the Western Enlightenment was not the only way to see the world, and this subject is gravely understudied in the West. Also, growing up with Russian parents who immigrated to Canada, I wanted to keep in touch with my Russian heritage by looking at Russian architecture through a separate perspective from the Western paradigm within which I was educated. In adding my voice to the discussions about the Russian avant-garde movement, I reflect upon the power of visionary architecture to explore the intellectual culture of its time. My aim was to examine the following: how can visionary architecture help us understand the cultural connection between the cosmos and geometry during the Russian avant-garde period?

Before embarking on a deep dive into visionary architecture of the Russian avant-garde, it is important to define and understand what visionary architecture *is,* which is the focus of the first chapter. Visionary architecture by its nature is an art form that comes from architects envisioning a different future based on the

social and political issues that are present within the architect's culture. It is only fitting then to understand the intricasies of an intellectural culture by looking at the visions of those within that culture. This is why this thesis, along with providing a more nuanced background of the culture that architects of the time would have found themselves surrounded with, looks into visionary architecture specifically as a vessel to pick up on desires and values of the architect and their architectural theories, those which can only be embedded within a visual medium.

Following the introduction to the world of visionary architecture will be a small section on Enlightenment era visionary architecture. This will serve as both a further discussion of the theory behind visionary architecture as well as an account of the thought behind the rationality of the Enlightenment era that Russian Slavophiles disapproved of. This chapter will end by giving context between Western and Russian architecture, and some of the collaborations between Russia and Europe. While Russian Avant-garde architects visited the West, the ideas behind their work were not well understood. Discussing the collaborations between the architects of Russia and the West further serves as a debut to some of the thinkers that will be further expanded on in later chapters.

The second chapter will introduce theories from several Russian intellectuals. Their ideas come from multiple disciplines, including mathematics and philosophy, but nonetheless contributed to architecture. In this thesis, I use "the West" to refer to Europe and North America, both of which went through philosophical rationalisation during the Enlightenment period. This is the reason for the differentiation in intellectual culture between Russia and the West in the 19th and 20th centuries. Russian architecture has a completely different context compared to Western architecture, as historically Russia did not go through the same philosophical reforms as the West. Due to this divide, the architecture produced by the West was designed under a very different type of thinking than which existed in Russia. The second chapter aims to introduce the Russian way of thinking so that visionary architecture in chapter 3 can be understood within the paradigm that developed it, rather than filtered through a Western perspective.

The intellectual philosophical history of 19th century Russia influenced many disciplines in 20th century Russia including architecture. As all these disciplines are interconnected with shared philosophical backgrounds, studying them can allow us to examine architecture with a more nuanced understanding.[1] From reading the work of scholars such as Dr. Elizabeth C. English, who

1. Elizabeth C. English, "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition" (University of Pennsylvania, 2000), 5.

made pioneering connections between 19th century Slavophile philosophy and Russian avant-garde architectural theory, and Dr. S. Frederick Starr, who is an expert on Russian and Eurasian affairs, I have been able to develop a more thorough understanding of the influence of the social and intellectual history of Russia on 20th century architectural theory. In particular, English has studied the importance of approaching Russian avant-garde architectural theory from an interdisciplinary perspective in order to link rational and irrational ways of thinking that are not constrained by Western interpretation.[2] The connections she makes in her work between architectural theory and the disciplines that influenced it are observable in the visionary architecture designed by architects of the Russian avant-garde. I take a similar approach in my thesis and take a perspective that is not often used when approaching the complex topic of Russian avant-garde architectural theory.

With this said, because research on Russian history is often kept separated by discipline, it is important to broaden architectural research to disciplines like art, mathematics, science, and philosophy to understand the overall context.[3] From the disproof of Euclidean geometry, to esoteric philosophers, to the formation of the Slavophilism movement in the 19th century, the 20th century mystical philosophical culture continued to expand into a culture that involved merging Orthodox Christian values and exploration of the cosmos.[4]

The third chapter will then further develop the concepts described in the context given by the previous chapters. Having gained a new perspective on the Russian historical context in chapter two, we will then examine the complexity of the visionary architecture of the Russian avant-garde. With an understanding of the mystical mathematical and philosophical culture of Russian architects, we can look at the visions these architects produced with a nuanced approach to Russian architecture. This chapter will cover a piece from at least one architect from each of the popular groups of the Russian avant-garde movement: Suprematism, Rationalism, and Constructivism.

Suprematism was an art style founded by Kazimir Malevich (see section 2.5.1). Malevich attempted, through his abstract shapes and colours, to find a nonobjective form that would become the starting point towards a world of higher intuition and cosmic consciousness.[5] Malevich believed that through Suprematism, art had finally achieved its pure form.[6] Malevich's work was founded on mysticism and Russian symbolism,[7] and he was one of the many thinkers who was interested in the cosmic world and philosophy

2. English, "Arkhitektura I Mnimosti."

3. English, 5.

4. English, 17,71,131.

5. Magdalena Dabrowski, "Malevich and Mondrian: Nonobjective Form as the Expression of the 'Absolute,'" in The Avant-Garde Frontier: Russia Meets the West, 1910-1930, ed. Gail Harrison Roman and Virginia Carol Hagelstein Marquardt (Gainesville: University Press of Florida, 1992), 151,152.

6. Kasimir Malevich, *The Non-Objective World,* trans. Howard Dearstyne (Chicago: Paul Theobald and Company, 1959), 100.

7. Dabrowski, "Malevich and Mondrian: Nonobjective Form as the Expression of the 'Absolute,'" 147.

that came out of considerations of the fourth dimension,[8] as in his painting Black Square (see section 2.5.1).

The rise of Suprematism as an art style developed into Suprematist architecture. Malevich himself had brought Suprematism out of the two-dimensional with his Arkhitektons (see section 2.5.1) and El Lissitsky (see section 3.2.1) was a notable architect who used Suprematism as a technique of representation to further his theories on architecture and geometry.

As the 1917 revolution in Russia prompted a search for new ways of artistic expression,[9] the artistic debates of the post 1917 era gave rise to two groups of architects: the Rationalists (see section 3.3.1) and Constructivists (see section 3.4). Rationalism grew as an art movement soon after the revolution with the formation of INKhUK (Moscow Institute of Artistic Culture) in 1921, and with the formation of ASNOVA (Association of New Architects) in 1923. Constructivism was developed by the Working Group of Constructivists within INKhUK in the early 1920s and solidified into a defined movement in 1925 with the foundation of OSA (Organization of Contemporary Architects).[10] During the Russian avant-garde, ideology was closely associated with these two groups.[11] While they had different approaches, their goals overlapped.[12] Both groups strived to find a new architectural form to reflect their changing society.[13] Constructivists approached their goal through the arrangement of material and structure to find architectural form to express the needs of a new society. The Rationalists, on the other hand, considered materials and structural methods as important for spatial organization through the psychological perception of one's environment.[14]

With the avant-garde being a visionary movement in itself, looking closely at the visionary architecture of this visionary movement will reveal the deep tie to the cosmos and geometry of Russia's philosophical culture and history.

In the fourth and final chapter, I will take the theories that were prevalent during the time and use drawing as a form of research by adding onto the original works to understand further what these architects were trying to accomplish. The nature of visionary architecture means that examining it more closely may yield a closer understanding of the architect and therefore the cultural context in which the architect lived. Using the medium of visionary architecture, I explore philosophies and theories of hypergeometry, hyperphilosophy, time, mysticism, and the cosmos. Before examining the visionary drawings, I will provide an explanation

8. Regina Khidekel, Khidekel and the Cities of the Future, interview by Elena Dobriakova, accessed April 13, 2023, https://thecharnelhouse.org/2013/12/25/khidekel-and-the-cosmist-legacy-of-suprematism-in-architecture/; Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton, N.J: Princeton University Press, 1983), 239.

9. Aleksandr Viktorovich Anisimov, *Architectural Guide to Moscow* (Rotterdam: uitg. 010 publ, 1993), 15.

10. Anna Bokov, "Teaching Architecture to the Masses: Vkhutemas and the Pedagogy of Space, 1920-1930," *ProQuest Dissertations and Theses* (Ph.D., United States -- Connecticut, Yale University, 2017), 78, ProQuest Dissertations & Theses Global (2017159181).

11. S. Frederick Starr, "Writings from the 1960s on the Modern Movement in Russia," *Journal of the Society of Architectural Historians* 30, no. 2 (May 1, 1971): 174,175, https://doi.org/10.2307/988633; English, "Arkhitektura I Mnimosti," 75; Bokov, "Teaching Architecture," 83,84.

12. *Pioneers of Soviet Architecture: The Search for New Solutions in the 1920s and 1930s*, ed. Catherine Cooke, trans. Alexander Lieven (New York: Rizzoli, 1987), 106; Bokov, "Teaching Architecture," 83.

13. Khan-Magomedov, *Pioneers of Soviet Architecture*, 106.

14. Khan-Magomedov, 106.

of how projections in the fourth dimension are created. After, I will explain how I incorporated theories from Russian thinkers into the selected works and the reasonings behind my decisions. This chapter will end with an analysis of how the original intent of the drawings was changed after my interventions, and that in general, visionary architecture as architectural theory in a visual format means that drawing as a form of research can be applicable to further understanding a topic. This chapter is to put into practice the theories and ideas from each chapter in a visual way.

With my thesis, I strive to understanding influences such as esoteric philosophy, mysticism, hypergeometry and hyperphilosophy that appear in the Russian arts of the 1920s by understanding the cultural background that made them so influential. I aim to investigate these influences under the very specific architectural subset of visionary architecture, as it is an insightful and informative medium out of which to draw context and understanding of the culture within which it was made.

Introduction

1 Visionary Architecture and the Visions of the Modern Movement

1.1 Introduction

The way theory spreads through a society, and the way the history of an environment is embedded within culture means that the study of some niche topics can be an invaluable way to parse through cultural values, in this case: the study of visionary architecture. This chapter opens with the theory of visionary architecture and speculative drawing and its relationship with the field of architecture. Since the 15th century's advent of the modern profession of architecture, the constructor – the one who builds – and the architect – the one who holds the idea in their head – are separate professions. Visionary architecture brings this concept even further, where the design in an architect's head is not even meant to be built at all.

This chapter will first discuss the theory and goals of visionary architecture to provide context for visionary architecture during the Enlightenment. By doing so, it will further the understanding of the importance of the visionary in parsing out cultural values, as well as giving an understanding of the ideals and worldviews that persisted into the 20th century. Understanding the Enlightenment period helps us understand the cultural notions that persist from that time that remain today.

A famous project to come out of the 1920s was the Bauhaus, a school located in Weimar Germany. Other influential schools existed, too; while not as widely acknowledged, the impact of the VKhUTEMAS (Higher Art and Technical Studios), a school located in Moscow, Russia, is undeniable. Along with the interactions between these two schools, there were other many interactions between German and Russian artistic and architectural groups.

Upon acquiring a basic understanding of visionary architecture as a theory and how it was used during the Enlightenment period, the reader will be equipped to engage with the discourse on how Russian architecture is commonly misunderstood when seen through the Western perspective. Russia has a deep intellectual history that extends beyond the influence of the Western Enlightenment, and Russia experienced a lesser impact from the Enlightenment mindset in comparison to Europe. Overall, we can see that despite all these collaborations, the Western academic audience did not wholly understand the spirit behind Russian architectural ideas.[1] Whereas the philosophy of the Western Enlightenment emphasized a need for "logic" and "rationality" that persists in the Western intellectual framework to this day, Russian philosophy,

1. Elizabeth C. English, "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition" (University of Pennsylvania, 2000), 2–4.

promoted that rational thought was not the only way to see the world. The visionary architecture of the Russian avant-garde can show us a the uniquely Russian culture that influenced Russian artistic circles.

1.2 The Pertinence of the Speculative

1.2.1 The Theory of Visionary Architecture

Architects dream of building, but when they are faced with an obstacle to this, they dive into the incorporeal – architectural manifestos, architectural theories, architectural imaginings. So how do we distinguish architectural visions from pure fantasy? A design can be considered architectural based on the importance placed upon the design of the form, structure, and use. In that sense, not everything that is built is architecture, and the unbuilt can be very architectural. In fact, with new technology, many contemporary architectural fantasies or visionary architecture from past decades are capable of being built. Nonetheless, just because something is designed for a virtual world does not inherently classify it as "visionary architecture." Especially currently, with modern technological advancements such as virtual/augmented reality or powerful modeling software for cinema or video games, judging what makes visionary architecture *visionary* by whether it can be built or not, is a poor way of addressing this rich and marvelous topic. So how can we start to define visionary architecture in order to have a meaningful discussion about it?

The terms "visionary architecture" or "speculative drawing" are those that are given to designs that exist on paper: those that are impractical, idealistic, even utopian.[2] Unbuilt and unbuildable architecture includes drawings of architecture as well as models that represent the driving force of the author's ideas. This is also why you will find that for the purposes of this thesis, I may use "visionary architecture," "speculative drawing," and "speculative architecture" interchangeably. The creators' intent behind these theoretical works is driven by a similar impetus.

While being impractical or unbuildable is an aspect of defining visionary architecture, it is not the one and only way to categorize visionary architecture. Visionary architecture allows us to engage with the current social and political status quo – it tends to be a reflection of the society in which it was made, whether it is French painter-architect Louis Etienne Boullée's monument to science in his Cenotaph for Sir Isaac Newton or Russian avant-garde architect and educator Nikolai Ladovskii's visionary expansion of industry and urbanism in his intentionally abstract[3] Parabola Planning Scheme for Moscow (Figure 1). As introduced in the book *Visionary Architecture: From Babylon to Virtual Reality*, which also

2. John A. Walker, "Entry 689 Visionary Architecture," in *Glossary of Art, Architecture & Design since 1945*, 3rd ed. (Boston, Mass: G.K. Hall & Co., 1992).

3. Anna Bokov, *Avant-Garde as Method: Vkhutemas and the Pedagogy of Space, 1920-1930* (Zurich: Park Books, 2020), 504.

aims to define visionary architecture in order to have a meaningful conversation with readers, Thomsen says the following about the visionary: "In situations of political, economic, or cultural crisis, visionary thinking is especially important, because it enables us to challenge hidebound conventions and to open a path for innovative approaches and solutions."[4] It is because visionary architecture captures such a unique viewpoint of the time that it was created that it is a valuable time capsule for examining architectural theories throughout the ages. Visionary architecture, *because* it deals with visionary explorations and challenges of the present, represents a yearning for the future. It is within particularly conservative, repressive societies where visionary architecture has proliferated, as drawing on paper was the best way to expand on architectural aspirations.[5]

The intent of the architect to apply architectural theories or ways of thinking to their work, is a further aspect of visionary architecture. When producing visionary architecture, architects seek to work through the current era's conventions and engage with the current status quo. By doing so, they ultimately develop their own theories or engage with current theories, making visionary architecture fundamentally a visual theory. By using architectural speculation to explore a dream for the future within the current social context, these drawings in turn expand the theoretical base of the field of architecture.

4. Christian Werner Thomsen, *Visionary Architecture from Babylon to Virtual Reality* (Munich ; New York: Prestel, 1994), 7.

5. Walker, "Entry 689 Visionary Architecture."

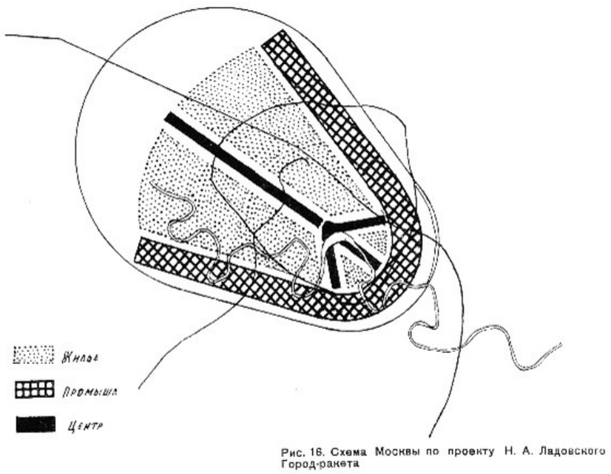


Figure 1

Nikolai Ladovskii's Parabolic plan for Moscow. Also called "The 'City-Rocket'" this case study was created as a critique of the linear city

Drawing by Nikolai Ladovskii, 1930

1.2.2 Philosophy of the Enlightenment

The Enlightenment, also known as the "long" 18th century, was a period of time that can be summarized in its simplest form as a search for reason. There was an emphasis on imitating the old classics, holding them up as an ideal to pursue, and Isaac Newton's methodology was applied to all subjects.[6] Newton launched a cultural shift with his writings and his theories. We can still see the influences of his approach to science today. At that time, for instance, *The Encyclopédie*, was published to disseminate information to the French population in hopes of attaining a more knowledgeable, and therefore happier, population.[7] However because *The Encyclopédie* included arts, and even mechanical arts, it should come as no surprise that the arts then followed an explosion of justification as well, in line with the formalistic way of pursuing science. People started to approach art and other disciplines in a way that more closely aligned with the rigorous way science was approached.

As the fields of arts and philosophy became rationalized, a new characteristic arose – the sublime. Seemingly contradictory to the main characteristics of the Enlightenment, the sublime is a quality of grandeur and power, that can be applied to art and architecture. This partially came again from Newton, when he published his theories of perception, and their relation to the nerves in the body.[8] His ideas brought about an interest in sensibility, and in how human nerves connect to allow humans to perceive the world.[9]

Edmund Burke, the philosopher, wrote a book about the ideas of the beautiful and the sublime titled *A Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful*, first published in 1757. This book broke down the origin of the sublime and how it stems from the human body, embracing Newton's theories of perception.

Burke's philosophical inquiries lent themselves well to artist representations, with phrases such as "Astonishment as I have said, is the effect of the sublime in its highest degree," "Greatness of dimension is a powerful cause of the sublime", or even "No passion so effectually robs the mind of all its powers of acting and reasoning as fear".[10] It is not difficult to see how the sublime makes its way into art and architecture.[11]

6. Linda Walsh and Tony Lentin, *The Enlightenment*, vol. The Enlightenment, History and The Arts (The Open University), accessed November 28, 2022, https://www.open.edu/openlearn/history-the-arts/history-art/the-enlightenment/content-section-0?intro=1.

7. Walsh and Lentin.

8. Koen Vermeir and Michael Funk Deckard, *The Science of Sensibility: Reading Burke's Philosophical Enquiry*, Archives Internationales d'histoire Des Idées 206 (Dordrecht New York: Springer, 2012).

9. Vermeir and Funk Deckard.

10. Edmund Burke, *A Philisophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful with an Introductory Discourse Concerning Taste* (New York: Harper & Brothers, 1871).

11. Burke.

The Enlightenment brought a fascination with nature not just in terms of the mechanics of our universe, but in terms of the natural world such as landscape and garden nature. Nature was regarded as something to observe and study, a natural object that can be controlled by human action.[12] On the other hand, in more theoretical contexts, the natural world was seen as ideal and therefore as something to emulate.[13] In both cases, the natural world was highly regarded.

1.2.2.1 Giovanni Piranesi

Giovanni Piranesi (1720-1778) was an artist and printmaker who is known for his depictions of Rome and his Prison series of illustrations. Although he lived towards the beginning of the Enlightenment, and is therefore not always included as part of the Enlightenment despite the artistic influence of his work, his *later* works embody the characteristics seen throughout the Enlightenment.[14] We will, as an example, examine his Prison series, when I compare it to his earlier Antique Rome series.

Piranesi looked to the past rather than towards the future, whereas a large majority of architects who make visionary architecture look towards the future.[15] In his art, Piranesi instead combined the past with the present, rather than the present with the future.

While Piranesi's early works of his Rome prints dutifully copied very old classical architectural elements, or highlighted the antique qualities of his colleagues contemporary classical realisations, in his later works Piranesi included his own variations in his classical reproductions.[16] Piranesi was not as interested in the actual ruins and part of his interest in what he called Rome's "remains" was a way for him to identify with the past and remove the distance created by time.[17] He also depicted the construction and stability inherent in the remains of these classical structures ; this interest is evident in his analysis of real structures and the many drawings he made depicting large and strong antique buildings.[18]

His interest in the ruins was not a melancholy rumination of time passed but instead an interest in these buildings' strong ability to stand, and as Piranesi stated, they were only lost due to ignorance and neglect, rather than inevitably crumbling over time.[19] Piranesi used his prints not to refer to the ruins themselves but as a way to place them into the context of his present life. His visionary views of classical architecture brought to life the power of ancient Rome, despite illustrating ruins. Piranesi reflected upon the idea of depicting social change through the decline of civilization.[20]

12. Walsh and Lentin, *The Enlightenment*.

13. Walsh and Lentin.

14. The Enlightenment is usually characterized as lasting from the late 1600s to the very early 1800s, so even though many of Piranesi's works are of the Neoclassical art style and Piranesi is not included with Enlightenment architects, as mentioned, he has been placed in this section as his later Prison series directly interacts with the Enlightenment characteristic of the sublime.

15. Gijs Wallis De Vries, "Flight Lines in Piranesi's Plan of Rome: A New Concept of Utopia," *Traditional Dwellings and Settlements Review* 22, no. 1 (2010): 33; Bent Sorensen, "Some Sources for Piranesi's Architectural Fantasies (Rome, Etchings)," *Burlington Magazine* 142, no. 1163 (2000): 82,89.

16. Sorensen, "Some Sources for Piranesi's Architectural Fantasies (Rome, Etchings)," 83.

17. Lola Kantor-Kazovsky, "Displeasure of Ruins Piranesi and the Monuments of Ancient Rome," *Apollo (London. 1925)* 166, no. 546 (2007): 47–53.

18. Kantor-Kazovsky.

19. Kantor-Kazovsky.

20. Thomsen, *Visionary Architecture*, 51.

Furthermore, Piranesi's Prison series was another of his visionary architecture series that similarly comments on the Modern world (See Figure 5 for one of the prints from this series). This series consisted of plates that were of gothic, gloomy and monumentally large depictions of prisons. The visionary architecture of the prisons contrasts light and darkness, scale, and an overall sense of fear and anxiety.

Piranesi's early set of the Prisons was simpler and lighter, the second set of plates was harsher,[21] and coincided with the emergence of the Enlightenment concept of the sublime.[22] This element of the sublime was that of a beauty found in terror, usually also containing a grandness in scale. Piranesi himself had once declared that "in the midst of fear springs forth delight,"[23] reinforcing his visionary architecture's contribution to the idea of the sublime. By the time the second edition of this series was published, the Enlightenment's distancing from divinity was already well in effect, we can see this in the structures shown on the plates. The ancient elements of the prison, combined with their dreary atmosphere and infinite architectural elements seem to be an interpretation of the contemporary condition, or perhaps the condition of the human body.[24] This combines the past (the visionary architecture) with the present (the emotional effect of the art as the argument).

Both Piranesi's Rome series and Prison series show how his visionary architecture is a commentary of the present with the past. Visionary architecture is an appropriate theoretical framework to examine how these drawings display Piranesi's arguments of the past and the condition of the present.

1.2.2.2 The Triad of Enlightenment Architects and their Visions

"Architecture Parlante" in French, or Talking Architecture in English, was a style of architecture made popular by Claude Nicolas Ledoux in the 18th century, where the form of the architecture is what explains its own meaning. This was seen in the work of both Jean-Jacques Lequeu, and Etienne-Louis Boullée, two other revolutionary period architects. It is interesting to note the reasons behind their speculative nature, and the intent behind their work. All in all, the visionary architecture made by these three architects was a form of visual studies for their cerebrations.

Étienne-Louis Boullée (1728-1799) wanted to be a painter, but was encouraged by his father to become an architect. Boullée

21. Isabel Weadock, "The Prisons by Piranesi," *Bulletin of the Detroit Institute of Arts of the City of Detroit (1919)* 22, no. 8 (1943): 83, https://doi.org/10.1086/BULLDETINST41500905.

22. Thomsen, *Visionary Architecture*, 46–55.

23. De Vries, "Flight Lines in Piranesi's Plan of Rome: A New Concept of Utopia."

24. Walter Pach, "Imagining Democracy, Punishment, and Infinity: Giovanni Battista Piranesi's Carceri d'invenzione," 2022, 7, https://escholarship.org/uc/item/1pc602bp.

Figure 2
Ancient Intersection of the Via Appia and Via Ardeatina
Etching and Engraving by Giovanni Piranesi, ca 1760

Figure 3
Drawing Study of the Ancient Intersection of the Via Appia and Via Ardeatina
Etching and Engraving by Giovanni Piranesi, 1752

Figure 4
Architecture, Perspectives, Grotesques, Antiquities
Etching and Engraving by Giovanni Piranesi, ca 1749-50

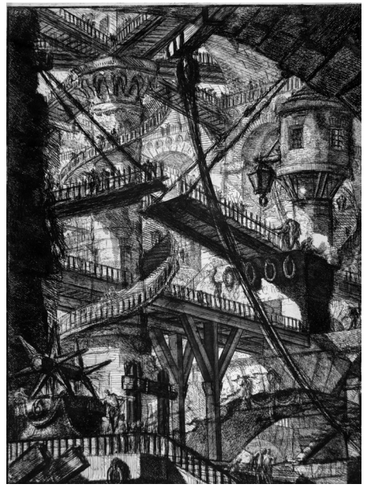


Figure 5
A print from Piranesi's Carceri series: Folder 7
Etching by Giovanni Piranesi, 1745

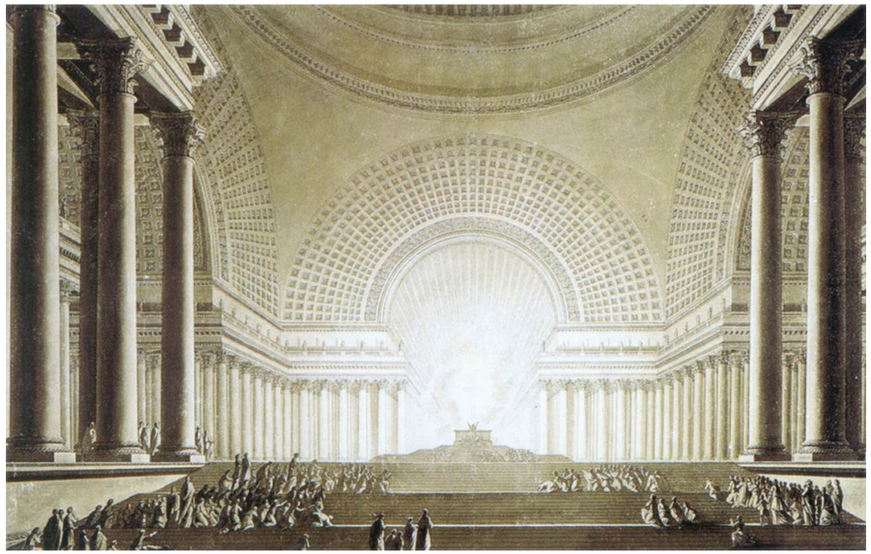


Figure 6
Plan for a Métropole
Painting by Etienne Louis Boullée, 1781

Figure 7
Proposal for a Museum Interior
Painting by Etienne Louis Boullée, 1781

25. Helen Rosenau and Etienne Louis Boullée, *Boullée & Visionary Architecture* (London, New York: Academy Editions ; Harmony Books, 1976). 89.

26. Rosenau and Boullée.89.

27. Rosenau and Boullée., 106.

28. Burke, *A Philisophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful with an Introductory Discourse Concerning Taste*., 92.

kept his painter's roots as he designed his visionary pieces. He was inspired by Enlightenment ideals, and infused "character" into his buildings; the design was to induce only the feelings that were related to the building (see Figures 6 and 7).[25] This is an approach characteristic of Talking Architecture. His Cenotaph has "character", and as defined by Boullée, that is when the building invokes only the feelings it is designed to do.[26] This sentiment captures the essence of Talking Architecture.

To expand on how his building has character, and how visionary architecture was the vessel to help him achieve the interpretation he wanted to express, Boullée used his paintings to depict his theories on art and nature. We can see Boullée's fascination with the sublime and the beautiful, and how Boullée had seemed to solve some of Burke's musings through the act of visionary architecture. This is to say, Boullée's thoughts in his Essay on Art demonstrate the height of Enlightenment reverence and need for reason, and shows his devotion to what nature can teach us.

Boullée mentions in his Essay on Art, when discussing his design for the Cenotaph for Newton (figures 8-11), that part of the reason he made the Cenotaph a sphere was because all dimensions are the same, and that this ensures that the observer cannot reach the edges and therefore is forced to look at it from afar.[27] Boullée's theory behind the design of his Cenotaph touches on Edmund Burke's idea that infinity is a characteristic of the sublime. According to Burke, "Another source of the sublime is infinity ... Infinity has a tendency to fill the mind with that sort of delightful horror which is the most genuine effect and truest of the sublime."[28] Boullée achieves this sublime infinity in many different manners. He did this in the Cenotaph with the subject matter of the cosmos, during the day, the interior surface of the Cenotaph looks like the night sky, and during the night, the interior is lit up by a large light like the sun, which at that time was not technologically possible. His subject matter spoke of infinity, from Newton's laws governing the gigantic universe, to representing the universe itself.

He also represents infinity through sheer size and form, by using an enormous sphere. This also for example, touches on Burke's idea that the sublime is expressed through greatness of dimension, as Boullée's sphere is large and imposing, and stretches out in all three directions, with the observer at the bottom. Burke had written in his inquiry, "Greatness of dimension is a powerful cause of the sublime ... for certainly there are ways and modes wherein the same quantity of extension shall produce greater effects than it is found to do in others. Of these, the length strikes least; a hundred

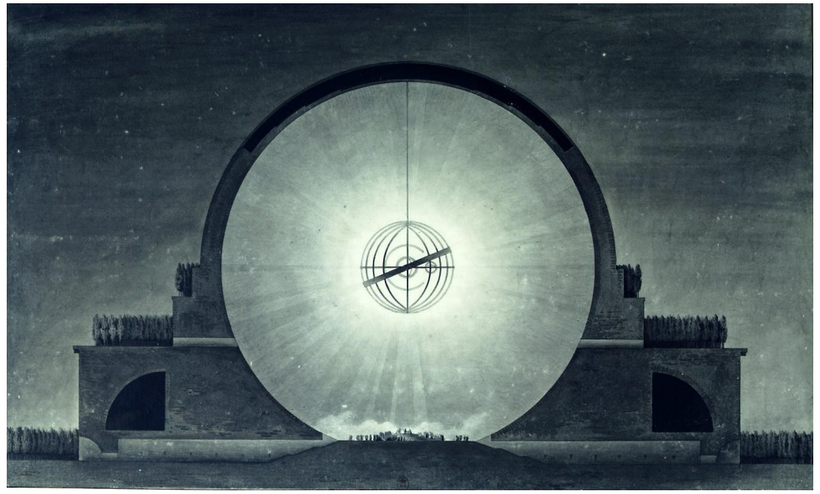


Figure 8
Section of Boullée's Cenotaph for Newton, During the Night with Day Effect
Painting by Etienne Louis Boullée, 1784

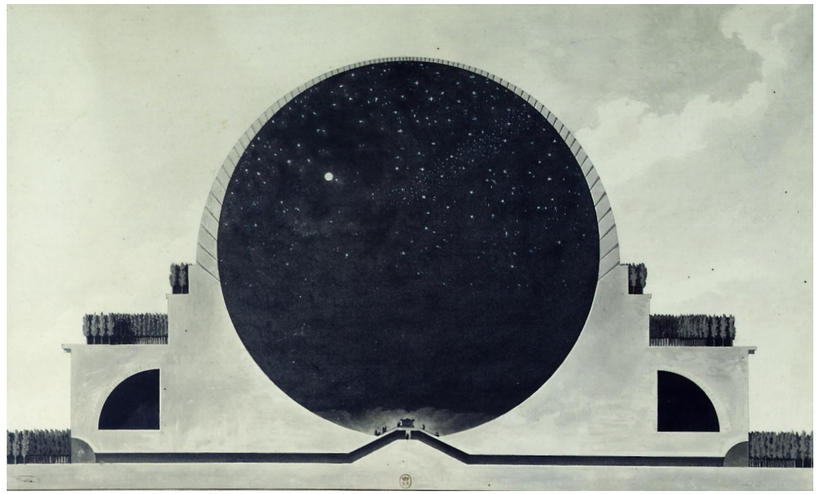


Figure 9
Section of Boullée's Cenotaph for Newton, During the Day with Night Effect
Painting by Etienne Louis Boullée, 1784

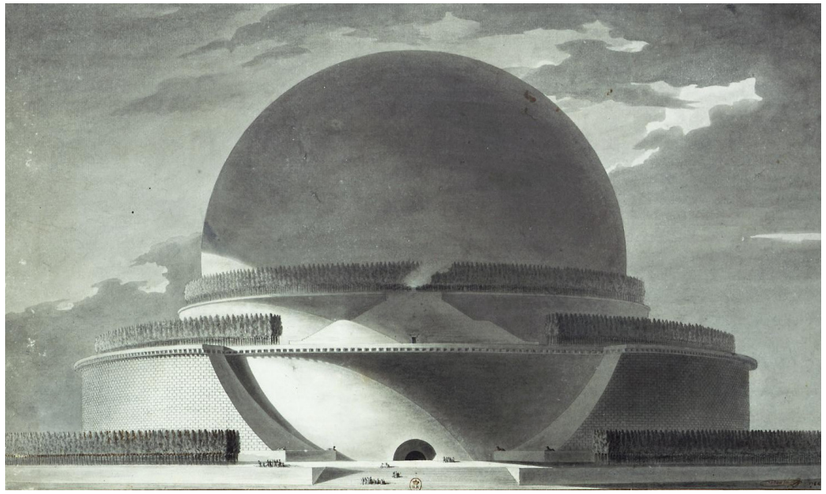


Figure 10
Elevation of Boullée's Cenotaph for Newton
Painting by Etienne Louis Boullée, 1784

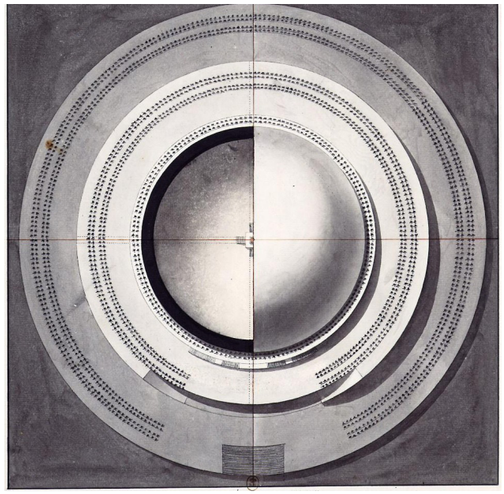


Figure 11
Plan of Boullée's Cenotaph for Newton
Painting by Etienne Louis Boullée, 1784

yards of even ground will never work such an effect as a tower a hundred yards high, or a rock or mountain of that altitude."[29] Boullée had solved this problem by using a sphere, placing an observer at the bottom to take in the enormity of the geometrical form, and its lack of length, width, and depth: just leaving the infinity of a sphere. It is the ideas of visionary architecture that allowed Boullée to design in this manner. Of course, the Cenotaph for Newton is unrealistic to build, but as a painter and a visionary architect, Boullée embedded his theories of the sublime within such a large volume, only made possible by designing architecture not meant to be built.

In a like manner, Claude-Nicolas Ledoux (1736-1806) was influenced by Enlightenment ideals when designing his architecture. Ledoux's drawings depict a love for material and simple geometric forms, as that is what he characterized as part of the architectural experience.[30] A lot of Ledoux's works were in fact designed to be built; however, the scope and cost of his designs often prevented his visions from being realized in full.[31] The Ideal City of Chaux (Figure 12) is an example of one of such projects. He was commissioned to design a Saltworks farm and ended up designing a whole city around it. Only the Saltworks farm and the Worker's housing was built.

In his design for the housing for the rural caretakers (Figure 13), he used a sphere, and just like Boullée, he loved both the sphere and pyramid shapes for their sublime qualities.[32] The grandeur of what he wished to express with his architecture is what stopped it from being built, but is also what made it visionary. He did not want to downsize his ideas to build them, making his drawings a visual of his views on architecture. Ledoux's belief in Talking Architecture is what allowed him to express his contemporary ideas of the social language of architectural form,[33] hence by engaging with contemporary ideas of architecture, ended up with visionary architecture as architectural theory.

The last in this triad of *Architecture Parlante* architects is Jean-Jacques Lequeu (1757- ca.1825) who worked as an architect, a surveyor, and a cartographer. His drawings were not popular during his lifetime, however they did reveal his Western tastes of the fantastic and the romantic.[34] While not as rigorous as Boullée and Ledoux, with designs evoking the Baroque art style, he was still a product of his time, with a "naïve faith in science,"[35] and an interest in Gothic novels – and therefore influenced, at least indirectly, by Piranesi's engravings.[36]

29. Burke. 91.

30. Jean-Claude Lemagny, *Visionary Architects: Boullee, Ledoux, Lequeu* (Houston: University of St. Thomas, 1968).

31. Lemagny.

32. Lemagny, 92.

33. Anthony Vidler, *Histories of the Immediate Present: Inventing Architectural Modernism*, Writing Architecture (Cambridge (Mass.): MIT Press, 2008), 25.

34. Lemagny, *Visionary Architects: Boullee, Ledoux, Lequeu*, 150.

35. Lemagny, 151.

36. Thomsen, *Visionary Architecture*, 46–55; Alice Labourg, "Reconstructing Gothic Architecture in Ann Radcliffe's Novels: From Decorative Details to Picturesque Tableaux," *Polysèmes*, no. 21 (May 30, 2019): 6, https://doi.org/10.4000/polysemes.4637; Lemagny, *Visionary Architects: Boullee, Ledoux, Lequeu*, 151.

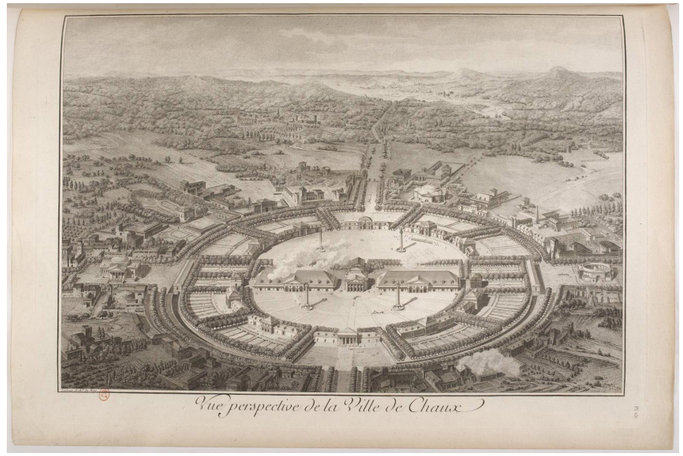


Figure 12
Perspective of the City of Chaux
Print by Claude Nicolas Ledoux, 1804

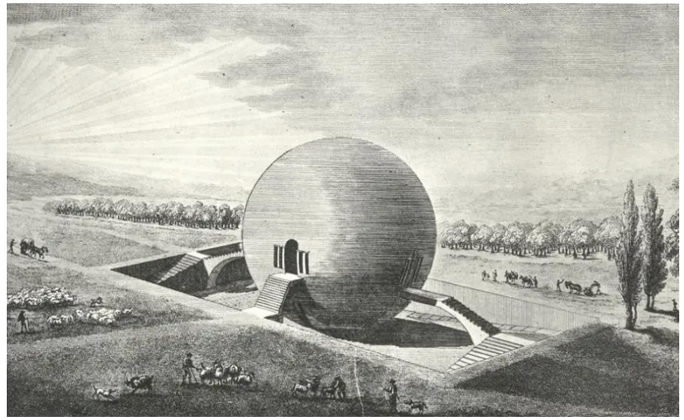


Figure 13
Quarters for the Rural Caretakers
Engraving by Claude Nicolas Ledoux, 1770

For example, his Subterranean Labyrinth for a Gothic House (Figure 14) shows his penchant for unconventional and (sometimes) unsettling visions. According to Lequeu's annotations, this Gothic House is designed for initiations into the "Society of Sages and Most Courageous Men," and they must overcome their fear of death through daunting trials of different elements: air, water, and fire.[37] It was discovered that Lequeu's inspiration for this house was a novel called Séthos (published 1731) by Abbé Terrasson wherein the main character was initiated into the secrets of ancient Egypt through a series of trials.[38] Obviously, this would never be built, but this is what visionary architecture is for – to explore possibilities of what architecture can do without needing to build it.

Lequeu, like Boullée and Ledoux, also employed spheres in his work. Also like Boullée, in his work "Temple of the Earth," (Figure 15), Lequeu seems to idealize the natural world, pushed by the Enlightenment's push for reason and rationalization. The exterior inscription reads "To Supreme Wisdom." Similar to Boullée's cenotaph, Lequeu's temple has holes in it to simulate stars from the inside, and the exterior is decorated with the engravings of the continents. Similar to Boullée's praise of Newton and Newton's discoveries in the design of the Cenotaph, Lequeu's interior to his Temple of the Earth also provides a scientific veneration to the solar system as the inside has a smaller globe that reproduces the movement of the earth through the sky and provides a place for gathering and discussion.

The work of these three architects demonstrates how visionary architecture is a useful tool to understand the impacts of a culture on people's thought processes and ideas. Ledoux once said, "If you want to become an architect, begin by being a painter."[39] Being able to express themselves liberally without consideration of physical realities through painting allowed these architects to cultivate their ideas more effectively and engage with contemporary traditions, academic or otherwise. It is this speculative approach that allows for further development of architectural theory, particularly when examining the potential of the future given the context in which we exist.

37. "Underground of a Gothic House, from Civil Architecture," The Morgan Library & Museum, May 20, 2020, https://www.themorgan.org/exhibitions/online/lequeu/underground-gothic-house-civil-architecture; Lemagny, *Visionary Architects: Boullee, Ledoux, Lequeu*, 187.

38. Lemagny, *Visionary Architects: Boullee, Ledoux, Lequeu*, 187.

39. Lemagny, 68.

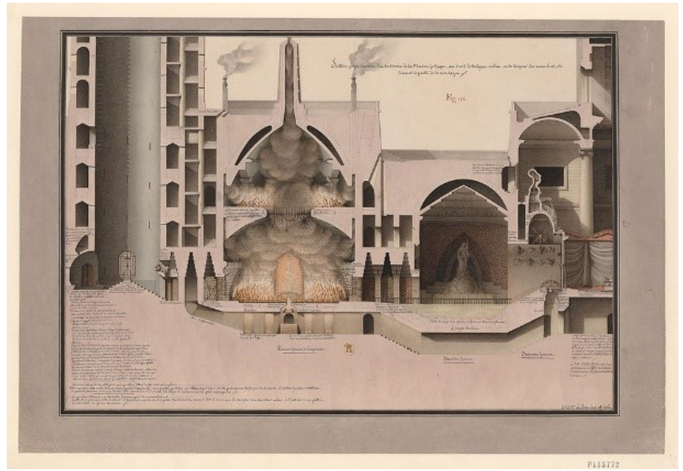


Figure 14
Subterranean Labyrinth for a Gothic House
Watercolour painting by Jean-Jacques Lequeu, 1804-11

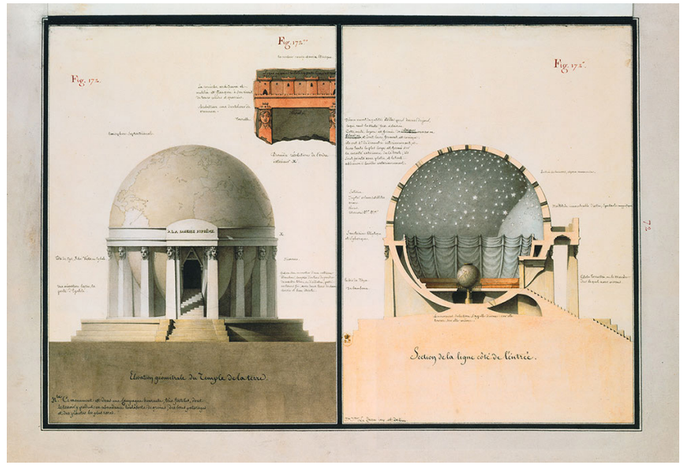


Figure 15
Design for a Temple of the Earth
Watercolour painting by Jean-Jacques Lequeu, 1794

1.3 The Birth of Modern Architecture

1.3.1 The Visionary Avant-Garde

There have been many avant-garde movements throughout history, when new experimental concepts, different than society's norms, were developed. Any avant-garde movement in itself is visionary – the very term avant-garde means new experimental concepts particularly in the arts.[40] The avant-garde of the 1920s goes by many different names depending on the culture to which one is referring, due to many avant-garde movements throughout history. In the West, the 1920s avant-garde movement is called the Modernist movement, or Modernism. However, it would be incorrect to call the Russian 1920s avant-garde "Modernist" as what is referred to as Russia's "Modern" movement is called "Russian Moderne" or "the New Style."[41] This style is roughly defined the period of time that characterised the turn of the 20th century, anywhere from 1890 to 1916.[42] As such, the 1920s avant-garde can be called Modernism in the West, but it would be incorrect to call the Russian avant-garde such, as the term "Moderne" is reserved for this earlier Russian art and architecture movement. The 1920s avant-garde for both Russia and the West was particularly radical in the intense and fast paced political and socio-cultural movements that were happening during the early 20th century. It is important to look at the visionary architecture of art and architecture movements to give us an insight to the deep nuances of all the affecting factors of these time periods.

Throughout the 1920s, there was the emergence of schools that taught a new design philosophy. Curricula like this aimed to bring order after the war by creating and expressing the emerging sensibilities of the early 20th century,[43] as well as a need for a reform in the arts on how to design and teach with new materials that no longer work with historical crafting traditions.[44] The anti-historical tradition in architectural design stemmed, in part, from the industrial boom, which often resulted in an animosity towards ornament.[45] Along with the push of industrialisation in the post-war period, a machine-made aesthetic of smooth finishes was born in the 1920s, marking a change in the materials used in and appearance of architecture.

One of the schools that emerged during this period was the well-known Bauhaus School in Germany. Founded in 1919 and shut down in 1933, this school is well known for combining art and industry in its educational plan, influencing many of the European

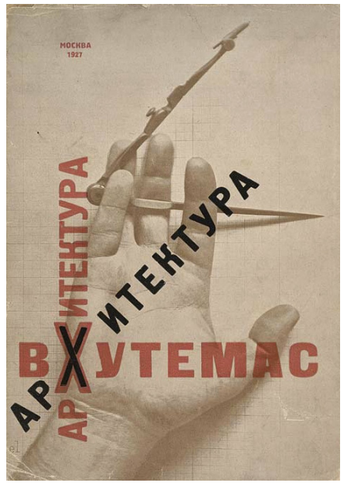


Figure 16
Architecture at the VKhUTEMAS Book Cover
Letterpress Illustration by El Lissitsky, 1927

40. Winston Holt, "Avant-Garde," in *The Winston Dictionary of Canadian English*, n.d., 38; "Avant-Garde," in *Collins COBUILD Advanced Learner's Dictionary* (HarperCollins), accessed October 6, 2023, https://www.collinsdictionary.com/dictionary/english/avant-garde.
41. William C. Brumfield, "Anti-Modernism and the Neoclassical Revival in Russian Architecture, 1906-1916," *Journal of the Society of Architectural Historians* 48, no. 4 (December 1, 1989): 371, https://doi.org/10.2307/990455; Aleksandr Viktorovich Anisimov, *Architectural Guide to Moscow* (Rotterdam: uitg. 010 publ, 1993), 14.
42. Brumfield, "Anti-Modernism and the Neoclassical Revival," 371; Anisimov, *Architectural Guide to Moscow*, 14.
43. Tony Fry, *Tony Fry's Defuturing: A New Design Philosophy* (United Kingdom: Bloomsbury Publishing USA, 2020), 54,55,128.
44. Frank Whitford, *Bauhaus*, Reprinted, [preface 1991], World of Art (London: Thames & Hudson, 1995), 13–26.
45. Fry, *Defuturing*, 129.

46. Whitford, *Bauhaus*, 11,12.
47. Whitford, 12.
48. In 1923, the new national government was instated in Germany, and in 1924, the right gained the upper hand in the parliament.
49. Whitford, *Bauhaus*, 148.
50. Whitford, 150.
51. Whitford, 192–96.
52. Whitford, 9–12.

avant-garde architects that are well known to this day. The Bauhaus had three aims: the first to train craftsmen, painters, and sculptors so that they could combine their efforts in the future, the second to upgrade the social standing of crafts to the level of fine arts, and third aim was the least clear as it was for the Bauhaus to connect with the leaders of the crafts and industries in Germany.[46] This became particularly important as the school was dependent on the money earned from selling its products and designs, with some public subsidy.[47] Gropius knew that the German government change in 1924[48] meant that the school would likely have trouble with funds due as this government change would affect the school's subsidies.[49] The students felt that the focus of the school was changing, particularly by the painters who felt they were becoming obsolete.[50] It was partially due to this subsidy taken away (along with political developments) that the Bauhaus ended up closing in 1933.[51] As such, during the time the school was operating, the Bauhaus adjusted its curriculum to the calls of industry.[52] It was particularly after the Bauhaus exposition of 1923 that the school started getting industry commissions.

The unrest of the 1920s in Europe also meant that the Bauhaus produced projects that were made with new intellectual goals in mind, resulting in an upsurge in visionary ideations. At the Bauhaus, after passing a preliminary course on design, colour, and form, students could choose to advance to a specific stream. Options included architecture, planning, ceramics, weaving, furniture design, wall painting, theatre, or metal work.[53]

From 1920-30 however, there was another school in Moscow that had a teaching program that was "equally progressive and more comprehensive":[54] the VKhUTEMAS (Higher State Artistic and Technical Studios). This school was also larger with an enrolment of over 2000 students (making it about ten times as large as the Bauhaus),[55] with many similarities in terms of educational content: painting, sculpture, graphics, textiles, ceramics, woodworking, metalworking, and architecture.[56] The school strived to incorporate contemporary ideals within the socialist era.

While the Bauhaus focussed on craftsmanship and materiality, the VKhUTEMAS balanced its approach of craftsmanship with the traditional arts of painting and sculpture.[57] Both of these schools were in concordance with each other about their radical goals: to bring about educational reform to closely reflect the new contemporary world.[58] Not to mention, both schools chose architecture as their medium of choice for this change.

53. Fry, *Defuturing*, 128.
54. Anatole Senkevitch, "The Vkhutemas :A Soviet Bauhaus," *Journal of the Society of Architectural Historians* 33, no. 3 (1974): 238.
55. Paul Wood, ed., *The Challenge of the Avant-Garde*, Art and Its Histories, bk. 4 (New Haven, CT : London: Yale University Press ; Open University, 1999), 244; Bokov, *Avant-Garde as Method*, 40.
56. Senkevitch, "The Vkhutemas :A Soviet Bauhaus," 238.
57. Bokov, *Avant-Garde as Method*, 22.
58. Bokov, 40.

Both the VKhUTEMAS and the Bauhaus were the prime movers of the 1920s avant-garde in terms of their design and architectural discourse, and as Anna Bokov, an architectural historian,[59] wrote in her book detailing the history of the VKhUTEMAS that both of the schools "forg[ed] modern concepts of expressive forms, dynamic spaces, and total environments."[60]

1.3.2 Collaborations between Europe and Russia

Even before the founding of the Bauhaus and the VKhUTEMAS, art groups from these two locales had been in contact with each other, so it was only natural that artists, both inside and outside of these schools, corresponded and attended the same events, and submitted work to the same publications and exhibitions. This communication between Russia and the West during the 1920s avant-garde period led to an exchange of ideas. Some examples of this includes Russian art exhibitions in Germany and El Lissitsky's participation in the publishing of VKhUTEMAS/VKhUTEIN[61] material, such as in the magazine *ABC Beiträge zum Bauen* (ABC Contributions on Building) and *Rußland: Architektur für eine Weltrevolution* (Russia: An Architecture for World Revolution).

The famous French architect Le Corbusier, known as one of the pioneers of Modern Western architecture, had a documented interest in Soviet architectural ideas. He visited Moscow in 1928, 1929, and 1930, and had shown interest in the Constructivist Publication *Sovremennaya Arkhitektura* (Modern Architecture).[62] *Sovremennaya Arkhitektura* was a journal published by the Constructivists from 1926-1930, and this publication mentioned Le Corbusier's work frequently. Le Corbusier was even listed as part of the editorial board for two of the issues.[63] His interest grew in the 1920s, and the early 1930s presented him with an opportunity to comment on Soviet projects. During that time, he had also submitted an entry to the Palace of Soviets competition in 1932, but it was rejected by the Soviet political leaders serving as jury.[64]

Furthering his involvement with Russian architecture, Corbusier designed in Moscow with the Russian Constructivist architect Nikolai Kolli to create the Tsentrosoiuz, a government building referring to the headquarters of the Cooperative movement.[65] An alternative name for this building is the Central Union of Consumer Cooperatives.[66] The building was not regarded kindly by the time it was finished in 1936, and it lacked several features that were

59. Her Dissertation at Yale University, published in 2017, is titled *Teaching Architecture to the Masses: VKhUTEMAS and the Pedagogy of Space, 1920-1930.*

60. Bokov, *Avant-Garde as Method*, 52.

61. In 1926, the VKhUTEMAS (Higher State Artistic and Technical Studios) was renamed to the VKhUTEIN (Higher State Artistic and Technical Institute) due to an administration change.

62. English, "Arkhitektura I Mnimosti," 7.

63. Lidia Smirnova, "Sovremennaya Arkhitektura Magazines as an Example of Russian Constructivism Idea of Household (Byt).," n.d., 8.

64. Bokov, *Avant-Garde as Method*, 56–59; Joseph D McCadden, "Review: Jean-Louis Cohen. Le Corbusier and the Mystique of the USSR: Theories and Projects for Moscow, 1928-1936. Translated by Kenneth Hylton. Princeton: Princeton University Press, 1992. Xvi, 254 Pp. $49.50," *Russian History (Pittsburgh)* 20, no. 4 (1993): 366, https://doi.org/10.1163/187633193X00775.

65. Jean-Louis Cohen, "Le Corbusier's Centrosoyuz in Moscow," *Future Anterior* 5, no. 1 (2008): 53, https://doi.org/10.1353/fta.0.0003.

66. Jean-Louis Cohen, *Le Corbusier and the Mystique of the USSR: Theories and Projets for Moscow, 1928 - 1936* (Princeton, NJ: Princeton Univ. Press, 1992), 60.

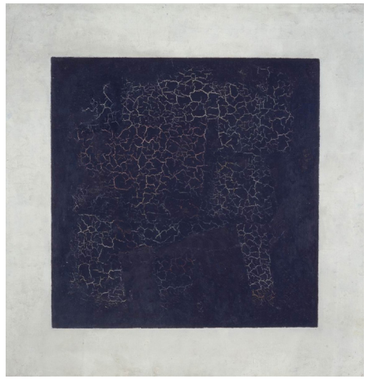


Figure 17
Black Square
Oil painting by Kazimir Malevich, 1915

67. McCadden, "Le Corbusier and the Mystique of the USSR," 366; Cohen, "Le Corbusier's Centrosoyuz in Moscow," 55,56.

68. L. Hilberseimer, "Introduction," in *The Non-Objective World* (Chicago: Paul Theobald and Company, 1959).

69. Wood, *The Challenge of the Avant-Garde*, 200.

70. Kasimir Malevich, *The Non-Objective World*, trans. Howard Dearstyne (Chicago: Paul Theobald and Company, 1959).

71. Sophie Lissitzky-Küppers and El Lissitzky, *El Lissitzky : Life, Letters, Texts* (New York: Thames and Hudson, 1980), 8.

72. Bokov, *Avant-Garde as Method*, 57; Lissitzky-Küppers and Lissitzky, *El Lissitsky*, 7.

73. Mildred Friedman and Walker Art Center, eds., *De Stijl: 1917-1931: Visions of Utopia; [Publ. on the Occasion of the Exhibition De Stijl: 1917 - 1931, Visions of Utopia, Organized by Walker Art Center]*, 4. print (New York: Abbeville Press, 1986).

74. Manfredo Tafuri, *Theories and History of Architecture* (London ; New York: Granada, 1980), 40.

originally envisioned for it.[67] Nevertheless, the Tsentrosoiuz is a tangible witness to Le Corbusier's interest in Soviet architecture and the influences of Soviet architectural ideas on his work.

While Le Corbusier and other European architects were interested in Russian architecture and even visited the country, Russian architects were also doing the same with Europe: corresponding, traveling, and participating in exhibitions. One of several exhibitions was the 1922 Exhibition of Russian Art held in Berlin. The exhibition, which included well-known artists such as Vasilii Kandinskii, also introduced new artists, such as the Constructivist Vladimir Tatlin and the Suprematist Kazimir Malevich.[68]

When Malevich developed Suprematism in 1913, he was already a well-known painter. In 1915, he published a new series of works which included his famous Black Square (Figure 17), where the name "Suprematism" was circulated. To Malevich, Suprematism was a response to the current 20th century world, rather than an escape from it.[69] Through dynamic form with static colours, Malevich brought forward a very insightful discussion of the perception of reality (further discussion in Chapter 3).[70]

Malevich was a mentor to El Lissitsky, who was a Soviet Architect and painter of the Russian Avant Garde. With the influence of his mentor Kazimir Malevich, Lissitsky developed his own theories that coalesced into his proun series (see sections 3.2.2 and 4.3), from which his proun room at the 1923 Great Berlin Art Exhibition was derived. The Russian revolution of 1917 was to Lissitsky the beginning of a new epoch, where he explored new modes of representation.[71] In the 1920s, Lissitsky kept to his artistic convictions through his Rationalist investigations of using scientific rigor to create desired aesthetic effects.

A year after VKhUTEMAS was established, Lissitsky traveled to Berlin on behalf of the school to promote Soviet art in the West, where during his four years in Germany, he met many renowned figures including Walter Gropius, Theo van Doesburg, and Ludwig Mies van der Rohe.[72] He even joined the De Stijl group, the famous Dutch group founded by Theo van Doesburg during the avant-garde that worked towards a universal harmony through the deconstruction of nature resulting in abstract forms.[73] In 1922, Lissitsky, in collaboration with Ilya Ehrenburg (a successful Soviet writer and journalist) published *Veščˇ*, which was a journal that was specifically meant to bridge the gap between Russian art and Western Culture.[74]

Figure 18

Lissitsky's catalogue cover for "The First Russian Art Exhibition" [Erste Russische Kunstausstellung]

Illustration by El Lissitsky, 1922

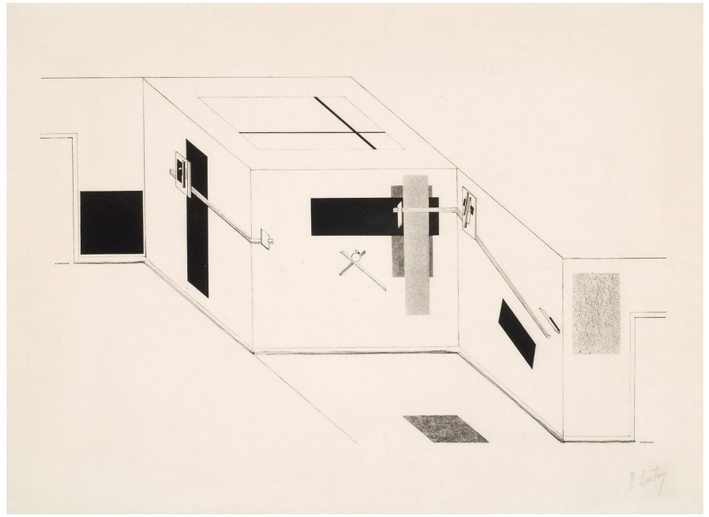


Figure 19

Lissitsky's axonometric projection of the Proun Room Installed at the Greater Berlin Art Exhibition

Lithograph by El Lissitsky, 1923

During Lissitsky's stay in Germany, he also designed the catalogue cover of The First Russian Art Exhibition in Berlin in 1922 (Figure 18), which had 700 works by 167 different artists.[75] Soon after, Lissitsky's famous proun Room (Figure 19) was displayed in the 1923 Great Berlin Art Exhibition. This room is Suprematist in itself, not a room supporting Suprematist symbols – and Malevich had proposed the idea of a Suprematist space.[76] The room was not only Suprematist, but also embraced Russian Constructivism.[77] Lissitsky produced many works abroad or for international audiences, and so his Soviet ideals were shared and disseminated in the West.

Around the same time, in 1925, another Russian architect, Konstantin Melnikov, made his international debut with the display of his Soviet Pavilion in Paris. This exposition promised a show of Modernist[78] movement European architecture, and many new radical artists were invited to participate. Melnikov's pavilion became known as a Constructivist structure, even though Melnikov did not consider it Constructivist.[79] This is partially because the Soviet official who was the guide to the exhibit greatly encouraged a Constructivist view of Melnikov's approach.[80] However it is important to note that Melnikov did not align himself with any Russian art style group. Frederick Starr, the author of *Melnikov: Solo Architect in a Mass Society*, had the privilege of interviewing Melnikov. When analysing how Melnikov was perceived by the public based on his final design, Starr notes that Melnikov described his work as neither Constructivist nor Rationalist.

In any case, while the pavilion was both loved and hated by many alike, it drew a lot of attention and exposed the West to Melnikov and to Russian architecture as intended. Melnikov was granted the highest award by the French judging panel, and he received praise from many of Europe's leading architects of the time, including but not limited to Le Corbusier, Josef Hoffman (director of the Vienna School of Art), and August Perret (pioneer of reinforced concrete).[81]

Yet another example of interaction between Russia and the West was that of Vasilii Kandinskii (1866-1944). Kandinskii was a Russian painter and sculptor who had studied art in Munich and remained there until the first World War, at which point he returned to the Soviet Union, participating in the art culture there, including forming the art organizations INKhUK[82] in May of 1920[83] and RaKhN[84] in October of 1921.

75. Bokov, *Avant-Garde as Method*, 57.

76. Nancy Lynn Perloff and Brian M. Reed, eds., *Situating El Lissitzky: Vitebsk, Berlin, Moscow*, Issues & Debates (Los Angeles, CA: Getty Research Institute, 2003), 50.

77. Perloff and Reed, 54.

78. Refer to the first paragraph of section 1.3.1 for a discussion on the term "Modern" and the differences between the uses of the term.

79. S. Frederick Starr, *Melnikov: Solo Architect in a Mass Society* (Princeton, N.J: Princeton Univ. Press, 1978), 88.

80. Starr, 88.

81. Starr, 102.

82. INKhUK: an acronym for the Institute of Artistic Culture, an organisation founded by Kandinskii which sought to redefine art methods through a theoretical and research based approach.

83. The organization was active from 1920-1924, and Alexander Rodchenko took over as head after Kandinskii left in 1921.

84. RAKhN: an acronym for the Russian Academy of Artistic Sciences, an organization founded by Kandinskii and Alexander Gabrichesvskii. The organization was active from 1921-1930, but in 1925, was renamed to GAKhN, an acronym for the State Academy of Arts.

During this period of time, Kandinskii continued to keep in contact with Walter Gropius and kept Gropius informed of his academic pursuits. With this in mind, it is very likely that Kandinskii was inspired by Bauhaus principles when forming INKhUK.[85] In 1921, Kandinskii left INKhUK to Berlin to set up another division of RaKhN, and in then in the summer of 1922 he began to teach at the Bauhaus, with the longest teaching period of nine years in Germany. At the Bauhaus, as the school started moving towards an industrial laboratory style of teaching, Kandinskii and several other professors such as Paul Klee (a Swiss-German painter) and Theodore Lukas Feininger (a German-American painter more commonly known by his alias T. Lux Feininger) remained at the school to try to provide a counterbalance to the Western rationalist thinking that was saturating the school.[86] During Kandinskii's time at the school, he was appointed as a Master of Form and he took over the mural painting workshop. He also taught the basic design course with a mandatory seminar on colour. As a man well versed in theory along with his other qualifications, it is not surprising that Gropius would invite him to teach. Kandinskii is the artist credited with the first non-figurative composition in art, and his 1911 essay "Concerning the Spiritual in Art" was venerated as a theoretical piece.[87] He believed that different kinds of art would come together in the future to create a unified synthesis. Similar to Lissitsky, Kandinskii attempted to find explanations for the subjective: in his case he attempted to find universal laws to explain the feelings behind colours and sounds.[88] In essence, Kandinskii was aiming to create a visual language that he hoped would convey feelings in a clearer manner than a verbal one.[89]

All of these interests and collaborations between artists and architects alike meant that the West and Russia had many interactions and exchange of ideas. However, whether the Russian ideas were understood with Russian traditions in mind rather than being absorbed into a Western cultural philosophy by its Western audience is a different conversation. I will address this next.

85. Whitford, *Bauhaus*, 95.

86. Whitford, 136–50.

87. Whitford, 95.

88. Whitford, 110.

89. Whitford, 111.

1.4 The West's Failure to Understand Russian Architecture

The Russian movement was brought to the attention of the West during the 1920s due to artistic collaborations with artists and artistic organizations in Germany and France, but the West looked no further than they needed to in order to find and bring out any surface similarities.[90] This has led to decreased investigations into the unique thought processes behind Russian architecture, which can be traced from a 19th century intellectual movement called Slavophilism (see chapter 2). Slavophiles believed that Russia should follow its own path forged through its own character rather than follow Europe as a model for its development. Slavophilism was a movement based on the Orthodox faith, and its followers believed that Russia would be able to re-introduce spiritual values to the West, thereby re-teaching the West how to embrace community over individualism and embrace faith and intuition rather than only rationalization.[91]

As the Enlightenment took over the West, on a large-scale Russia rejected its ideals in favour of the Russian mystical philosophy that encouraged intuition, creativity, and the connection to the spiritual.[92] This mystical philosophical culture can be seen in many disciplines such as arts, sciences, maths, philosophy, architecture, and others.[93] One might even say that Russia benefited from the fact that the Enlightenment did not reach there widely, as Russian academic circles included both rational and nonrational logic when theorising in different disciplines.

With this background in mind, we can discuss the issue: In Europe, because many of the ideas of the Russian avant-garde architects were seen through Western ideals, they were seen as reworkings of Western theories, rather than with understanding of the significant cultural impressions of Russian philosophical culture on Russian architecture.[94] Most European architects from the time failed to account for the research of the social and intellectual Russian history and the political minefield that Russian architects had to navigate post the 1917 October Revolution.[95] This dynamic is still seen today.

The following is an example of how Western architects may "misinterpret" the nuances behind Russian architecture due to lack of knowledge about Russian cultural context. To demonstrate, think of the term Rationalism as it is usually applied in

90. S. Frederick Starr, "Writings from the 1960s on the Modern Movement in Russia," *Journal of the Society of Architectural Historians* 30, no. 2 (May 1, 1971): 170–78, https://doi.org/10.2307/988633; English, "Arkhitektura I Mnimosti," 3,4,7.

91. Peter K. Christoff, *An Introduction to Nineteenth-Century Russian Slavophilism : A Study in Ideas*, Slavistic Printings and Reprintings 23 ('s-Gravenhage: Mouton & Co, 1961), 38,39; M. Bischof, "Vernadsky's Noosphere and Slavophile Sobornost'," in *Biophotonics and Coherent Systems in Biology* (Boston, MA: Springer US, 2005), 285, 286, https://doi.org/10.1007/978-0-387-28417-0_20; George Bosworth Burch, "The Philosophy of P. D. Ouspensky," *The Review of Metaphysics* 2, no. 2 (1951): 135–37, http://www.jstor.org/stable/20123259; English, "Arkhitektura I Mnimosti," 71,72.

92. English, "Arkhitektura I Mnimosti," 2.

93. English, 5.

94. English, 1–9.

95. Starr, "Writings from the 1960s," 171.

architecture. The first thought for most people with a background in architecture is that of Italian Rationalism from the 1920s and 1930s which was born from Enlightenment ideals. Diving into the nuances of different architecture styles, Russian Constructivism was more comparable to the style that most associate with Western Rationalism.[96]

The Rationalist style that was heavily developed in Italy during the 1920s and 30s was developed to express efficiency and the rational expression of the social and functional parts of the building and grappled with the techniques and reality of materials available. The Russian Constructivists visually had a similar expression of their architecture. Even though Soviet architects regarded Constructivism primarily as a new method of design,[97] a secondary characteristic was that of approaching architecture through a systematic approach.[98] This is just to make the connection that Western Rationalism and Russian Rationalism are different, and if one Western Rationalism could be compared to Russian *Constructivism*, Russian Rationalism, whose underlying goal is to rationalize the world by finding psychological explanations for how people perceive space,[99] is completely different than what someone with a Western architectural background would assume at first glance due to their association with the word "Rationalism."[100] The term "Rationalism" has been associated with other movements, making Russian Rationalism a more complicated topic of study.[101] To make a note of this specific instance, in this thesis, it is important to note that my use of the term Rationalism refers to the Russian Rationalism, and not the Rationalism that is usually thought of in the West. This is just one very broad example of how a misinterpretation from the West takes place when looking at Russian sources, when the Russian culture and history is misinterpreted.

Other misrepresentations of Russian arts place Russian art styles and movements as originating from the West, rather than from their own history. For example, some Russian avant-garde theories were mis-attributed as originated from Cubism and Futurism, which are Western art movements.[102] Especially due to the disinterest of pursuing Rationalism the same way the Western world was (at least on a broad scale) many avant-garde Russian theories originated from Russia's own history rather than Western Rationalism. Without understanding the 19th century intellectual traditions that led into 20th century Russian architectural theory, Russian ideas get misrepresented as originating in the West,[103] due to the Western Russian avant-garde scholars either who did not or

96. Anna Bokov, "Teaching Architecture to the Masses: Vkhutemas and the Pedagogy of Space, 1920-1930," *ProQuest Dissertations and Theses* (Ph.D., United States -- Connecticut, Yale University, 2017), 80, ProQuest Dissertations & Theses Global (2017159181).; Elizabeth C. English, conversation with author, May 24, 2023.

97. Selim O. Khan-Magomedov, *Pioneers of Soviet Architecture: The Search for New Solutions in the 1920s and 1930s*, ed. Catherine Cooke, trans. Alexander Lieven (New York: Rizzoli, 1987), 149; Catherine Cooke, *Russian Avant-Garde: Theories of Art, Architecture, and the City* (London: Academy Editions, 1995), 99.

98. Khan-Magomedov, *Pioneers of Soviet Architecture*, 149.

99. Khan-Magomedov, 106; Bokov, "Teaching Architecture," 93–123; English, "Arkhitektura I Mnimosti," 139–44; Alan Colquhoun, *Modern Architecture*, Oxford History of Art (Oxford ; New York: Oxford University Press, 2002), 122.

100. Bokov, "Teaching Architecture," 28; English, "Arkhitektura I Mnimosti," 70.

101. Bokov, "Teaching Architecture," 28.

102. English, "Arkhitektura I Mnimosti," 3.

103. English, 3.

104. Some scholars *could not* write about intellectual traditions that influenced Russian architectural theory of this time due to censorship and safety of the scholars in question.

105. Gail Harrison Roman and Virginia Carol Hagelstein Marquardt, eds., *The Avant-Garde Frontier: Russia Meets the West, 1910-1930* (Gainesville: University Press of Florida, 1992), 54,55.

106. English, "Arkhitektura I Mnimosti," 1–9.

107. English, 4,8.

108. English, 239.; Elizabeth English, conversation with author, January 22, 2023.

109. Bokov, "Teaching Architecture," 2.

110. English, "Arkhitektura I Mnimosti," 4; Bokov, "Teaching Architecture," 27.

111. English, "Arkhitektura I Mnimosti," 5.

could not[104] look past the surface claim that Russian architectural forms appropriated those of the West.[105]

It is with this lack of understanding of Russian culture that leads the Western academic circle to mis-interpret and mis-attribute Russian avant-garde architectural theories into Western Modernism.[106]

Furthermore, there is the issue of Soviet censorship. The censorship of the press in the Soviet Union removed references to religion, which included removing religious-philosophical texts from libraries. This suppression has made it difficult for even modern Soviet scholars to understand the full picture of the Russian avant-garde, let alone Western scholars who are even farther removed from the language and the culture.[107] This has also contributed to a lack of understanding of the deep and unique cultural thought thinking of Russian avant-garde architects in Western architectural theory.

Additionally,Western interpretations of the Russian point of view are hindered by Russia's complicated political situation, meaning Western scholars who are used to being able to accept the written word at face value miss that in Soviet Russia particularly, many Soviet artists and architects wrote in metaphor to be able to get past censorship.[108]

The combination of the political confrontation between the West and the Soviet Union and the difficult phrasing of Rationalist, Constructivist and other Russian art theories[109] has made it difficult to understand Russian writings about art and architectural theory during the avant-garde era. The self-censorship of the works adds further challenge to placing the theories within their proper context in Western academia.[110]

When looking at Russian architecture, it is important to also look at other disciplines, as Russian tradition permeated all disciplines.[111] By looking at other arts disciplines, we can start to bring that knowledge into architecture as well. It is essential to acknowledge the importance of Slavophile ideas, and not only Western Rationalist ideas.

I believe that looking at visionary architecture of the Russian avant-garde will be a useful endeavor for continuing to expand the knowledge of early 20th century Russian architecture within the Western worldview, due to visionary architecture's ability to capture aspirations of a culture at the time it was imagined.

1.5 Summary

Visionary architecture as a theoretical framework is an effective tool for exploring the beliefs and history of a culture. The Enlightenment is a period of time that has left many influences in Western academic culture, whereas Russian traditions have continued along a separate path. While Russia shared its projects and visions with the West, Russian ideas were not well understood and the Russian-centric meanings were lost, as in contrast, the European Modernist ideas were developed from the intellectual context of the Enlightenment period. Meanwhile, visionary architecture as shown in this chapter, can be used as a tool to explore biases and thoughts present in a given historical context. With the understanding gained in this chapter about how visionary architecture can be used for analysis, and the discussion of the Russian philosophical culture that was then embedded into 1920s Russian architectural theory, the next chapter will serve as further insight to the “Russian traditions” that were introduced in this chapter.

Introduction

Visionary Architecture and the Visions of the Modern Movement

2 The Emergence of Cosmos and Geometry in the Russian Avant-garde

The Cosmos and Geometry as seen in Russian Visionary Architecture and Speculative Drawings

Four-Dimensional Geometry as a tool to explore Russian Avant-Garde Visionary Architecture

Conclusion

2.1 Introduction

There are many intellectual traditions that contributed to the influences upon the Russian avant-garde period. From the rise of a spiritual Orthodox culture mixed with the rise of n-dimensional geometry, an understanding of the 19th century intellectual tradition and its effect on the 20th century, the combination of these fields yields a deep and rich background that will help to understand the visionary prospects of architectural figures.

Euclidean geometry had been the only definitive one for over 2000 years. Newton's work[1] was built on that foundation, and his work had significantly influenced people's perspectives during the age of the Enlightenment to the extent that it formed the basis of the concept of "reason" during this time.[2] This meant that when Nikolai Lobachevskii proved that Euclidean geometry could not be proved, this new development in geometry caught the interest of many disciplines besides mathematics. From science fiction writers like H.G. Wells to architects like American architect Claude Bragdon and Russian architect El Lissitsky who incorporated hyperspace philosophy into their work, four-dimensional philosophy was a popular subject of interest in the early 1900s. In philosophy, philosophers such as Nikolai Fedorov and Petr Uspenskii introduced cosmic mystical philosophies that influenced the work of many Russian avant-garde artists and architects.

Around the same time that Lobachevskii was pursuing mathematics, the early 1800s saw rise to a Russian cultural movement – the Slavophile movement. Around the 1830s, Aleksei Khomiakov and Ivan Kireevskii, two of the main originators of this movement, proposed a Russian solution to Russia's social issues, one that utilized Russia's unique heritage and Orthodox Christian values. In opposition to this were the "Westernizers" a group that wanted to steer Russia into following its Western neighbours.

The Slavophile movement paved the way for Nikolai Fedorov (see section 2.3.2), who influenced many Russian thinkers and whose ideas were the basis of the Cosmist movement.[3]

Overall, due to the influences of the early 19th century, the Russian avant-garde had a unique cultural heritage to draw from, mostly untouched by Enlightenment values, giving us a new topic of study. It is essential to understand the cultural background of Russian history to understand the artistic and philosophical disciplines of Russia and thus its architecture, and the second chapter aims to serve as that introduction.

1. Newton's work, particularly his *Principia* was highly influential and a turning point in physics and geometry. The Principia refers to Newton's *Philosophiæ Naturalis Principia Mathematica*, or "The Mathematical Principles of Natural Philosophy," wherein Newton wrote about his theories of the law of motion and his theory on gravitational forces.

2. Judith V. Grabiner, "The Centrality of Mathematics in the History of Western Thought," *Mathematics Magazine* 61, no. 4 (1988): 221, https://doi.org/10.2307/2689357; Linda Walsh and Tony Lentin, *The Enlightenment*, vol. The Enlightenment, History and The Arts (The Open University), accessed November 28, 2022, https://www.open.edu/openlearn/history-the-arts/history-art/the-enlightenment/content-section-0?intro=1.

3. George M. Young, *The Russian Cosmists: The Esoteric Futurism of Nikolai Fedorov and His Followers* (Oxford ; New York: Oxford University Press, 2012). This book describes the Russian philosophical context to Fedorov's ideas, which held many tenets of the Slavophile movement, before discussing his Philosophy of the Common Task and how Fedorov's ideas influenced Cosmist thinkers. Overall, this account gives a comprehensive review of Fedorov's influence within Russia's mystical philosophical intellectual culture; Bruce Lerro, "The Slavophile Russian Cosmists," *Dissident Voice [BLOG]* (blog) (Santa Rosa: Newstex, January 20, 2023), 2767185078, Politics Collection, http://search.proquest.com.proxy.lib.uwaterloo.ca/blogs-podcasts-websites/slavophile-russian-cosmists/docview/2767185078/se-2?accountid=14906.

2.2 Nikolai Lobachevskii and his Influences

2.2.1 Lobachevskii and Non-Euclidean Geometry

Nikolai Lobachevskii (1792-1856) was a mathematician who had proved that Euclid's fifth postulate could not be proved. Lobachevskii's work was influential in not only mathematics, but other disciplines as well, and thus a lot of theories from different disciplines can be traced back to this discovery, architecture included. The law states that if two straight lines on the same plane have an angle of less than 180° between them, they will eventually meet. Up until Lobachevskii's discovery, for 2000 years, Euclidean geometry was the only geometry known and mathematicians attempted to prove it for centuries. Mathematicians had been unsatisfied with this postulate for centuries, as the postulate was too complicated and seemed like it should be provable as a theorem.[4] Even Euclid himself seemed to have avoided using it when possible.[5]

While there were several mathematicians working on this problem independently of each other, Lobachevskii published his results first in 1829, ahead of Janos Bolyai and Karl Gauss. Lobachevskii finally found a geometry that would allow more than one line to be drawn (an infinite number of lines in fact!) without intersecting the original. Unfortunately, Lobachevskii's discoveries were unsupported by the mathematical community during his time, with Gauss being one of the few people to support Lobachevskii.[6]

At small scales, such as the human scale, the differences between Euclidean and non-Euclidean geometry are hard to distinguish. Therefore, in an attempt to lay down a physical basis for his geometry, Lobachevskii attempted to measure the parallax of stars to try to find a physical example of non-Euclidean curvature, as at astronomical sizes he would be more likely to find a difference and hence prove the existence of a non-Euclidean geometry.[7] Lobachevskii concluded that that nobody could definitively determine the geometry of nature due to the precision of the measurement of stellar parallaxes necessary to be able to prove or disprove either Euclidean or Lobachevskii geometry.[8]

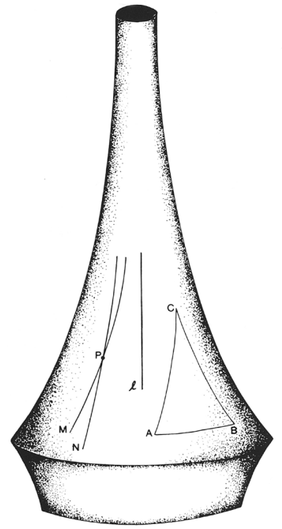
Lobachevskii persevered however he called his new geometry "imaginary", and it was internally consistent despite being different from Euclidean geometry. He called it "imaginary" as he

4. Leonard Mlodinow, *Euclid's Window: The Story of Geometry from Parallel Lines to Hyperspace*, 1st Touchstone ed (New York: Simon & Schuster, 2002), 37.
5. Mlodinow, 37.
6. Mlodinow, 118,119.
7. "Nikolai Ivanovich Lobachevsky," Encyclopedia, accessed November 21, 2023, https://www.encyclopedia.com/people/science-and-technology/mathematics-biographies/nikolai-ivanovich-lobachevsky; Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton, N.J: Princeton University Press, 1983), 13,14.
8. V. N. Berestovskii, "Lobachevsky Geometry and Stellar Parallaxes," *Siberian Mathematical Journal* 63, no. 5 (September 2022): 841, https://doi.org/10.1134/S0037446622050032; V. Ya. Perminov, "The Philosophical and Methodological Thought of N. I. Lobachevsky," *Philosophia Mathematica* 5, no. 1 (February 1, 1997): 12, https://doi.org/10.1093/philmat/5.1.3.

9. N. I. Lobachevskiĭ and Athanase Papadopoulos, *Pangeometry*, Heritage of European Mathematics (Zürich, Switzerland: European Mathematical Society, 2010), 229; Lynn Gamwell, *Exploring the Invisible: Art, Science, and the Spiritual*, Revised and expanded edition (Princeton, New Jersey: Princeton University Press, 2020), 281; Berestovskii, "Lobachevsky Geometry and Stellar Parallaxes," 841.
10. Henderson, *The Fourth Dimension*, 1983, 4.
11. Elizabeth C. English, "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition" (University of Pennsylvania, 2000), 18.

thought it was a geometry that could only exist in the imagination and not in nature.[9] However, not long after in 1868, an Italian mathematician by the name of Eugenio Beltrami picked up Lobachevskii's work and brought his research out of the realm of the "imaginary" and into a tangible reality. Beltrami did this by discovering a surface that matched that of Lobachevskii's geometry. He developed a model called the "pseudosphere" to showcase this concept: shown in Figures 20 and 21. The introduction of this model sparked a renewed interest in non-Euclidean geometry within the field of mathematics.[10]

Eventually, the resurgence in the interest of mathematics inspired by Lobachevskii's work led to further mathematical discoveries such as complex numbers, vector theory, and Albert Einstein's theory of relativity. Lobachevskii was a great influence for many other thinkers in various disciplines, from mathematics and physics to philosophy and architecture.[11]



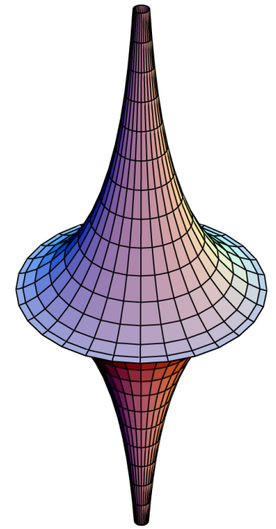


Figure 20 (left)

Beltrami's Pseudosphere for the Lobachevsky-Bolyai Geometry
Illustration by Eugenio Beltrami

Figure 21 (right)

A modern digital model of a pseudosphere (an inverted sphere), where the geometry extends infinitely in both directions and has a constant negative curvature (except for the transition between the two sides).

Model by Eric Weisstein, from a Wolfram web resource

2.2.1.1 Lobachevskii's Disproof of Kant

Immanuel Kant (1724-1804) had offered up geometry and mathematics as part of his philosophies. As Henderson wrote in her book on geometry in Modern Art, "For Kant, 'geometry' meant Euclidean geometry, the only geometry known for two thousand years. And in Kant's transcendental idealism, 'space' was Euclidean space, possessing of necessity three dimensions."[12] Ever since Kant was young, he had been interested in "space" as a concept.[13]

12. Henderson, *The Fourth Dimension*, 1983, 12.
13. B. A. Rozenfel'd, *A History of Non-Euclidean Geometry: Evolution of the Concept of a Geometric Space*, trans. Abe Shenitzer, Studies in the History of Mathematics and Physical Sciences 12 (New York: Springer-Verlag, 1988), 179.

Lobachevskii was the dean of the Faculty of Physical and Mathematical Sciences at Kazan University in Russia at the same time that the university was put under severe scrutiny by the chief Architect of the Ministry of Religious Affairs and National Education. He expressed disappointment regarding the university's instruction of Kant's philosophies, fearing that it would counter Christian theology.[14] It was not uncommon in the early twentieth century that challenging Euclidean geometry was tied to rejecting tradition.[15]

Lobachevskii was one of those figures who rejected Kant's conception of space as reality's truth, and if he had not done so, he could not have explored non-Euclidean geometry, as Kant's philosophy held up Euclidean geometry as a fundamental truth. Lobachevskii's philosophical background enabled him to investigate and develop a geometry unsupported by Kantianism.[16] And so, Lobachevskii came up with imaginary geometry (as explained in section 2.2.1), and then later expanded upon this concept to come up with "pangeometry." Both imaginary geometry and Euclidean geometry were each their own subtypes within the overarching geometry of pangeometry.[17] Lobachevskii felt compelled to contemplate the scientific and philosophical foundation of his new geometry, which he did, claiming that space was an a posteriori concept[18], and that the concept of motion is what drives geometrical concepts as without motion space could not be conceived.[19]

Alexander Vucinich, a professor who studied the history of Russian Science and introduced many Russian academic contributions to the West, wrote, "Lobachevskii was in command of an epistemological argument which enabled him to assert that there were no inner contradictions in the claim 'that certain forces in nature follow one geometry and others their own unique geometries.'...to Lobachevskii, geometry and all its categories had to have a basis in the external world"[20] Lobachevskii's main interest and goal was in establishing scientific truth.

2.2.3 Vladimir Shukhov

Vladimir Shukhov (1853-1939) was primarily an engineer who was influenced by Lobachevskii's work, and in turn, influenced many of the architects of the Russian avant-garde as well as participating in direct collaborations. With his developed mathematical structural theory, he was a distinguished engineer and participated in the design of many projects. Some of the designs that Shukhov is most known for include his hyperboloid lattice structures in the designs

14. Alexander Vucinich, "Nikolai Ivanovich Lobachevskii: The Man behind the First Non-Euclidean Geometry," *Isis* 53, no. 4 (December 1962): 474, https://doi.org/10.1086/349633; Ian Stewart, *Significant Figures: The Lives and Work of Great Mathematicians* (New York: Basic Books, 2017), 112–14, https://ebookcentral.proquest.com.
15. Henderson, *The Fourth Dimension*, 1983, 17.
16. Perminov, "Philosophical and Methodological Thought," 10–16; "Lobachevsky's Contribution to Philosophy," *Nature (London)* 179, no. 4571 (1957): 1176, https://doi.org/10.1038/1791176b0.
17. English, "Arkhitektura I Mnimosti," 18; Lobachevskiĭ and Papadopoulos, *Pangeometry*, 230.
18. In Kant's philosophy, an *a priori* concept is one that exists due to the condition of having a mind, while an *a posteriori* concept is one derived from experience.
19. Vucinich, "Nikolai Ivanovich Lobachevskii," 475.
20. Vucinich, 475,476, quoted in N.I. Lobachevskii. *Polnoe sobranie sochinenii* [*Complete Works*], Vol. 2 (Moscow-Leningrad, 1949), p. 159.

21. Selim O. Khan-Magomedov, *Pioneers of Soviet Architecture: The Search for New Solutions in the 1920s and 1930s*, ed. Catherine Cooke, trans. Alexander Lieven (New York: Rizzoli, 1987), 20.
22. English, "Arkhitektura I Mnimosti," 20.
23. Elizaveta Edemskaya and Asterios Agkathidis, "Rethinking Complexity: Vladimir Shukhov's Steel Lattice Structures," *Journal of the International Association for Shell and Spatial Structures* 57, no. 3 (September 30, 2016): 4, https://doi.org/10.20898/j.iass.2016.189.806.
24. English, "Arkhitektura I Mnimosti," 25.
25. English, 26.
26. English, 29.
27. English, 29.
28. Rainer Graefe, M Gappoeva, and O Perchi, *V. G. Shukhov: 1853 - 1939 ; Iskusstvo Konstrukcii* (Moscow: Izdat. Mir, 1994), https://djvu.online/file/w0CZ2xoK3Txqc., quoted in English, "Arkhitektura I Mnimosti" 29, 219.
29. Selim O. Khan-Magomedov, *Konstantin Mel'nikov*, Mastera Arkhitektury (Moskva: Stroĭizdat, 1990). 25, 88, 146, 179, quoted in English, Elizabeth C. "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition." University of Pennsylvania, 2000. 219.

of his famous towers and doubly curved roofs.[21] His hyperboloid structures were derived from Lobachevskii's work, resulting in complex forms such as his diagrid lattice towers.[22] Another notable structure derived from hyperbolic geometry was the light, efficient barrel vault roof construction system for Moscow's upper trading rows, today known as the GUM (state department store). He also designed many beautifully engineered skylights.

In his work, Shukhov invented a structural system for a lattice water tower that was inexpensive and could be assembled fairly quickly, based on a formula that would define proportional relationships between elements[23] by taking the form of a non-Euclidean hyperbolic paraboloid (see Figure 22).[24] Shukhov received a patent for this invention in 1899. The hyperbolic shape of the tower was based directly on Lobachevskii's work on imaginary hyperboloid geometry, hence it's similarity in looks to Beltrami's pseudosphere.[25] Shukhov spent years in the early 20th century experimenting with forming towers using his hyperboloid structures. Eventually, in 1918 he designed a radio transmission tower to be built in Moscow. At 350 m, this tower would have been taller than the Eiffel Tower and at least 25% lighter. Unfortunately, due to a lack of materials, the 2200 tons of steel necessary was not available and it was built only to a height of 130 m. (see Figure 23) This smaller than designed tower was completed in March, 1922.

With this in mind, Shukhov likely influenced many of the architects of the avant-garde, such as Vladimir Tatlin and his Monument to the Third International. This connection is made by English, who recognized that the proposed height for Tatlin's Monument to the Third International would not have been a baseless design choice if Tatlin had been aware of Shukhov's design for the 350m tall Shabolovka Radio Transmission Tower, which is a distinct possibility due to their visual resemblances.[26] Furthermore, English established that the design for Tatlin's tower was made after Shukhov's initial designs for the Shabolovka tower, and that there is a strong possibility that Tatlin was aware of Shukhov's work.[27]

Another notable architect that Shukhov collaborated with was Konstantin Melnikov. Shukhov was the engineer for two of Melnikov's garages[28] and Melnikov had also written about his appreciation for Shukhov's work and Shukhov himself.[29] An esteemed engineer, Shukhov's work was part of the intense circulation of math and technology that was popular in the 1920s.

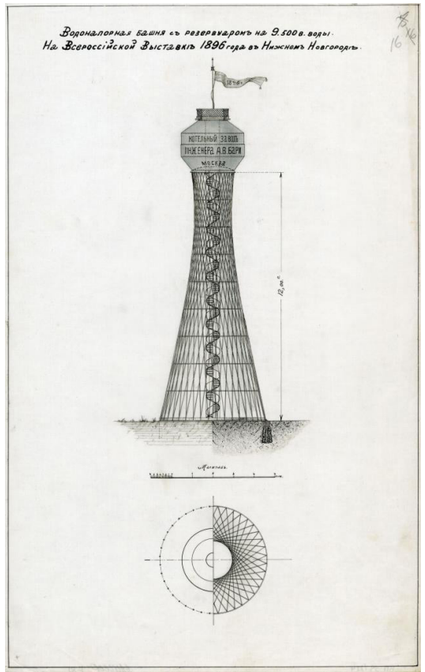


Figure 22

The Shukhov hyperboloid water tower as drawn on the patent application

Drawing by Vladimir Shukhov, 1896

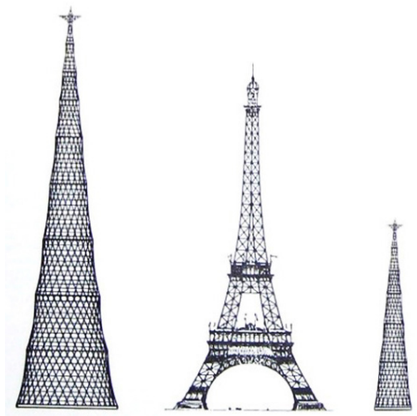


Figure 23

The Shabolovka Radio Tower in Moscow as designed (left) and as built (right) compared with the Eiffel Tower (middle)

Collage by Elizabeth C. English, 2000

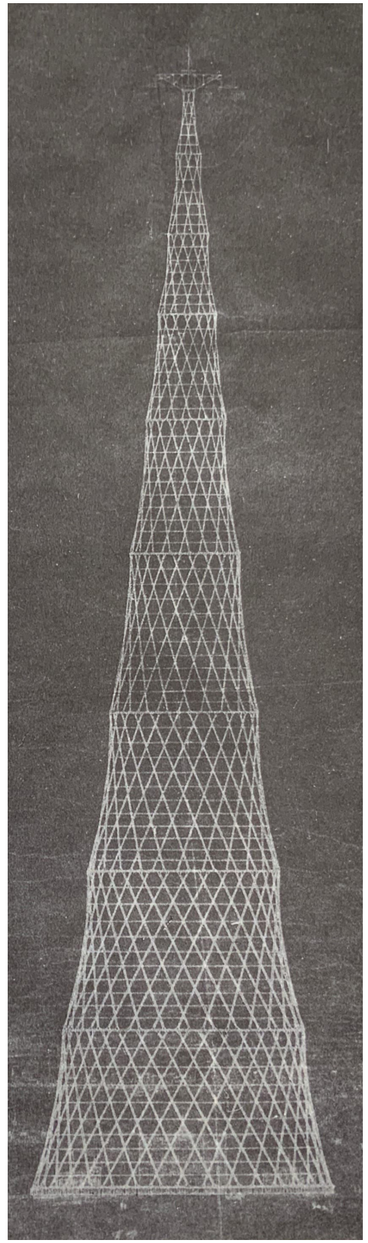


Figure 24

Shukhov's hyperboloid radio transmission tower at it's designed height of 350m

Drawing by Vladimir Shukhov, 1919

2.3 Slavophilism and the Cosmos

2.3.1 Russian Philosophy and the Rise of Slavophilism

Merging math and science with theology and art was a distinguishing feature of 19th century Russian philosophy.[30] During this century, those who shared nonconforming views were suppressed, including Pavel Florenskii (a genius in many disciplines) – whereas there were others, such as Tsiolkovskii (a rocket scientist) who was well known despite his nonconforming views in the eye of the government. This is because such figures were "allowed" to be well known and revered in their disciplines, as long as their actual work did not reject the status quo.[31]

In the early 1800s, the Russian cultural climate opened up to Western philosophy, particularly German philosophy. The emphasis on philosophy and religion was primarily because at this point the dominant German intellectual circles were focusing on these topics.[32] Solving social questions, too, was a philosophical enterprise descended from the German circle of thought.[33] Men in the 1830s and 40s sought to solve Russia's social problems with this background and one group following this frame of mind was the Westernizers. They believed that Russia needed to catch up to the West in all regards, from the cultural to the technological.

While there were plenty of Western solutions in Russia, one of the founders of Slavophilism, Aleksei Khomiakov (1804-1860), joined others from that school of thought in proposing a Slavophile solution to Russia's social issues –one that found strength in Russia's unique heritage.[34] Several Slavophiles in the 1830s expressed the thought that while the time of the West was a bright endeavour that produced many great works, its time was over and it was time for Russia to succeed it.[35] This comparison of the youth of Russia taking over the dying west was prevalent throughout the 19th century. With the West dissolving into a perceived dreadful individualism, Russia's prior isolation was a virtue and Russia could now rise to unify the world.

Khomiakov believed that at the end of history, mankind will be reunited again through the Russian Church. By the 1840s, Khomiakov was able to expand on the principles of Sobornost' and Communality.[36] Sobornost' comes from the Russian word sobrat', which means to gather or unite. To Khomiakov, it was this charac-

30. English, "Arkhitektura I Mnimosti," 70,71.

31. Bruce Lerro, "The Slavophile Russian Cosmists," *Dissident Voice [BLOG]* (blog) (Santa Rosa: Newstex, January 20, 2023), 2767185078, Politics Collection.

32. Peter K. Christoff, *An Introduction to Nineteenth-Century Russian Slavophilism : A Study in Ideas*, Slavistic Printings and Reprintings 23 ('s-Gravenhage: Mouton & Co, 1961), 44.

33. Christoff, *An Introduction*.

34. Christoff.

35. Christoff. 38-39.

36. Christoff, 95.

teristic of sobornost' which differentiated Orthodox Christianity from Western "religious rationalism:" against Catholicism due to its "postulate of obedience to external authority" and Protestantism due to its encouragement of individualism.[37] The state of sobornost' is one of an energy field that connects everyone in an experience of communion, where experience and knowledge are shared.[38] The idea of sobornost' was based on the idea that freedom, faith, love and community were the foundation for personhood, and with these values one can become closer to a universal spiritual union, and the Russian church, according to Khomiakov, was the ideal community for this concept of the sobor.[39]

Ivan Kireevskii (1806-1856), also credited as a co-founder of the Slavophile movement along with Khomiakov, was a proponent in the concept of "integral knowledge." To Kireevskii, faith was man's highest cognitive faculty – faith should be reasonable.[40] This concept of integral knowledge came from merging the concept of reason with the teaching of faith, as it is through the integration of faith and reason that reality can be understood.[41] Both Kireevskii and Khomiakov were opposed to blind faith and religious zealotry.[42] To both men, it was love and being able to unite through the mystical that was more important than rationalistic intellect; faith was not the opposite of reason, but its guiding force.

When it came to unifying the people of the world, the reason the Slavophiles believed it was possible and that Russia was the correct place for it is that the opportunity was available in Russia through the Orthodox Church and the Russian sobor.[43] When opposing the West, Slavophiles mostly wanted to make it clear that this avenue was still open.[44]

With the precedent set by the Slavophiles, it was not unusual for architects and artists to be interested in the concept of death, faith, and resurrection of humanity.[45] One might even say today, just as the Slavophiles had, that Russia's unique path had actually been a blessing as it saved them from the rationalistic and formalistic West.[46] The work of the Slavophiles paved the way for figures like Nikolai Fedorov, a Christian philosopher who built upon the basic principles from the Slavophile positions outlined by Khomiakov and Kireevskii.

37. M. Bischof, "Vernadsky's Noosphere and Slavophile Sobornost'," in *Biophotonics and Coherent Systems in Biology* (Boston, MA: Springer US, 2005), 286, https://doi.org/10.1007/978-0-387-28417-0_20.

38. Bischof, 286.

39. Randall A. Poole, "Slavophilism and the Origins of Russian Religious Philosophy," in *The Oxford Handbook of Russian Religious Thought*, by Randall A. Poole, ed. Caryl Emerson, George Pattison, and Randall A. Poole (Oxford University Press, 2020), 136,146, https://doi.org/10.1093/oxfordhb/9780198796442.013.8.

40. Poole, 139.

41. Irina Shmerlina, "Slavophile Philosophy and the Subjective School in Sociology: An Experience of Comparative Analysis," *Sociological Journal* 29, no. 2 (June 29, 2023): 78, https://doi.org/10.19181/socjour.2023.29.2.4; Poole, "Slavophilism and the Origins of Russian Religious Philosophy," 133.

42. Poole, "Slavophilism and the Origins of Russian Religious Philosophy," 139.

43. George M. Young, *Nikolai F. Fedorov, an Introduction* (Belmont, Mass: Nordland Pub. Co, 1979), 173.

44. Young, 173.

45. S. Frederick Starr, *Melnikov: Solo Architect in a Mass Society* (Princeton, N.J: Princeton Univ. Press, 1978), 240–58.

46. Poole, "Slavophilism and the Origins of Russian Religious Philosophy," 135.

47. Young, *The Russian Cosmists*, 23.

48. V. V. (Vasiliĭ Vasilevich) Zenkovskiĭ and George L. (George Louis) Kline, *A History of Russian Philosophy* (London: Routledge and Paul, 1953).

49. Young, *The Russian Cosmists*, 103.

50. Young, *Nikolai F. Fedorov*. 13.

51. Ludmilla Koehler, *N.F. Fedorov : The Philosophy of Action*, ed. Douglas Radcliff-Umstead, Carla Lucente, and Richard Yang (Pittsburgh, Pennsylvania: Institute for the Human Sciences, 1979), 81.

52. James Patrick Scanlan, ed., *Russian Thought after Communism: The Recovery of a Philosophical Heritage* (Armonk (N.Y.) London: M. E. Sharpe, 1994), 67.

53. Young, *Nikolai F. Fedorov*, 137–39.

2.3.2 Nikolai Fedorov's Philosophy

Nikolai Fedorov (1829-1903) was a religious critical philosopher, whose ideas merged philosophy, Orthodox spirituality, and science. Fedorov took an active approach towards fulfilling his God's doctrine. He merged Western technological advances with Slavophile goals such as communal wholeness.[47] Fedorov believed that philosophy, beyond being understood, must be practiced: rather than just sitting back and thinking, one should take action.[48] Fedorov's system relied on the fact that Christ had already redeemed mankind. In Fedorov's Orthodox Christian belief, Christ had started the resurrection by showing humanity what needs to happen, but it is up to humanity to figure out how, hence evolving science by applying faith.[49]

The Philosophy of the Common Task, a book published posthumously by Fedorov's followers, contained the main idea of bringing back the dead.[50] This would of course overpopulate the Earth, as it means we would have harnessed the knowledge found in science to resurrect all those who have already died by harnessing their original particles. This endeavour would lead to the overpopulation of the earth and thus require space to place all the people. Fedorov's solution was to colonise outer space. Fedorov himself had always talked about how mankind needs to guide itself on the spaceship of Earth.[51] The project of making a spaceship out of the Earth would, according to Fedorov, consist of placing a special cone on the Earth which would harness the Earth's electromagnetic field. By harnessing the Earth's electromagnetic field, humanity would be able to steer the Earth through outer space like a rocket for the purpose of searching for particles of those who had already died.[52]

Fedorov took the Slavophile idea of the qualities of Russia and applied them to his Philosophy of the Common Task. To Fedorov, it was exactly the "backwardness" of Russia that would allow it to be such a great leader for his Universal Project, as Russia was storing up spiritual energy while other countries were advancing without thought and wasting theirs. The qualities that Russia has retained, those of communal living, kinship, and state service among others, were actually, in his mind, Russia's strength in becoming the leader of universal salvation.[53]

To Fedorov, science and faith had to go hand in hand: the knowledge that comes from faith is more advanced than current science, but they are both not enough on their own. George Young, a professor at the University of New England who studies Fedorov

and Russian Cosmism, wrote about Fedorov's philosophy; "When faith and science both become fully active, rather than passive, ways of knowing, the differences between the two will disappear, and science will discover the truth that faith has already told us. Faith alone is not enough, just as science is not enough."[54] This excerpt explains Fedorov's religious way of viewing the world, which provided a broader outlook as it allowed an understanding of the world beyond just what can be observed.

To be clear, Fedorov did not confuse the two, he did not search for God with science, and he did not prove scientific discoveries through religion, but both religion and science were very real and very true. Fedorov's ideas throughout his time were greatly suppressed: his name could not be mentioned in any printed materials, and there was a huge fear surrounding the retribution one would experience if possession of his materials were discovered.[55] Despite the lack of written work due to any mention of Fedorov being erased under the rule of Stalin in the 1920s[56], it would be an injustice to deny the influence Fedorov had on many of his followers within different disciplines.[57] Be that as it may, famous figures such as Fedor Dostoevskii, Vladimir Soloviev and Konstantin Tsiolkovskii were all figures who were impressed by his work.[58]

54. Young, 99.

55. Young, 196.

56. Scanlan, *Russian Thought after Communism*, 26.

57. English, "Arkhitektura I Mnimosti," 129–32.

58. Eric Naiman, "Gathering Dust," *TLS, the Times Literary Supplement*, no. 5773 (2013): 3.

2.3.3 Russian Cosmism

Cosmism was a cultural and philosophical movement that was based on Slavophile thought and Fedorov's Philosophy of the Common Task. Cosmism mostly consisted of the following characteristics: that of immortality, breaking through the barriers of human evolution and the cosmos, scientific progress, colonization of the cosmos, and Orthodox Christianity. Cosmism also included a mix of asceticism and some principles taken from Marxism.[59] All of these were present in Fedorov's ideas: immortality given by scientific and faith-based endeavours that would break through the current known natural laws. Many of the Cosmists were masters of several disciplines, with some discipline examples being philosophy, art, theology, and natural science.[60] Consequently, many of their theories seemed plausible due to their respective expertise and knowledge. The Cosmists were overall driven by a very Slavophile sentiment with their anti-Western pro-Russian rhetoric. As Cosmists followed principles of the Slavophile movement and applied Fedorov's ideas within their intellectual practices, Cosmism was banned by Stalin during the Soviet period.

59. Ellen Pearlman, "The Resurgence of Russian Cosmism," *PAJ (Baltimore, Md.)* 41, no. 2 (2019): 86, https://doi.org/10.1162/pajj_a_00475.

60. Young, *The Russian Cosmists*, 5.

The Cosmists can be generally divided into two categories, the Religious Cosmists, and the Scientific Cosmists. With understanding of the mystical philosophical intellectual culture of this time, it is not surprising that many of the figures in the "Russian Religious Renaissance"[61] such as Fedor Dostoevskii (writer and journalist), Lev Tolstoi (writer, religious thinker) and Vladimir Soloviev (religious philosopher) were either outright Cosmists or wrote about subjects that could be traced back to Fedorov's philosophy rooted in Slavophile thought. As for the Scientific Cosmists, there were many scientific figures that are well known, including Konstantin Tsiolkovskii (see section 2.3.4). Tsiolkovskii was a Russian rocket scientist whose work paved the way for decades-away space travel. His ideas re-conceptualized flight beyond the confines of the Earth, and his fiction stories often featured a Russian leader who led his international team on expeditions to explore and colonise the cosmos.[62] While Fedorov is of course a main figure behind the ideas of the Cosmist movement, Tsiolkovskii is also a very well-known figure for his contributions to Cosmism.

All three of the main art and architectural groups of the avant-garde movement in Russia – the Futurists, Constructivists, and the Suprematists – embraced the values of Cosmism into their non-objective art in order to realize their visions.[63] One example of this is the Suprematist style sets and costumes behind the Futurist Opera Victory over the Sun (see section 2.5.2.1).[64] Another reference to the Cosmists' re-imaginings of the world can be found in the 1924 film Aelita, a story that clearly takes inspiration from Fedorov's ideas about space colonisation as it recreates the Bolshevik revolution on Mars.[65] Additionally, Aelita contains a scene featuring a spaceship which closely resembles Tsiolkovskii's first spaceship draft. Mars was a popular waypoint for Cosmists who were imagining a new world.[66]

Cosmism became popular and continued to develop despite being banned (although many Cosmists did not come out unscathed) as its ideals preached a universality that could offer solutions to many problems in different disciplines. The complexity offered by the Russian soul allowed Cosmism to prosper as it was inclusive of all: from a person on Earth to the farthest reaches of space.

61. The Russian Religious Renaissance is a term used to denote the years roughly from 1880-1950 in which there was a resurgence of philosophy and spirituality, based in Orthodoxy.

62. Young, *The Russian Cosmists*, 151.

63. Pearlman, "The Resurgence of Russian Cosmism," 86.

64. English, "Arkhitektura I Mnimosti," 174,175.

65. English, 164.

66. Pearlman, "The Resurgence of Russian Cosmism," 87.

2.3.4 Konstantin Tsiolkovskii

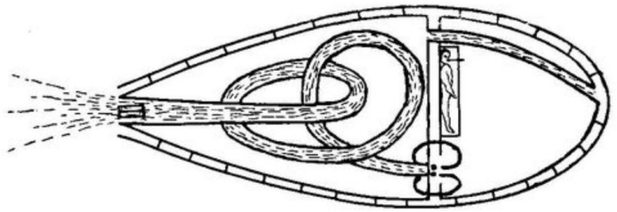


Figure 25
Tsiolkovskii's Scheme of a Rocket
Drawing by Konstantin Tsiolkovskii, 1914

Throughout his life, Konstantin Tsiolkovskii (1857-1935) dreamed of getting to space and his work has led him to be considered the father of Russian rocketry and space travel. Tsiolkovskii was known for his science and stories but due to censorship, he was not allowed to discuss his interest in Fedorov's ideas. When Fedorov worked at the library at the Rumiantsev Museum in Moscow, he liked to help those who caught his interest, as Tsiolkovskii did. Not only did Fedorov save Tsiolkovskii from suicide, but he became his mentor, both spiritual and mathematical.[67] With this relationship we can surmise that Tsiolkovskii appreciated Fedorov's ideas and the influences of Fedorov's worldview in Tsiolkovskii's work is evident.[68] Tsiolkovskii developed rocket propulsion and stated later in life that the problem of communications in outer space had never left his mind.[69]

Tsiolkovskii also took a comprehensive approach to his visions and theories, one of which consisted of recognizing the spirit or feeling of the universe. With Fedorov as his mentor, the Fedorovian influences are clear,[70] with one of his most non-technical writings advocating for the existence of the "atom spirit," referring to Fedorov's idea that the particles of the universe are made up of the deceased.[71] This line of thought brought him to a spiritual discussion of where the living spirit goes after death.

His work laid the foundation for the Soviet Union achievements of getting to space in the 20th century.[72] He published fantastical works that were based on scientific data, he explained how several different concepts might work in outer space, and he calculated many scientific predictions for space travel.[73] He used stories as a way to provide science-based stories for his fantasies, while also using them as a way to explore his philosophy. His work that touched multiple disciplines is what made him both a respected space scientist, science fiction writer, and an icon of the Cosmist movement.[74]

67. Koehler, *N.F. Fedorov : The Philosophy of Action*, 80,81; Stephen Lukashevich, *N. F. Fedorov (1828-1903): A Study in Russian Eupsychian and Utopian Thought* (Newark: University of Delaware Press, 1977), 30.

68. English, "Arkhitektura I Mnimosti," 133; Koehler, *N.F. Fedorov : The Philosophy of Action*, 80.

69. Koehler, *N.F. Fedorov : The Philosophy of Action*, 81.

70. English, "Arkhitektura I Mnimosti," 133; Koehler, *N.F. Fedorov : The Philosophy of Action*, 80,81.

71. Young, *The Russian Cosmists*, 148,149,151.

72. Lerro, "The Slavophile Russian Cosmists."

73. Adam Starchild and Konstantin Tsiolkovsky, *The Science Fiction of Konstantin Tsiolkovsky* (Seattle, Washington: University Press of the Pacific, Inc., 1979).

74. Starchild and Tsiolkovsky.

2.4 The Rise of N-Dimensional Geometry

Right before the popularization of Einstein's theory of relativity, at the beginning of the 1900s, artists and writers were interested in the impact of the fourth dimension. From Kant's writings in the 18th century, the concept of multidimensional space really began gaining traction in the second half of the 19th and its discussion reached a peak by the end of the 19th century. In the 18th century, the concept of the fourth dimension was first linked with time,[75] although primarily up until the introduction of Einstein's theory of relativity, the fourth dimension was mostly conceived as another spatial dimension.

There were a few different avenues to which the theory of the fourth dimension spread, such as theosophy, science fiction stories, and of hyperspace philosophy. Hyperspace philosophy is a term developed to put a name to the philosophy of writers such as the English mathematician Charles Hinton (1853-1907), American architect Claude Bragdon (1866-1946), and Russian philosopher Petr Uspesnkii (1878-1947) to differentiate them from the purely mathematical discussions.[76]

In the realm of science fiction there are writers such as Herbert George Wells (1866-1946) who wrote dozens of stories. The concept of multidimensional space is present in H.G. Wells' work The Plattner Story,[77] in which he used Möbius' mathematical concepts. In 1827, August Möbius, a German mathematician famous for his invention of the Möbius strip, wrote about the fourth dimension in Barycentric Calculus, stating that four-dimensional space cannot be imagined.[78] In this story, the main character visits and returns from the fourth dimension and his reversed heart and features are the proof. This takes influence from what happens when a two-dimensional character follows a Möbius strip, as seen in Figure 26.

The popularity of the fourth spatial dimension exploded as a concept with the popularisation of the 1884 book *Flatland: A Romance of Many Dimensions*, by Edwin A. Abbott. It was written as both a satirical novel critiquing the social culture of the Victorian era, as well as a mathematical introduction to understanding spatial dimensions. In the story, a square living in Flatland is introduced to the world of three dimensions by a sphere visiting him by poking through his plane in Flatland, where talk of the existence of a third dimension is prohibited. Eventually, after bringing the square out of his flat dimension to show him the view from the third

75. Rozenfel'd, *A History of Non-Euclidean Geometry*, 179.

76. Henderson, *The Fourth Dimension*, 1983, 25.

77. Herbert G. Wells, *The Plattner Story and Others*, accessed February 15, 2024, https://www.gutenberg.org/files/42989/42989-h/42989-h.htm.

78. Rozenfel'd, *A History of Non-Euclidean Geometry*, 180.

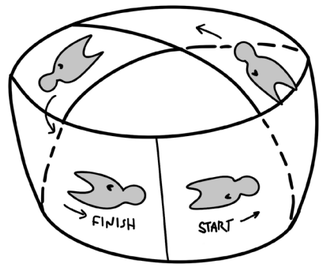


Figure 26.
Here is an example of a Möbius strip, an object with only one side. For clarity, imagine this strip as translucent, and that the two-dimensional figure can be seen from any vantage point. Notice how the figure's heart ends up on the right side (similar to how H.G. Well's The Plattner Story where the hero returns from the fourth dimension back into the regular third dimension with a reversed heart) This diagram demonstrates how such a thing could happen with a two-dimensional hero venturing into the three-dimensional world.
Diagram by Author

dimension, the sphere throws the now enlightened square back into his flat second dimension after the square realizes that if there is a three-dimensional world to his one of two dimensions, there might be a four-dimensional world to the sphere's third dimension, or even a fifth or sixth! Unfortunately, in the sphere's world, talk of the fourth dimension is just as prohibited as talk of the third is in the square's world. The book served as an analogy between the second and third dimension to the third and the fourth dimension. An easy introduction to understanding the geometry of the higher dimensions, *Flatland* is still regarded as a classic to this day both for its social commentary and for its mathematical contributions.

Another example of the contribution to the interest in four-dimensional space was the discovery of the X-ray by Wilhelm Röntgen in 1895. With the interest in seeing beyond the visible human spectrum, now possible with Röntgen's scientific apparatus, who was to say that the fourth dimension could not exist just because it couldn't be perceived? Many of the new scientific discoveries towards the end of the 19th century helped to solidify that there might be another reality that humans cannot perceive, which could possibly be the fourth dimension.[79] It was the artistically-minded who could expand on this concept with their intuition and imagination, which led to philosophical discussions about hyperspace and also lead to the rise of art styles such as Cubism and Suprematism, among others. Ultimately, the topic of multidimensional space pervaded many disciplines, including but not limited to mathematics, science, philosophy, writing, art, and architecture.

As already mentioned, spatial geometry that extends into any number of spatial dimensions grew in popularity during the first half of the 19th century. This kind of geometry was dubbed "n-dimensional geometry." It was not really considered its own field and in the third quarter of the 19th century it was typically used as an add-on to other mathematical problems. In fact, the popularity of n-dimensional geometry came about gradually after its use as an extension of analytical[80] geometry.[81] Prior to Einstein's special and general theories of relativity, the fourth dimension was treated as a spatial phenomenon first and foremost.[82]

The addition of a fourth dimension posed new challenges with the addition of dimensions beyond the third, dubbed "hyperspace."[83] Figures in hyperspace can only be seen as snippets of three-dimensional space, the same way the flat planes of the second spatial dimension make up the third dimension, such as flat surfaces that make a cube (see Figures 27 and 28).[84]

79. Linda Dalrymple Henderson, "The Image and Imagination of the Fourth Dimension in Twentieth-Century Art and Culture," *Configurations* 17, no. 1 (2009): 140, https://doi.org/10.1353/con.0.0070.

80. Also known as coordinate geometry

81. Henderson, *The Fourth Dimension*, 1983, 6.

82. Henderson, "The Image and Imagination," 133.

83. Henderson, *The Fourth Dimension*, 1983, 7.

84. English, "Arkhitektura I Mnimosti," 157,158,184. I found English's choice of choosing Bragdon's plates (seen in Figures 27 and 28) compelling to demonstrate this concept.

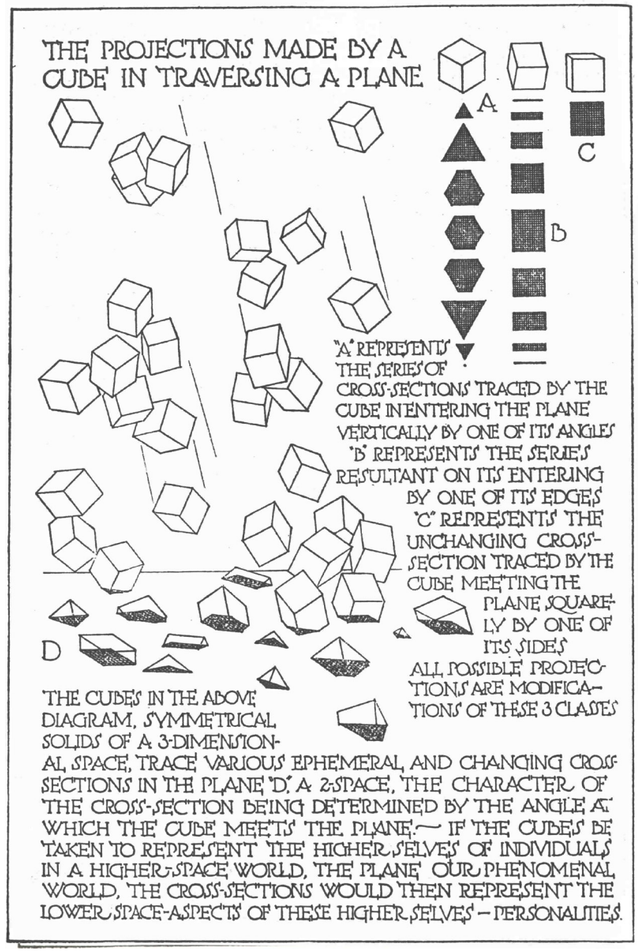


Figure 27

The projections made by a cube in traversing a plane

Plate by Claude Bragdon, 1913

Figure 28

Personalities: Tracings of the Individual (Cube) in a Plane

Illustration by Claude Bragdon, 1913

The appearance of n-dimensional geometry led to an attempt to visualise it. For example, Washington I. Stringham (1847-1909), an American mathematician attempted a portrayal of four-dimensional solids in 1880 by using rational formulas to extrapolate how hypersolids can look in three-dimensional space (see Figures 29 and 30).[85] However, as written in Linda Henderson's book The Fourth Dimension and Non-Euclidean Geometry in Modern Art, Henderson states that this view gives a false sense of completeness as it does not look like a dimension is missing (the missing dimension being the fourth).[86]

Claude Bragdon, an American architect and theosophist was a huge proponent in explaining the higher dimension with his hand illustrated plates. He wrote numerous books on representing the fourth spatial dimension; one of his more famous ones was A Primer of Higher Space.[87] An example of some diagrams explaining how to visualize the projections of cubes in the fourth dimension from his well known book Projective Ornament[88] can be seen in Figures 31 and 32.

In the 1890s Kazan University, the university at which Lobachevskii had worked, published translations of earlier Western works on non-Euclidean geometry, which included Eugenio Beltrami (1835-1900), Bernhard Riemann (1826-1866), Herman von Helmholtz (1821-1894), and Henri Poincaré (1854-1912), which introduced the Western European philosophy of spatial relativism developed from non-Euclidean geometry.[89]

Before the 1917 Russian revolution, the two separate concepts of non-Euclidean geometry and the fourth dimension gained popularity at around the same time. Russian artists and poets referenced the concept of the fourth dimension more often than that of non-Euclidean geometry.[90] This is interesting to note, as according to a study that outlines published Russian works in the late 19th century up until 1910, there was at least five times more content on non-Euclidean geometry than on the fourth dimension.[91]

Only in the 1920s in Russia did the confirmation of Einstein's general theory of relativity start to deeply influence art and theory and introduced concepts such as curved space. Resurgence of the interest in Lobachevskii along with the publishing of the theory of relativity allowed Lissitsky and others to explore curved space.

The difficulty in conceiving the fourth dimension as a spatial dimension is what led to the other theory of fourth dimension being time instead, as it is an easier idea to understand.[92] Despite

85. Henderson, *The Fourth Dimension*, 1983, 8.

86. Henderson, 9

87. Claude Fayette Bragdon, *A Primer of Higher Space (the Fourth Dimension)* (Tucson, Ariz: Omen Press, 1972).

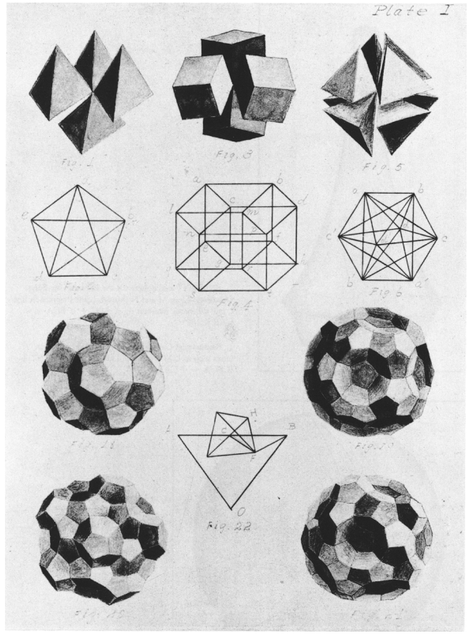
88. Claude Fayette Bragdon, *Projective Ornament* (New York: Dover Publications, 1992).

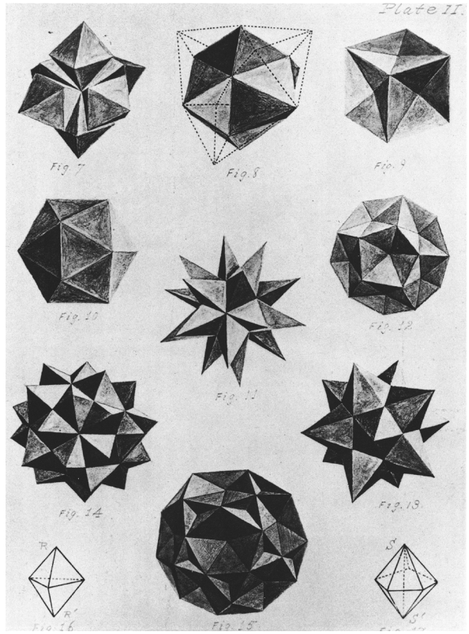
89. Henderson, *The Fourth Dimension*, 1983, 242.

90. Henderson, 241.

91. Henderson, 241, 242.

92. Henderson, 9.





Figures 29 and 30 (above)
Regular Figures in n-Dimensional Space
Illustrations by Washington Stringham, 1880

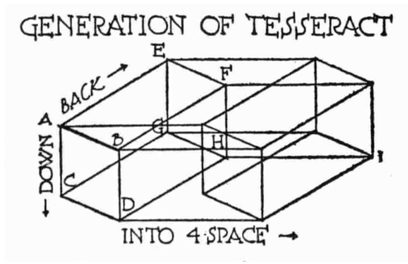


Figure 31
Corresponding Projections of Cube and Tesseract
Diagram by Claude Bragdon, 1915

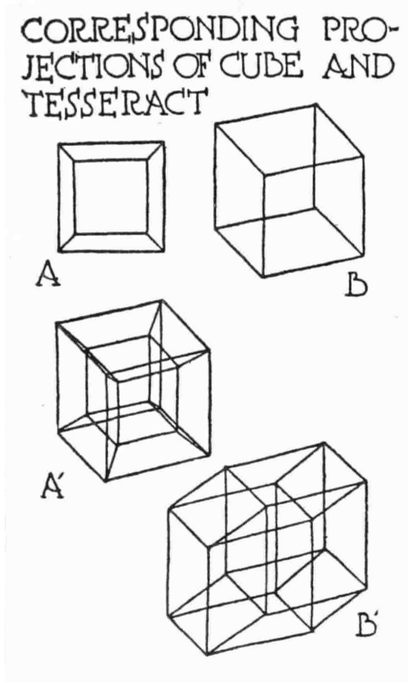


Figure 32
Generation of Tesseract
Diagram by Claude Bragdon, 1915

this being the simpler theory to understand, during the early 20th century, it was still the two subjects of the fourth dimension and of non-Euclidean geometry that were more interesting to the public.[93] In Russia, there were many figures who explored geometry from Lissitsky and Malevich to the field of hyperspace philosophy of Petr Uspenskii and Pavel Florenskii, as seen next.

93. Henderson, 9,10.

2.5 Theorists of the Philosophy of the Fourth Dimension

There were many architects, painters, and theorists who were influenced by the newly resurfaced interest in n-dimensional geometry and its applications in different disciplines. Additionally, Nikolai Fedorov's ideas were quite prevalent among philosophers of various schools of thought. The following section explains the approach to three different figures during the early 20th century: a painter and two philosophers. The three thinkers I will discuss were influential to many disciplines of the Russian avant-garde, including architecture, and the connections between Fedorov and Malevich and between Uspenskii and Florenskii were first proposed by English.[94] The first figure I will talk about is Kazimir Malevich, who theorized upon the fourth dimension through his art with an interest in the cosmos. Then I will talk about Peter Uspenskii, a philosopher who used Russian Slavophile ideas as a base for his four-dimensional philosophy. Lastly I will discuss Pavel Florenskii, a devout Russian Orthodox philosopher and mathematician who explored philosophy through a religious and mathematical perspective.

2.5.1 Kazimir Malevich

Kazimir Malevich (1879-1935) was an artist and art theorist whose work, both written and painted, influenced many other artists and architects during the avant-garde. He founded an influential art style that he called Suprematism. Malevich believed that the real world was no longer a suitable source for artistic precedent, and so he abstracted his art so that it would feel purer and channel only emotion. Malevich believed that due to the influence of Suprematism, art had finally achieved its pure form, as he wrote, "The new art of Suprematism, which has produced new forms and form relationships by giving external expression to pictorial feeling, will become a new architecture: it will transfer these forms from the surface of canvas to space."[95] Part of the reason for his "abstract" style in Suprematism is that to him, reproduction of reality does not add anything new to the interpretation of the nature of our world, however an artist that creates new things rather than reproduces what is in front of them is an artist who creates drawings that are actually new realities rather than reflections of nature, and these new realities are not any less meaningful.

94. English, "Arkhitektura I Mnimosti," 158–72, 206–23.

95. Kasimir Malevich, *The Non-Objective World*, trans. Howard Dearstyne (Chicago: Paul Theobald and Company, 1959), 100.

Figure 33

Suprematist Composition Conveying the Feeling of a Mystic “wave” from Outer Space

Drawing by Kazimir Malevich, 1917

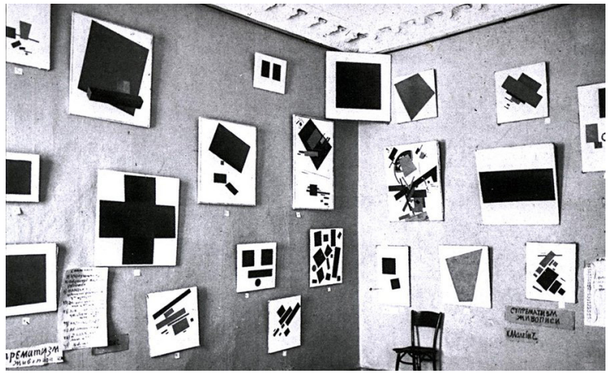


Figure 34

Malevich’s Black Square in the 1915 Petrograd Exhibition “0.10 (Zero-Ten) the Last Futurist Exhibition of Painting”

Photograph author unconfirmed, 1915

Figure 35

Black Square

Painting by Kazimir Malevich, 1915.

96. Kasimir Malevich, *The Non-Objective World*, trans. Howard Dearstyne (Chicago: Paul Theobald and Company, 1959), 11.

97. Malevich, 36.

98. English, “Arkhitektura I Mnimosti,” 163.

99. After reading “Arkhitektura I Mnimosti,” where English first proposed a connection between Malevich’s work and Orthodoxy (see reference above), I have been able to identify religious references in other artists work of this time.

100. English, “Arkhitektura I Mnimosti,” 163.

101. Magdalena Dabrowski, “Malevich and Mondrian: Nonobjective Form as the Expression of the ‘Absolute,’” in *The Avant-Garde Frontier: Russia Meets the West, 1910-1930*, ed. Gail Harrison Roman and Virginia Carol Hagelstein Marquardt (Gainesville: University Press of Florida, 1992), 154.

102. Susan P. Compton, “Malevich’s Suprematism - The Higher Intuition,” *Burlington Magazine* 118, no. 881 (1976): 585.

103. Pearlman, “The Resurgence of Russian Cosmism,” 87.

In Malevich’s book The Non-Objective World, of which only the German translation by A. von Riesen exists in its original form, Malevich wrote, “We find the concrete element in the sciences and religion – the abstract in art. Thus art has its definite place in the hierarchy of phenomena and can be examined scientifically.”[96] He wrote about conciousness and our perception of reality in that a human cannot perceive reality as it is. His style of art comes from an intense reflection of how to depict reality. Malevich then moved on to write about some of the specific phenomena that lead to such thinking, such as light and colour values that are then used to represent new realities. This to him split creative work into two groups: that of the artistic (the insight of the artist) and that of the productive-technical (the engineer/the scientist).[97]

Overall, Malevich had a rigorous scientific approach to portraying reality that did not interefere with his metaphysical philosophical worldview. Although never directly mentioned in writing, many of his paintings featured religious iconography,[98] such as his Composition Conveying the Feeling of a Mystic ‘wave’ from Outer Space (Figure 33) resembling the cross of Christ. This icon in particular is visible in many artist’s works from this time period.[99]

Malevich was one of the many thinkers who was interested in the ideal world and the philosophy offered by the fourth dimension. One of Malevich’s most famous works is his “Black Square” of 1915 (Figures 34, 35), which at the installation of 0.10, also called the Last Futurist Exhibition in 1915-16, was hung up in the room in the place traditionally reserved for Orthodox holy icons, making it a religious reference.[100] Several of Malevich’s paintings in this exhibition alluded to the fourth dimension through their titles. Malevich’s Suprematism paintings drew reference from both the mathematical and the philosophical, to come together for a new “universal” meaning.[101] The concept of the number zero was central to Suprematism, for example, the Black Square being placed on white infinity.[102] The exhibition title was another specific reference to Malevich’s mathematical and philosophical interest in the number “0,” as in the title of the exhibition, “0” represented the start of a new world after the passing of the old one, and the number “10” was chosen for the original number of artists that were asked to participate in the exhibition.[103]

Regina Khidekel, Lazar Khidekel’s daughter in law and the head of the Lazar Khidekel Society said in an interview, “When the founder of Suprematism, Kazimir Malevich, arrived at this Black Square, he soon understood that Suprematism – or, that is to say, geometric abstraction – is the terminal stage of abstract art, that this art

that [sic] is connected with the cosmos, with cosmic vision."[104] The square along with the other Suprematist works were, according to Malevich, connected by "the fourth dimension."[105] With the Black Square as the beginning of his Suprematist journey, we can see how all three themes of the religious, the cosmic, and the geometrical, are present and intertwined in his theories. Malevich was very much involved with the mystical religious intellectual culture of the Russian avant-garde, to which Uspenskii's theories also contributed (see section 2.5.2.1).

Part of Malevich's approach is that art is no longer bound to the canvas; we can see that with his exhibition (Figure 34) and his Arkhitecktons (Figure 36). His Arkhitektons were part of his experimentations into Suprematist architecture. To Malevich, Suprematist architecture is "the primacy of volumetric masses and their spatial solution in consideration of weight, speed, and direction of movement."[106] His Arkhitektons were visionary models that explored ideals in architecture, they were a "Suprematist architecture of pure form."[107] The forms of the buildings are there only to explore the style, and have no function at all, and the interior is unimportant.[108] However despite there being no function to the building, the volumes were designed with great care as three-dimensional compositions and were designed as research.[109] Their blankness allowed Malevich to focus on light, shape, scale and its volume, as it can be seen from any angle as a three-dimensional composition. Malevich had stated that the one art that is "truly contemporary" is that of architecture, and he stressed that generating forms, including functional ones, could not be accomplished "without an aesthetic effect."[110]

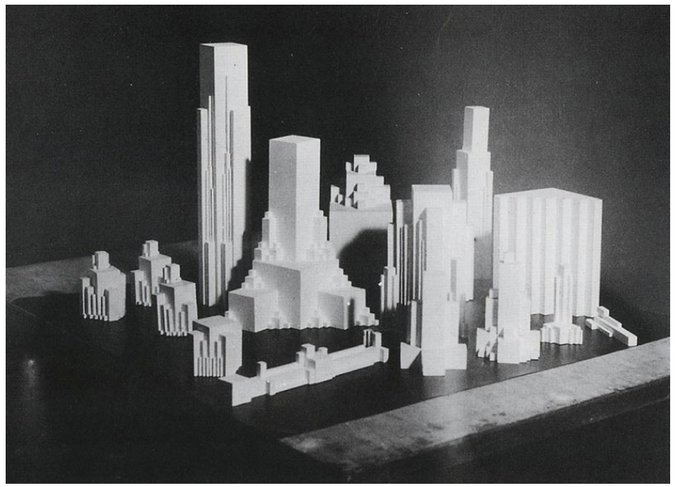


Figure 36
Malevich's Arkhitekton Models, made between 1923-1928
Photograph author unconfirmed

104. Regina Khidekel, Khidekel and the Cities of the Future, interview by Elena Dobriakova, accessed April 13, 2023, https://thecharnelhouse.org/2013/12/25/khidekel-and-the-cosmist-legacy-of-suprematism-in-architecture/.

105. Henderson, *The Fourth Dimension*, 1983, 239.

106. Kazimir Malevich et al., "The 'Arkhitekons' and 'Plantets' of Suprematism," *Sovremennaya Arkhitektura*, no. 3 (1927): 104–6., quoted in Wolfe, Ross. "The 'Arkhitektons' and 'Planets' of Suprematism." *The Charnel-House* (blog), November 22, 2012. https://thecharnelhouse.org/2012/11/22/the-arkhitektons-and-planets-of-kazimir-malevich-and-his-students-nikolai-suetin-and-iakov-chashnik-mid-1920s-with-commentary-by-aleksei-gan/.

107. Malevich, *The Non-Objective World*, 101.

108. Alan Colquhoun, *Modern Architecture*, Oxford History of Art (Oxford ; New York: Oxford University Press, 2002).

109. Malevich et al., "The 'Arkhitekons' and 'Planets' of Suprematism," quoted in Wolfe, Ross. "The 'Arkhitektons' and 'Planets' of Suprematism." *The Charnel-House* (blog), November 22, 2012.

110. Khan-Magomedov, *Pioneers of Soviet Architecture*, 64.

111. Bridgeman Art Library, ed., *Art: The Definitive Visual Guide*, First Canadian Edition (Toronto: Dorling Kindersley, 2008), 440; Aleksandra Shatskikh, "The Cosmic Visionariness of Kazimir Malevich," *Leonardo* 54, no. 1 (February 2021): 126, https://doi.org/10.1162/leon_a_01991.

112. Charlotte Douglas, "Aero-Art, The Planetary View: Kazimir Malevich and Lazar Khidekel," in *Lazar Khidekel & Suprematism*, ed. Regina Khidekel, Lazar Khidekel and Suprematism (New York: Prestel in association with Modernism Inc., San Francisco, 2014), 28.

113. Douglas, 28.

114. Douglas, 30–31.

115. Shatskikh, "The Cosmic Visionariness of Kazimir Malevich," 128.

Malevich often used white in the background of his paintings, as he felt that white more closely resembled the concept of infinite space than the colour blue, as white makes a person perceive a strong sensation of space in that the whiteness embodies the energetic tensions of the universe, as well as that of irrational space.[111] Moreover, with public interest in engineering research on spaceflight, Malevich published a text about self-orbiting satellites using gravitational forces between the Earth and the Moon, which was perceived as a fantastical idea by the general public, despite Tsiolkovskii's calculations proving it as a distinct possibility (and the calculations still hold true today).[112] It is in fact Malevich who had first used the Russian word "sputnik," meaning "companion" and "fellow traveller", in his introduction to Suprematism: 34 Drawings, now associated with the first artificial Earth satellite (launched in 1957). Tying together Malevich's interest in the cosmos, both the spiritual and the physical were his "Suprematist Satellites," two examples being Figures 37 and 38.

The sketch, "Scheme of Movement of Creative Units within Infinity" (Figure 37) has written notes that mention a hyperbolic line of space travel, with an infinite amount of units that measure different things. Malevich, along with other artists, took the new concept of flight as an opportunity to discard earthly anchors, and soon the freedom from gravity turned into forming "heavenly" connections with earth to create something free and weightless as opposed to the heavy ground.[113] Malevich used his abstract art to convey feelings along these lines. He drew connections between the natural scientific laws of the universe and that of human culture, and hence the Suprematist satelites would be placed in between moon and planets imitating natural celestial bodies that are already in orbit.[114] On the whole, Malevich conceived of his satelites in Suprematist forms as this would allow him to connect science and art.

Malevich's dip into volumetric Suprematism by form of his Arkhitektons combined his engagement with the cosmos through the Suprematism satellites that were the precursor to the architectural work of his Planits. While he was a painter first and foremost, his experiments of Planits are an architectural endeavour, and Malevich played the role of architect for this visionary idea. Conceived originally as Arkhitektons, they were supposed to be able to be transformed into "planits" (homes) for "earthits" (people).[115] As Fedorov's philosophy of ressurrecting all of humanity would force the human population to expand into the cosmos, Malevich's architectural solution to this quest was the proposal of his Planits (see Figure 39 for an example of one of Malevich's

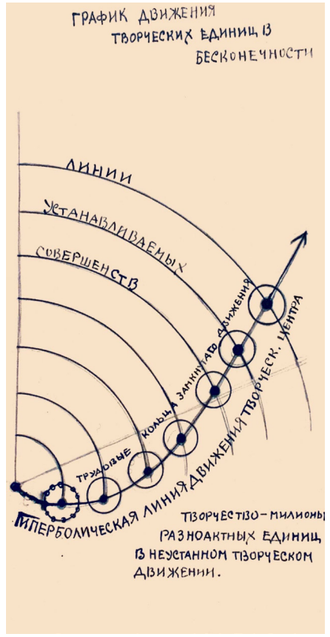


Figure 37
Scheme of Movement of Creative Units within Infinity

Written Notes (translated by author) from Top to Bottom:
"A graphic showing the movement of creative units"
"Lines | set | perfectly"
"Working circles of closed movement"
"hyperbolic line of the movement of the creative center"
"Creativity - Millions of different measurement units in infinity"

Diagram by Kazimir Malevich, ca 1923

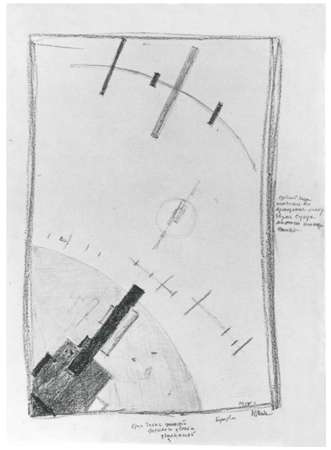


Figure 38
Study for Suprematism 52. System A
Pencil sketch by Kazimir Malevich, 1917-18

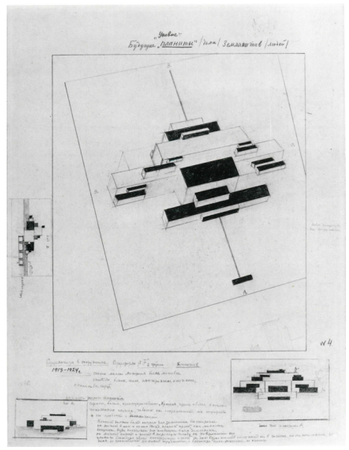


Figure 39
Future Planits for Earth Dwellers
Pencil drawing by Kazimir Malevich, 1923-24

Planits). Malevich had once written in 1916 to Mikhail Matiushin, a fellow avant-garde artist friend, a sentiment that completely embodied Fedorovan ideals: "The Earth has been abandoned like a house infested with termites. And indeed in man, in man's consiousness lies the aspiration to space, the inclination to 'tear off the sphere of the earth.'"[116] Malevich had always been interested in spaceflight, and the introduction of his Planits is another manifestation of the dissemination of Fedorovian ideals throughout the Russian avant-garde, not to mention an extremely visionary solution. The Planits were Malevich's way of engaging with the interests brought forwards by his society: a reflection of the cosmic views and interest in space flight and non-Euclidean geometry, as well as a religious background built upon the Slavophile ideals and expanded upon by philosophers such as Fedorov. With the combination of the religious implications of some of his works like the Black Square, and his explorations of infinity and the cosmos, the religious cosmic mysticism that pervaded the Russian avant-garde is clearly visible within Malevich's visionary Suprematist creations.

116. Malevich, Kazimir. "To Mikhail Matiushin," Before June 23, 1916, quoted in Irina Anatol'evna Vakar et al., eds., *Kazimir Malevich: Letters, Documents, Memoirs, Criticism*, English edition (Millbank, London: Tate Publishing, 2015), 89.

2.5.2 Petr Uspenskii

Petr Uspenskii (1878-1947) was a philosopher who dealt with hyperspace philosophy and was major influence on many of the architects and artists of his time. Uspenskii had a vested interest in the fourth dimension and its philosophy and he was one of those who started introducing the theory of relativity into his philosophical research at least by the early 1910's as seen in his work Tertium Organum,[117] which was published in 1911. In this book, Uspenskii picked up where Kant left off – where Kant talked about how the laws of the world are derived from the human mind, Uspenskii continued by trying to explain why we have such forms of intuition.[118]

Uspenskii proposed that the fourth dimension is not just a geometrical phenomenon, but that there is also a psychological component to it, which explains the inability to perceive the happenings of higher dimensions.[119] Uspenskii believed that the fourth dimension was connected with the mind rather than being a purely spatial phenomenon and had even stated that "thought moves along the fourth dimension."[120] Uspenskii's higher dimension was a spatial one, albeit with the caveat that time is part of it – but not wholly one or the other.

For example, Uspenskii wrote an analogy of a two-dimensional being to help us understand this. If a sphere were to try to show itself to a Flatlander living in a two-dimensional plane, then the

117. Petr Uspenskiĭ, *Tertium Organum : The Third Canon of Thought : A Key to the Enigmas of the World*, trans. E. Kadloubovsky (London: Arkana, 1990).

118. George Bosworth Burch, "The Philosophy of P. D. Ouspensky," *The Review of Metaphysics* 2, no. 2 (1951): 252, http://www.jstor.org/stable/20123259.

119. Burch, 258; Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton, N.J: Princeton University Press, 1983), 248.

120. Ouspensky, "The Fourth Dimension," in *A New Model of the Universe*, p. 86, quoted in, Henderson, *The Fourth Dimension*, 1983, 249.

Flatlander would see a circle getting bigger and bigger until it comes to its biggest point (the sphere's diameter) before becoming small again and disappearing. While this was happening, it would also appear that the circle is moving to and away from the Flatlander as it is changing in size. In this way, the Flatlander has experienced an illusion of movement and change through time, while it is just due to its inability to perceive the third dimension. In the same way, the motion and time that we experience as three-dimensional beings are also an illusion; we are seeing a slice of the fourth dimension just as the Flatlander could not experience the sphere in its entirety. After explaining this analogy of a two-dimensional being experiencing three-dimensional space through time, Uspenskii brings it back to the third dimension and how three-dimensional beings (people) are experiencing the fourth dimension:

> It will then become clear what is meant by saying that a four-dimensional body may be regarded as the trace of the movement in space of a threedimensional body in a direction not contained in it. The direction, not contained in three-dimensional space, in which every three-dimensional body moves, is the direction of time. By existing, every three-dimensional body moves in time, as it were, and leaves the trace of its motion in the form of a time-body, or a four-dimensional body. Because of the properties of our perceiving apparatus, we never see or sense this body; we only see its section, and this we call a three-dimensional body. Therefore, we are greatly mistaken in thinking that a three-dimensional body is something real. It is merely the projection of a four-dimensional body – its drawing, its image on our plane.[121]

Taking the analogy further into the other direction, Uspenskii wrote in Tertium Organum that a five dimensional being to us may appear as a three-dimensional body moving in time.[122] This brought him to his discussion of eternity, where eternity is not an extension of time that extends infinitely but rather perpendicular to time, and in this way, eternity, is every moment. Therefore, by extending into eternity which is no different as a coordinate of length, width, and height, eternity is an extension to another axis of space, and therefore time is the fourth dimension of space.[123] The theory of relativity was instrumental for Uspenskii when discussing the fourth dimension, as Uspenskii's philosophy existed within a multifold space, where space does not act equally such as in an analytical geometry.

Uspenskii also connected death and the soul with his concepts of eternity and the perception of the fourth dimension. After Uspenskii had introduced this concept of perceiving the fourth dimension through movement and time, Uspenskii proceeded to write about life and death. To him, a life may be represented as a four-dimensional body stretched out in time, and a body does not actually exist as it is just a section of a four-dimensional body that is incomprehensible to us.[124]

121. Uspenskiĭ, *Tertium Organum*, 37.

122. Burch, "The Philosophy of P. D. Ouspensky," 258.

123. Uspenskiĭ, *Tertium Organum*, 32,33.

124. Uspenskiĭ, 168,212.

It seems that Uspenskii was highly influenced by Orthodox ideals in a Slavophile manner, as this talk of unity and wholeness was one of the tenets of Slavophile philosophy. In his hyperspace philosophy, Uspenskii talks of life and death and how it all connects. For example, Uspenskii used a circle as a visual representation of a life to illustrate the idea that birth and death are the same point of the circle. There is a sense of unity within that example. Not to mention, near the end of *Tertium Organum*, Uspenskii states,

> Life is not opposed to death. On the contrary, the one includes the other. Unity and multiplicity, motion and immobility; oneness and divisibility, good and evil, truth and falsehood – all these divisions are impossible there. Everything subjective is objective, and everything objective is subjective. That world is the world of the unity of opposites.[125]

Uspenskii also used texts by church fathers for his esoteric philosophy.[126] He analysed parts of The Philokalia, which is a collection of texts by ascetic Orthodox religious writers from the Middle Ages. In general, Uspenskii mixed his thoughts on higher dimensions with the mystical. To him, the world we experience here on Earth is the "unreal world" and there is a "real world" out there, called different names, from the "ideal world" to the "world of many dimensions."[127] According to Uspenskii, this "ideal world" is inaccessible to most people due to its inherent mystical properties and "higher logic," a term Uspenskii coined to explain the importance of emotions such as love and compassion.[128] Uspenskii insisted that this "higher logic" is found in most religious and philosophical systems as a key role to them.[129] This state, also called "cosmic consciousness" followed a similar impetus to Fedorov's beliefs, and Uspenskii wrote that "Cosmic consciousness is also possible of attainment through the emotion attendant upon creation – in painters, musicians and poets. Art in its highest manifestations is a path to cosmic consciousness."[130]

Uspenskii used mathematics and geometry as vessels for his philosophy. He believed that science and psychological phenomena could be reconciled though ancient methods[131] and through religion. The philosophy of mysticism is wholly compatible with scientific phenomena such as space and time.

125. Uspenskiĭ, 227.

126. Sergei Sergeevich Loginovsky, "A Strategy for Interpreting the Philokalia by Peter D. Ouspensky in Tertium Organum," *Sophia* 62, no. 2 (June 2023): 249, https://doi.org/10.1007/s11841-022-00943-y.

127. Loginovsky, 254,255.

128. Loginovsky, 255.

129. Loginovsky, 255.

130. Uspenskii, quoted in Compton, Susan P. "Malevich's Suprematism - The Higher Intuition." *Burlington Magazine* 118, no. 881 (1976): 585.

131. Uspenskiĭ, *Tertium Organum*, 101.

2.5.2.1 Influence of Uspenskii on Abstract Art

Uspenskii's theories made a big impact on the avant-garde movement and were most certainly known by many of his contemporaries. Notably however, is the influence of Uspenskii on both Vasilii Kandinskii and Kazimir Malevich.

To enumerate, Mikhail Matiushin (1861-1934) was a painter, a composer, and part of the Russian Futurist group "Union of the Youth," founded in 1913. Many Russian avant-garde artists participated in exhibitions held by this group. Matiushin had wrote an essay that is very reminiscent of Uspenskii titled The Sensation of the Fourth Dimension. Furthermore, while Russian Futurists were discussing cubism in the early 1910s, Matiushin also used Uspenkii's Tertium Organum as a precedent.[132]

Likewise, Malevich was also aware of Uspenskii's work.[133] Matiushin and Kazimir Malevich, along with Aleksei Kruchenykh (another futurist artist, theorist, and poet) had worked together on the Futurist opera Victory over the Sun. This opera was a manifesto of Futurist ideals – the speech, music, and art design were all carefully construed to evince non-objective thinking.[134] The opera also was centered on a plot that took place in the solar system, and in the end Futurist robot-like figures defeated the sun which represented the destruction of the cognitive ability to perceive reality. This space opera once again highlights the interest in cosmic thought in the avant-garde.

This opera was partially inspired by Uspenskii's writings. In 1913, the year Malevich first made a sketch of his famous Black Square, he had exhibited his painting Lamp (Musical Instrument) (Figure 40) which was catalogued under "Cubo-Futurist Realism." The composition seemed to be modelled on a Picasso still life which was exhibited in Moscow at the time, and it seems that Malevich had noticed the link to the fourth dimension, illustrated by a diagram from Howard Hinton's book The Fourth Dimension which Uspenskii had quoted in Tertium Organum.[135] The Hinton diagram was also present in one of the sets for the opera, and beside it, Malevich had drawn another diagram. Malevich's diagram was derived from Bragdon's description of a parallel projection of a hypercube (see section 4.2.4), and was later published and sent to Uspenskii in 1913.[136]

Malevich's Black Square was also present in the costume and set design of the opera, representing pure art form and the link to the fourth dimension.[137] The aim of the opera was to achieve a "higher intuition," and both Matiushin's music and Malevich's sets alluded to Uspenskii's idea to create "a language of the future."[138] Where Uspenskii wrote about higher logic that came from assessing the world through a new geometry, Malevich used Suprematism to access a different plane that is incomprehensible to us.[139] The effects of Uspenskii's theories on Malevich's works have been investigated by several art historians.[140]

Many avant-garde artists, including Kandinskii, incorporated contemporary science and technology into their paintings,[141] and with the cosmic yearning visible in such paintings and visionary work it is clear that the influence of Slavophilism and Fedorov are present. Along with Malevich and his Futurist friends and countless other participants of the Russian avant-garde, Vasilii Kandinskii was another such painter who had been infleunced by Uspenskii's philosophy. Kandinskii as an abstract art painter advocated for the spiritual nature of abstract painting.

While Kandinskii never mentioned the fourth dimension by name in any of his published work,[142] Uspenskii's influences upon Kandinskii can be inferred from his interests and his theories.[143] However, although we can extrapolate his interest in the fourth dimension based on his ideas, his culture, and his peers, Kandinskii's interest in the fourth dimension can be confirmed. In 1912, he was an editor for an essay that spoke of the perception of higher dimensions, and a 1930 letter that Kandinskii wrote also has a reference to his fascination with the fourth dimension.[144] Kandinskii was interested in the depiction of subtle emotions, and he was mostly interested in occult sources.[145]

Kandinskii still maintained his link to Russia during his years in Germany where he would have been exposed to Uspenskii through correspondence with Russian avant-garde artists,[146] and his interest in theosophy and esotericism are attested to.[147] Uspenskii's work helped to shape Kandinskii's experiments with the inner sound or vibration of the soul.[148] Additionally, after Kandinskii's long stay in Germany and teaching at the Bauhaus, Kandinskii wrote that he realized that "[his] vision of art has its origins in the true Russian soul, ... in contrast to the Western European principles of jurisdiction."[149] This is certainly a very Slavophile sentiment.

Uspenskii's idea that art can be used as language[150] is touched on by both Malevich and Kandinskii as artists. Overall, as Uspenskii's ideas were discussed in Russian avant-garde intellectual circles, his ideas merged with others' to form the cosmic and religious theories that can be seen in visual forms such as painting and architecture.

132. Compton, "Malevich's Suprematism," 579; Andrei B. Nakov and Kazimir Malevich, *Malevich: Painting the Absolute* (Farnham: Lund Humphries, 2010), 249, 250.
133. Henderson, *The Fourth Dimension*, 1983, 239,240; Colquhoun, *Modern Architecture*, 122.
134. Nakov and Malevich, *Malevich*, 297,298.
135. Compton, "Malevich's Suprematism," 579.
136. Compton, 579.
137. Pearlman, "The Resurgence of Russian Cosmism," 87.
138. Compton, "Malevich's Suprematism," 580.
139. English, "Arkhitektura I Mnimosti," 161.
140. Compton, "Malevich's Suprematism," 579–85; Dabrowski, "Malevich and Mondrian: Nonobjective Form as the Expression of the 'Absolute,'" 153; Nakov and Malevich, *Malevich*; John Milner and Kazimir Malevich, *Kazimir Malevich and the Art of Geometry* (New Haven: Yale University Press, 1996), 73; Robert Chadwell Williams, *Artists in Revolution: Portraits of the Russian Avant-Garde, 1905-1925* (Bloomington: Indiana University Press, 1977), 118–24; Patricia Railing, *From Science to Systems of Art : On Russian Abstract Art and Language 1910-1920, and Other Essays* (Forest Row, East Sussex, England: Artists' Bookworks, 1989), 36–45.
141. Charlotte Douglas and Kazimir Severinovich Malevich, *Kazimir Malevich* (New York: H.N. Abrams, 1994), 27.
142. Henderson, *The Fourth Dimension*, 1 983, 240.
143. English, "Arkhitektura I Mnimosti," 161; Henderson, *The Fourth Dimension*, 1983, 240.
144. Henderson, *The Fourth Dimension*, 1983, 240,241; English, "Arkhitektura I Mnimosti," 161.
145. Maria. Carlson, *"No Religion Higher than Truth" : A History of the Theosophical Movement in Russia, 1875-1922* (Princeton, N.J: Princeton University Press, 1993), 197.
146. Henderson, *The Fourth Dimension*, 1983, 240; Railing, *From Science to Systems of Art : On Russian Abstract Art and Language 1910-1920, and Other Essays*, 36.
147. John E. Bowlt and Vasilii Kandinsky, *The Life of Vasilii Kandinsky in Russian Art: A Study of On the Spiritual in Art*, ed. John E. Bowlt and Rose-Carol Washton Long, 2 ed. with corrections and updated bibliography, Russian Biography Series 4 (Newtonville, Mass: Oriental Research Partners, 1984), 44–47; Nakov and Malevich, *Malevich*; Williams, *Artists in Revolution*, 104, 106, 107; Rose-Carol Washton Long, *Kandinsky, the Development of an Abstract Style*, Oxford Studies in the History of Art and Architecture (Oxford : New York: Clarendon Press ; Oxford University Press, 1980), 16–34.
148. Louise Hardiman and Nicola Kozicharow, "Introduction: Modernism and the Spiritual in Russian Art," in *Modernism and the Spiritual in Russian Art New Perspectives* (Cambridge: Open Book Publishers, 2018), paragraph 21, https://books.openedition.org/obp/4644?lang=en.
149. Charles Pickstone, "A Theology of Abstraction: Wassily Kandinsky's 'Concerning the Spiritual in Art,'" *Theology* 114, no. 1 (January 2011): 33, https://doi.org/10.1177/0040571X10387346.
150. Compton, "Malevich's Suprematism," 580.

Figure 40
Lamp (Musical Instrument)
Oil painting by Kazimir Malevich, 1913

2.5.3 Pavel Florenskii

Understanding Pavel Florenskii (1882-1937), is an important step to understand the spiritual ideas that were employed by many writers, philosophers, artists, and architects, Melnikov (section 3.5.1) included.[151] His ideas were also engaged with in the maths and sciences in the early 20th century as well. As his ideas were present in many disciplines, examining Florenskii's philosophies can make understanding the theories and assumptions of many other figures from the 19th century more clear, particularly due to the nature of his theories. Florenskii was an Orthodox priest whose philosophy was based in Russian Orthodox tradition and the Slavophile concept of Sobornost'. The Russian Philosopher Vladimir Soloviev was as inspiration. In a similar way that Lobachevskii derived non-Euclidean space from Euclidean space, Florenskii hoped to develop a system of metalogic to regular logic.[152]

Florenskii, like many of his contemporaries, had an interest in the cosmos, wherein he attempted to "reconcile science and revealed truth."[153] He continued to revise his cosmic model as Einstein's theory of relativity was published and his scope then included an analysis of the models of Lobachevskii, German mathematician Bernhard Rieman, and others.[154] His theologian mindset analysed space (the spatial concept), as he desired to find "the empyrean world of divine entities, and to do so he looked within the mathematical world of complex[155] numbers."[156] However, he also believed that the universe cannot be limited by any numbers. Florenskii was not alarmed by contradictions since to him, truth is made up of many facets.[157]

In his spiritual philosophy, he coined a term called Cult, short for "Kultura" which translates to Culture in English. This concept of Cult is an indescribable phenomenon arising from worship that affirms the full range of emotions and combines the divide between the spiritual and the earthly (a divide that according to Florenskii is artificial).[158] This is where he proclaimed that symbolic art, rather than obscuring the world reveals the world, because the spiritual can only be viewed through matter.[159] Florenskii demonstrated this concept in his book Ikonostas (Iconostasis). He wrote, "The artist does not himself invent the image, but only removes the covering from an image that already exists, ... he does not put paint on canvas, but, as it were, clears away ... the 'overpainting' of spiritual reality."[160] Florenskii's work is rooted in Slavophile culture and philosophy, and he believed in the merging of art and sciences, as well as how art could reveal the spiritual world, classifying artists as messengers of God.[161] To Florenskii, art is a medium that reveals

151. English, "Arkhitektura I Mnimosti," 206, 207, 211–13.

152. English, 165; Leonid Sabaneeff, "Pavel Florensky-Priest, Scientist, and Mystic," *Russian Review* 20, no. 4 (October 1961): 320, https://doi.org/10.2307/126694.

153. Sabaneeff, "Pavel Florensky-Priest," 317.

154. Sabaneeff, 318.

155. Complex numbers are 2-part numbers that consistent of a real part, that is a regular number, and an imaginary part. The imaginary part is expressed as a multiple of i, the square root of -1.

156. Sabaneeff, "Pavel Florensky-Priest," 318,319.

157. Sabaneeff, 320.

158. Viktor Bychkov, *The Aesthetic Face of Being: Art in the Theology of Pavel Florensky*, trans. Richard Pevear and Larissa Volokhonsky (Crestwood, NY: St .Vladimir's Seminary Press, 1993), 67.

159. Bychkov, 67.

160. Bychkov, 44. Bychkov's third chapter "Art" was based on Florenskii's *Ikonostas* vol. 1.

161. English, "Arkhitektura I Mnimosti," 166; Kirill Sokolov and Avril Pyman, "Father Pavel Florensky and Vladimir Favorsky: Mutual Insights into the Perception of Space," *Leonardo* 22, no. 2 (1989): 237–44, https://doi.org/10.2307/1575237.

162. Bychkov, *The Aesthetic Face of Being*, 44.

163. Pavel A. Florenskii, *Analiz prostranstvennosti i vremeni v hudožestvenno-izobrazitelnyh proizvedeniâh* (Moscow: Izdatel'skaia gruppa Process, 1993), 184. All translations from this source are by the author.

164. Elizabeth C English, "Rethinking the Russian Avant-Garde: Russian Mystical Philosophy and Rationalist Architectural Theory," 2004, 8; Bychkov, *The Aesthetic Face of Being*, 50.

165. English, "Rethinking the Russian Avant-Garde," 7.

166. Sokolov and Pyman, "Father Pavel Florensky and Vladimir Favorsky," 238,239.

167. Sokolov and Pyman, 239.

168. Florenskii, *Analiz*.

an unknown reality of a higher dimension than that of our perceivable world,[162] and in terms of higher mathematics and art he also stated that "the discourse is of time, how in the fourth coordinate, or the fourth dimension; without a doubt, this fourth coordinate should not be omitted without a trace in works of fine art."[163] Overall, Florenskii believed in the power of art in its ability to represent reality.

He taught at the VKhUTEMAS, under the position titled "Professor of Perspective and Processor of the Analysis of Space," and he gave a series of lectures with the title "Analysis of Space and Time in the Fine Arts."[164] As such, his ideas were distributed to the students in the early 1920s, students who then went on to become famous artists, architects, and writers.[165] In general, with his interest in mathematics, his interest in art means that he had close contact with many artists of the time. Another more concrete example however are his contributions to the journal Makovetz (cover seen in Figure 41). Florenskii contributed to this journal and had originally come up with the name Makovetz (the name of a hill on which the Monastery at Zagorsk is located) for a book he was planning on writing at the same time as Mnimosti v Geometrii (Imaginary Points in Geometry).[166] Both the journal name and the group that published it were influenced by Florenskii.[167]

During his tenure as a professor at the VKhUTEMAS, he wrote several books to visualize his theories of imaginary space, as well as a book titled Analiz prostranstvennosti i vremeni v khudozhestvenno-izobrazitel'nykh proizvedeniiakh[168] (Analysis of Space and Time in the Fine Arts) which was his transcription of his VKhUTEMAS lectures. In his book and lectures, Florenskii emphasized the importance of the fourth dimension and its relationship with art, as well as mathematics and religion, and how it all coalesces.

2.5.3.1 Favorskii's Covers to Florenskii's Written Works

Florenskii's book Mnimosti v Geometri (Imaginary Points in Geometry) and Chislo kak forma (Number as Form) were two books written in an attempt to visualise his theories on imaginary space (refer to Figures 42 and 43 for the book covers).[169] The importance of the word "mnimosti" meaning imaginary refers to two kinds of the imaginary: that of creative imagination, and that of the imaginary numbers in mathematics.[170] His mathematical works and application of his knowledge of non-Euclidean geometry to "spaces and electric fields" resulted in several contributions to scientific publications, and his work Mnimosti v Geometri was made during this time.[171]

Florenskii had asked Vladimir Favorskii (1886-1964), an artist and expert xylographer to design the cover of his book: Imaginary Points in Geometry. Favorskii had also given lectures at the VKhUTEMAS from 1921 to 1923, and was the one to invite Florenskii to his position at the VKhUTEMAS. Similar to Florenskii's interest in the function of time within geometry, Favorskii had believed in composition as a way to organize time.[172] Florenskii's belief of the mixture of geometry and art is seen within his explanation of Favorskii's cover to his book Mnimosti v Geometri, written in the book itself.

The cover is an artistic depiction of two surfaces. It was important to establish the plane separating the two sides, and that the page must be understood as a thin "representational space" that is an abstract colourless concept.[173] Thus the other graphical elements are projecting forwards and backwards. The left side of the engraving is depicting the visible surface of the plane, and the right side is the imaginary, mental side.[174] This engraving and every single element is deeply thought through to depict Florenskii's thoughts on imaginary space, from the placement of the mathematical imaginary number references, to the quality of the hatching lines.

169. English, "Arkhitektura I Mnimosti," 168.

170. English, 168.

171. Sokolov and Pyman, "Father Pavel Florensky and Vladimir Favorsky," 239.

172. Sokolov and Pyman, 237.

173. Pavel Aleksandrovič Florenskij, "Explanation of the Cover (1922)," in *Beyond Vision: Essays on the Perception of Art*, by Nicoletta Misler, trans. (c) Reaktion Books (London: Reaktion books, 2002), 10.

174. Florenskij, 12.

Figure 41
Makovetz Journal Cover
Wood engraging by Vladimir Favorskii, 1923

Figure 42
The book cover to Pavel Florenskii's Mnimosti v Geometrii (Imaginary Points in Geometry)
Wood engraving by Vladimir Favorskii, 1922

Figure 43
The cover to Pavel Florenskii's Chislo Kak Forma (Number as form)
Wood engraving by Vladimir Favorskii, 1922

2.5.3.2 The Philosophy of the Super-Body

I must include a preface for my readers for this subsection. This subsection is unique as the scholar English, to date, has been the only one to publish in the West research upon Florenskii's concept of the super-body, found in the transcription of his lectures in the book Analiz[175]. As such, the conclusions and quotes discussed in this subsection can be traced back to pages section 5.2 of "Arkhitecktura I Mnimosti."[176] This subsection is included here for context, and this subsection is referenced once more in section 4.4, wherein I use Florenskii's concept of the super-body as one of the theoretical bases to draw from for the conclusions made in chapter four.

Florenskii believed in the importance of the fourth dimension by understanding it through time, as well as how we perceive reality as he writes in Analiz, "Everyone knows of course, that reality is found in time, how we ourselves are in time, and that, consequently, all of our perceptions and assessments of reality are connected with time."[177] To him, any object has a thickness of time and the whole picture can only be wholly examined by incorporating a discussion of the fourth dimension.[178] As such, any object has properties in all four dimensions, and in our third dimensional universe, we are only seeing fragments of it as time passes us by – similar to what is described above with Uspenskii's theory on the fourth dimension. The third dimension are just slices of a bigger whole that we cannot perceive:

> If the representation of the third dimension is absent, or, for that matter, if spatial representation is not developed at all, then no effort can be taken to combine all the slices [of reality] into one whole spatial image, and many of them will remain in segments, and each slice will be depicted - on its own … And the idea of reality turns out to correspond to its true form no more than if one replaced the image of an oak tree with the crosscut section of its stump, or the human body with a crosscut section of a frozen corpse.[179]

> When we talk about corporeality, that is, three-dimensionality, all sorts of things in the physical world and fundamentally deny the physical reality of things in one or two dimensions, … We consider objects of one or two dimensions to be abstractions. The same is not the case with the fourth dimension - in time: every real object certainly has its own duration, large or small - it makes no difference. But this tiny part of time of the fourth coordinate definitely exists, and a three-dimensional object has zero duration, zero thickness in time, and is an abstraction and cannot in any way be considered part of reality [without the fourth dimension.] Thus, in addition to the impossibility of the object being perceived, it could not be conceivable, for the very processes of thought, that is, true thoughts, flow in time and they themselves have their own duration and sequence of elements.[180]

175. Florenskii, *Analiz*.

176. English, "Arkhitektura I Mnimosti," 169–71.

177. Florenskii, *Analiz*, 186. Translation by the author.

178. English, "Rethinking the Russian Avant-Garde," 8.

179. Florenskii, *Analiz*, 193,194. Translation by the author, quoted in, English, "Arkhitektura I Mnimosti," 170.

180. Florenskii, *Analiz*, 189. Translation by the author, quoted in, English, "Arkhitektura I Mnimosti," 169,170.

181. English, "Rethinking the Russian Avant-Garde," 8.

182. Florenskii, *Analiz*, 195. Translation by the author, quoted in, English, "Arkhitektura I Mnimosti," 170.

183. The nearest star, Proxima Centauri, is in reality only 4.24 light-years away

184. Florenskii, *Analiz*, 192.

185. Florenskii, 192,193. Translation by Author.

186. English, "Rethinking the Russian Avant-Garde," 9.

187. English, "Arkhitektura I Mnimosti," 206, 207, 213–18.

Florenskii named this concept, this whole, "a super-body:"[181]

> And so, all reality is extended in the direction of time no less than it is extended in each of the three directions of space. Every snippet of reality, once it is actually perceived or truly accepted, has its own timeline … In other words, every real entity has four dimensions and, if we consider it as a whole, some formation of four-dimensional geometry, then it is, not a body, but a super-body.[182]

To further demonstrate his point about the thickness of time, Florenskii brought up interstellar communications. While on Earth communications are instantaneous due to Earth's size, once we reach interstellar magnitudes even the speed of light will seem slow, as light is the fastest phenomenon that we know of. Florenskii gave the example that it might take seven years to send communications to the nearest star,[183] and millions of years to reach even further ones.[184] With this explanation in mind, Florenskii wrote,

> As we see, here the thickness in time of even the fastest phenomena is already clearly mentioned, and there is no possibility of thinking about it as negligibly small, thus, every part of reality, even the purely physical, has its own thickness in time and cannot in any way be discussed only in three-dimensions. What has been said will be strengthened immensely if we consider the physiological, mental, physiological and psychological aspects of reality, as perceived in genuine experience. Here, all the more, reality must be recognized in all its parts and individual configurations as four-dimensional.[185]

As can be seen, Florenskii argued that time as a dimension also does not just have one single reality but can also be consolidated into all sorts of different systems such as the ones described above.[186] His worldview encompassed a true synergy of mathematics, science, and arts, and his ideas had an impact on Russian avant-garde thinkers such as Melnikov's architectural visions.[187]

2.6 Summary

This chapter serves to provide a historical basis for Russian avant-garde architecture. It is important to understand the intellectual history of the Russian avant-garde – from Lobachevskii and his discovery of non-Euclidean geometry, the Russian Slavophile movement in the 19th century, and the subsequent Cosmist movement.[188] In engineering, there was the engineer Shukhov and his contributions to the field of architecture through his hyperboloid towers.[189] In philosophy, there were figures such as Fedorov with religious cosmic ideas, Uspenskii with his "higher logic," and Florenskii with his idea of a "super-body" due to the thickness of time.[190] With the understanding of how mathematical discoveries were disseminated and applied to philosophical thoughts, hyperspace philosophy arose from the appearance of n-dimensional geometry. On the whole, philosophy merged science, art and mathematics, leading to a uniquely Russian literary and artistic avant-garde culture.[191] The next chapter will delve into how this culture of cosmic vision and spiritual geometry that grew from Slavophile ideals is represented within the visionary architecture of the Russian avant-garde.

188. English, 9,10.

189. English, 10.

190. English, 11–13.

191. English, 1,2,9-12.

Introduction

Visionary Architecture and the Visions of the Modern Movement

The Emergence of Cosmos and Geometry in the Russian Avant-garde

3 The Cosmos and Geometry as seen in Russian Visionary Architecture and Speculative Drawings

Four-Dimensional Geometry as a tool to explore Russian Avant-Garde Visionary Architecture

Conclusion

3.1 Introduction

This chapter aims to apply the knowledge of Russian intellectual history from Chapter 2 with the theory of visionary architecture from Chapter 1 to work done by architects during the Russian avant-garde. How is this rich Russian culture present within architects' visionary architecture? Going through the different groups of architects, Suprematists, Rationalists, and Constructivists, this chapter aims to look closely at the visionary architecture from these differently-aligned architects and understand how the broader culture influenced them within their specific design philosophies. This chapter discusses three different movements of art and architecture: Suprematism, Rationalism, and Constructivism, along with one architect who did not align himself with any group. Within the Suprematist visionary architects, I will discuss El Lissitsky and his hypergeometry proun series, as well as Lazar Khidekel's Orthodox and cosmic-oriented designs. Within the Rationalist architects, was Nikolai Ladovskii, the biggest contributor to the pedagogy of the VKhUTEMAS. Krutikov. Ladovskii's former student and head of Ladovskii's laboratory was Georgii Krutikov,[1] and both of these architects had a focus on flight, technology, and social commentary through their visionary architecture. We will consider the Constructivist Vladimir Tatlin and his cosmic, mechanical tower, perfectly encapsulating the ideals of the 1920s. Lastly, I will discuss Melnikov, who was forbidden from practicing built architecture, and his turn to visionary architecture to continue participating in architecture. Selected projects from Chapter 3 will also serve as explanations for the further explorations and discussions that occur in Chapter 4. All of the projects, from the practical to the unpractical, are example of how visionary architecture as a medium allows us to see deep within a culture's philosophical, political, and sociological values.

1. Anna Bokov, "Teaching Architecture to the Masses: Vkhutemas and the Pedagogy of Space, 1920-1930," *ProQuest Dissertations and Theses* (Ph.D., United States -- Connecticut, Yale University, 2017), 122, ProQuest Dissertations & Theses Global (2017159181).

3.2 Suprematist Visionary Architects

3.2.1 El Lissitsky

Lazar Lissitsky, (1890-1941), shortened to El Lissitsky in English while in Russia he went by his first initial, "L", Lissitsky was a prominent architects and artist in the Russian avant-garde. Under the mentorship of Malevich, Lissitsky contributed greatly to the Suprematist movement. Lissitsky saw Suprematism as a technique, rather than a style of drawing, the same way someone can choose what kind of technical perspective to employ in a drawing, such as reverse perspective, fisheye lens, or orthographic.[2] Lissitsky used Suprematism as a technique in its visual strength, as he mentions in his 1922 New Russian Art: A Lecture:

> "Suprematism has confined the dynamic within itself, the dynamic as the origin of tensile forces. Suprematism has not, like Impressionism, portrayed movement; it has not, like Futurism, depicted the appearances of movement. It has formed dynamic tension by means of the relations between flat surfaces and colours. This canvas has grown out of the artist [organically] .... Every flat surface ... is a sketch of reality."[3]

By using Suprematism as a technique, Lissitsky had the use of another mode of representation for his study of geometries. The dynamic nature from the use of colour and bold simple shapes allowed him to focus on his theory rather than on visual complexities. He later expanded on his mode of graphical representation and its intersection with geometry in his 1925 essay: the non-objective workd. Within this essay, he discusses graphical representation of space by using geometry – he mentions how perspective is by most seen as the obvious way to show space, despite history of other types of ways to visualize three-dimensional space.[4] In this essay, he had a section titled "Irrational Space" where he talks about a positional system based on distance being measured only through colour and its intensity. Lissitsky used one of Malevich's paintings to illustrate his example (Figure 44). He also mentions the concept of white being the colour of space and unity.[5]

Additionally, Lissitsky talks about Lobachevskii's disproof of Euclidean space, and how a cube may be represented on such a space compared to Euclidean space. This leads into a discussion of how different multi-dimensional spaces, while existing algebraically, are impossible to visualize or conceive of. Lissitsky wrote that artists of his time believed that space and time are

2. Richard J. Difford, "Proun: An Exercise in the Illusion of Four-Dimensional Space," *The Journal of Architecture* 2, no. 2 (January 1997): 117,118, https://doi.org/10.1080/136023697374487.
3. Sophie Lissitzky-Küppers and El Lissitzky, *El Lissitzky : Life, Letters, Texts* (New York: Thames and Hudson, 1980), 338.
4. Lissitzky-Küppers and Lissitzky, 353–58.
5. Lissitzky-Küppers and Lissitzky, 354.

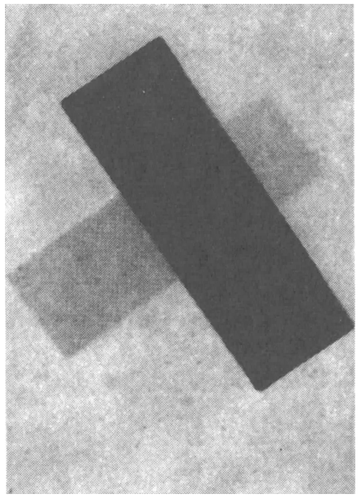
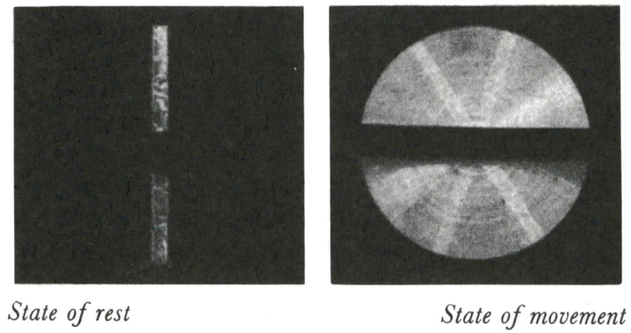


Figure 44
Composition by Malevich
This is one of Malevich's paintings that Lissitsky used in his essay as an example about a positional system using only colour and intensity, and that these distances are irrational.
Painting by Malevich, n.d.

6. Lissitzky-Küppers and Lissitzky, 355.

interchangeable, however he disagreed, and proclaimed that time is one-dimensional, in that it does not have depth. As Lissitsky wrote, "Space factors are *divergent*, time factors are *sequential*. This we must grasp clearly."[6] To him, time is observed by looking at moving objects in space.

As a result, Lissitsky introduced the concept of Imaginary Space and the name likely devolved from his earlier writings about mathematical imaginary numbers, which work mathematically but go against human instinct. Lissitsky's example of creating a form out of motion is demonstrated with a very simple example in Figure 45, which shows how the trail of an object in motion generates a completely *new* object. It is the concept of movement,



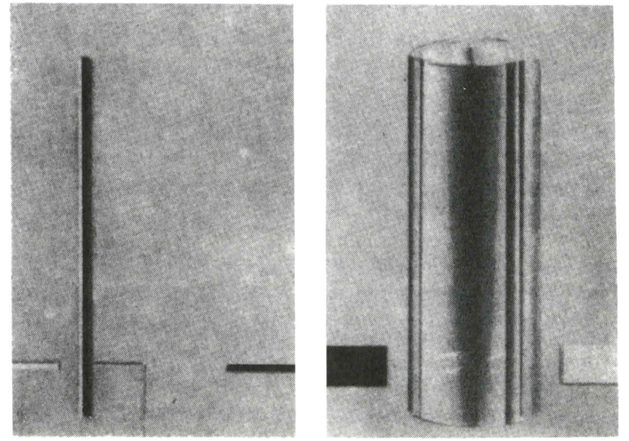


Figure 45
Imaginary surface and solid produced by rotation
Diagram by El Lissitsky, ca. 1925

which is the founding of the construction of Lissitsky's Imaginary Space.[7] What Suprematism as a technique achieves is symbolizing the dynamic through a static medium,[8] which allowed Lissitsky to explore his geometrical theories using a visual medium. Ultimately, Suprematism as a technique could not exist without its foundation of geometry. Lissitsky had said that rationality and imagination is where art comes from.[9]

As discussed in chapter 2, the rise in popularity of geometry and art in Russia went hand in hand with a cosmic spiritual philosophical influence, and this can be seen in Lissitsky's work.

El Lissitsky had written that "we are living through an unusual period in time a new cosmic creation has become reality in the world a creativity from within ourselves which pervades our consciousness,"[10] and "[the] path into the future ... is the path leading from creative intuition."[11] Lissitsky also wrote that Malevich's Suprematist Square "became a beacon" for "a world which issues forth from our inner being."[12] All these sentiments about reflecting inner consciousness or expanding into a cosmic vision comes from Russian thinkers and philosophers such as Fedorov and others – these sentiments ultimately arise from the Russian spirit that was present throughout the Russian avant-garde beginning from the 19th century.

We can trace the influence of 19th-20th century Russian philosophy to Lissitsky's way of viewing the world and the way he combines art with mathematics and blends logic with imagination. Lissitsky's use of Suprematist techniques is present in both his architectural and painting projects. Alongside Lissitsky's built works was his vast amount of paper architecture and proun paintings, which like many others, delve into the fourth dimension.

7. Lissitzky-Küppers and Lissitzky, 356.
8. Lissitzky-Küppers and Lissitzky, 356.
9. Difford, "Proun," 117.
10. Lissitzky-Küppers and Lissitzky, *El Lissitsky*, 331.
11. Lissitzky-Küppers and Lissitzky, 333.
12. Lissitzky-Küppers and Lissitzky, 331.

3.2.2.2 Lissitsky's Prouns

A proun, in its singular form is an acronym which stands for *Project for the Affirmation of the New*. Pronounced pra-oon, Lissitsky formed prouns not as a form of representation of our reality, but used contemporary knowledge in the formation of an art that is not dependent on any particular event or variable of reality.[13] Combined, according to Lissitsky, these components make up something rigorous yet unmeasurable.[14]

Lissitsky later defined his prouns as "The 'way station' between painting and architecture."[15] While many take this literally, knowing his history of interest and knowledge of geometry,[16] I say that this quote can alternatively be read as the "way station" between *two dimensions* and *three dimensions,* particularly as his theories on art and mathematics are heavily documented. His prouns are a blueprint for exploring how to move between two dimensions, the second and the third, to develop a way of understanding motion and dimensions. If he could develop a way to understand the relationship between the second and the third dimension, then we could use that as a base to understand the next jump of analyzing the relationship between the third and the fourth dimension.[17]

Lissitsky took a mathematical approach to his art. To him, the mathematical concept of ratio was important as ratio corresponds with composition.[18] Many of his prouns, such as the prouns shown in Figures 46-49, feature shapes in which it is not possible to tell whether the shape is receding into the paper or popping out towards the viewer. This shows his exploration of the relationship between the shapes and the two-dimensional plane, once again referring to his prouns being an intermediary step between the two-dimensional and the three-dimensional. Overall, Lissitsky applied the use of space and geometry to his prouns through the eyes and mind of an architect. For example, he turned his proun paintings that are reflections between the two-dimensional and the three-dimensional on a flat surface, into ones that are reinterpreting that two-dimensional to three-dimensional interplay in a three-dimensional space in the form of his proun room exhibition (proun room described in section 1.3.2.).

In Chapter 4, I use Lissitsky's prouns as case studies to continue Lissitsky's research, where I make the attempt to make that jump from the third dimension to the fourth dimension. While doing so I take great care in keeping with Lissitsky's concepts of geometry and composition. His study of how he uses Suprematism as a technique to display irrational distances as well as that of imaginary space

13. Lissitzky-Küppers and Lissitzky, 358.
14. Lissitzky-Küppers and Lissitzky, 358.
15. Lissitzky-Küppers and Lissitzky, 21.
16. Elizabeth C. English, "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition" (University of Pennsylvania, 2000), 172,173.
17. English, 173.
18. Esther Levinger, "Art and Mathematics in the Thought of El Lissitzky: His Relationship to Suprematism and Constructivism," *Leonardo* 22, no. 2 (1989): 229, https://doi.org/10.2307/1575236.

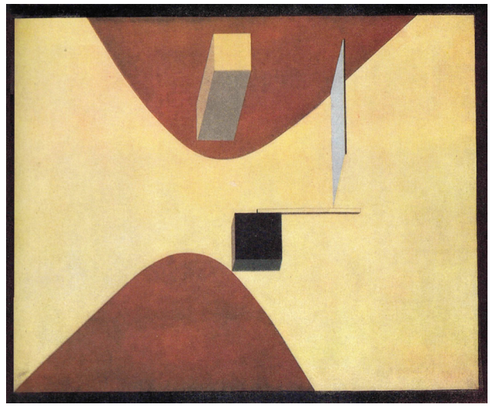


Figure 46
Proun 23, No. 6
Oil painting by El Lissitsky, 1919

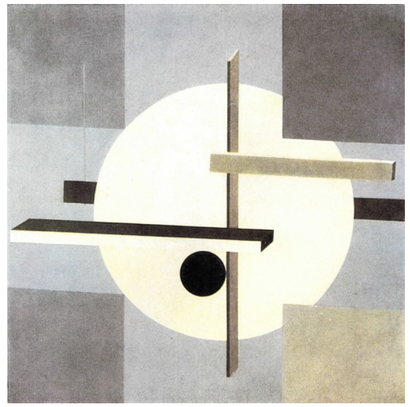


Figure 47
Proun R.V.N. 2
Painting by El Lissitsky, 1923

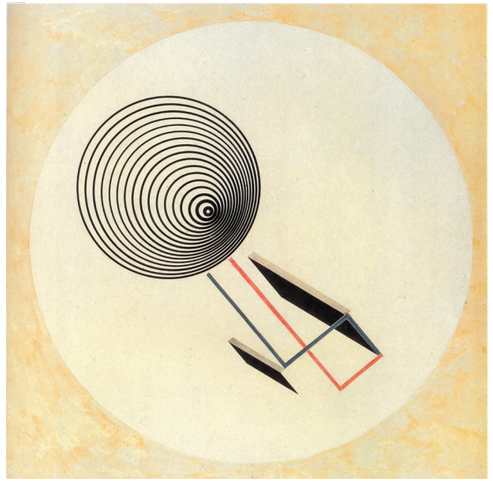


Figure 48
Proun 93, Free-floating Spiral
Watercolour and ink painting by El Lissitsky, n.d.

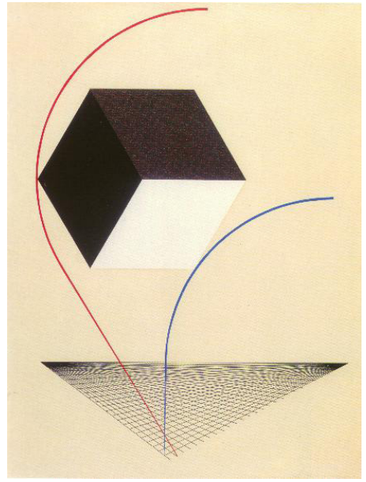


Figure 49
Proun
Collage by El Lissitsky, 1924

is important to understand as I employ both these techniques in Chapter 4 to employ drawing as research when expanding on this valuable topic.

Understanding the history and cultural influences that led him to look at architectural geometrical forms leads to a more complex view of his proun work within the context of his role as an architect and the intellectual and philosophical influences of his culture. His visionary work had been influenced by many Russian avant-garde thinkers within and outside of architecture, and his visionary work had inspired other architects. Within this context, his visionary work can be better understood.

3.2.2 Lazar Khidekel

Lazaar Khidekel(1904-1986) was both a painter and an architect. Khidekel went to the Leningrad Architecture School and was exposed to the ideas of Malevich there, and studied directly under Malevich. Throughout his schooling, Khidekel rose to become the leader in the avant-garde section of the school, and started working on bringing Suprematism into the architectural world.[19]

Regina Khidekel, Lazar's daughter in law and the head of the Lazar Khidekel Society wrote, "He believed that the initial artistic vision and form of an architectural structure determined its function..."[20] This illustrates well the purpose of visionary and paper architecture, as the initial idea in its entirety is the finished product, it does not have to be built to be finished. Visionary architecture stems from that initial artistic vision, as there are no built results to analyse to see how the public reacts to it. With this reminder of the qualities of visionary architecture, we can start to explore some of the cosmic ideas behind Khidekel's work.

Khidekel, like many other avant-garde artists and architects in the rapidly evolving technological era, took interest in spaceflight.[21] Many of Malevich's students, including Khidekel, translated the geometric forms into space stations, as these three-dimensional volumes and structures were seen as cosmic homes for the future of earth's spacefaring population.[22] Tsiolkovskii's science fiction stories were also quite popular. Khidekel took great inspiration from Malevich in terms of exploring the cosmos through Suprematist forms and elevated the concept to architecture rather than leaving it in the painted realm.

Rather than his work just showing the interest that many students had, especially pervasive at the university, I argue that the link

19. Boris Kirikov and Anna Vallye, "The Leningrad Avant-Garde and Its Legacy," *Future Anterior* 5, no. 1 (2008): 19, https://doi.org/10.1353/fta.0.0010.

20. Regina Khidekel, ed., "Introduction," in *Lazar Khidekel & Suprematism*, by Regina Khidekel, Lazar Khidekel and Suprematism (New York: Prestel in association with Modernism Inc., San Francisco, 2014), 7.

21. Charlotte Douglas, "Aero-Art, The Planetary View: Kazimir Malevich and Lazar Khidekel," in *Lazar Khidekel & Suprematism*, ed. Regina Khidekel, Lazar Khidekel and Suprematism (New York: Prestel in association with Modernism Inc., San Francisco, 2014), 27.

22. Regina Khidekel, Khidekel and the Cities of the Future, interview by Elena Dobriakova, accessed April 13, 2023, https://thecharnelhouse.org/2013/12/25/khidekel-and-the-cosmist-legacy-of-suprematism-in-architecture/.

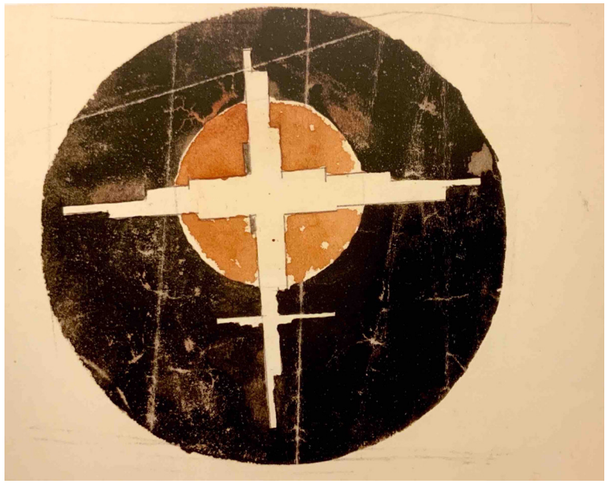


Figure 50
Suprematist Structure in the Cosmos
Gouache and ink painting by Lazar Khidekel, 1921

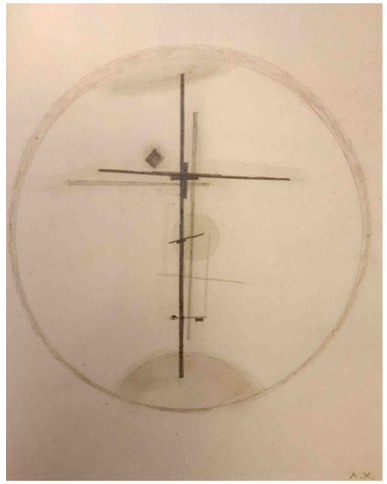


Figure 51
Cosmism: Suprematist Shadow in the Cosmos
Pencil drawing by Lazar Khidekel, 1922

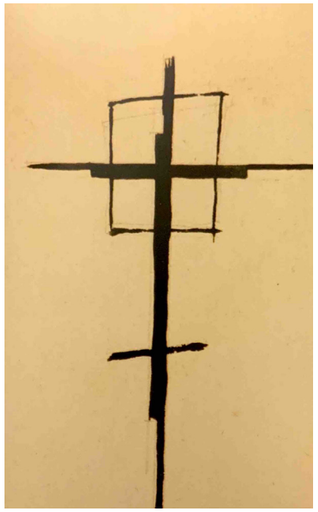


Figure 52
Design for a Cosmic Habitat
India ink drawing by
Lazar Khidekel, 1920

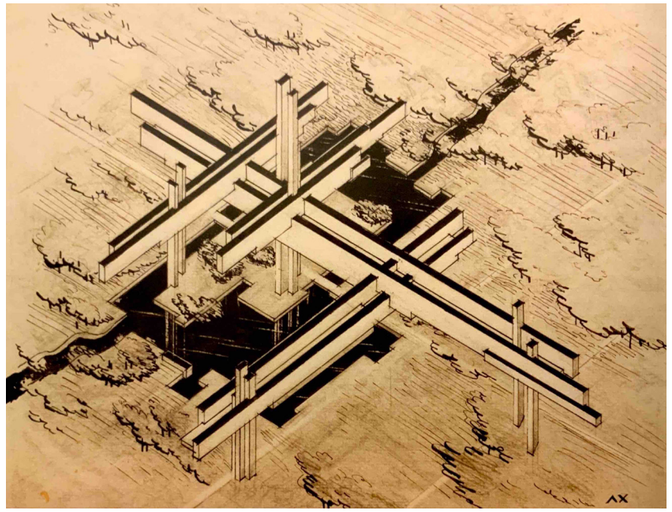


Figure 53
Design for a Futuristic City on Piers
India ink and pencil drawing by Lazar Khidekel, 1926

23. English, “Arkhitektura I Mnimosti,” 163.

24. Seeing the connection English makes (English, “Arkhitektura,” 161–63) with regards to Malevich’s connection to Fedorov, the same can be seen with Khidekel’s work as well.

between Khidekel’s work and Fedorov’s Common Task is clear. Considering his mentorship under Malevich, who also had Orthodox Christian references such as the Black Square (in its exhibition location),[23] the very obvious Christian cross imagery in Khidekel’s paintings, and his focus on cosmic dwellings and space colonisation in particular (as explained earlier about Fedorov’s thoughts of colonising God’s world), Fedorov’s ideas are present in many aspects throughout the entirety of his work.[24]

The visual qualities of the cosmic influences, tied together with the Orthodox Christian ones, are very evident throughout Khidekel’s work, as seen in the drawings shown below. As well, the of the titles make clear references in their use of the word “cosmic”and its variations. Taking “Suprematist Structure in the Cosmos” (Figure 50) as an example, the symbol of the Christian cross, on a black circular background with another red planetary body clearly make a reference to outer space and a celestial object, and the circular nature of the black square might be another reference to the infinite nature of space. Figure 51, “Suprematist Shadow in the Cosmos,” similarly features a reference to outer space, with the circles depicting planets. The Suprematist space dwelling resembles a Christian cross. The cosmic habitat in “Design for a Cosmic Habitat” (Figure 52) also represents a Christian cross. Khidekel did not focus his work on the physics of space travel, but instead focused on human perception, or the human scale, as seen by the “Design for a Futurist City on Piers” (Figure 53).

Turning Malevich’s Suprematist two-dimensional geometrical forms into three-dimensional ones, Khidekel starts to suggest that the forms could be functional for humans, as his floating space stations with their arms and body, placed in the context of space start to indicate a building. Khidekel brought Malevich’s ideas about the connection between science, art, and perception of form into the architectural realm with his visionary drawings.

3.3 Rationalist Visionary Architects

Rationalism was an art movement developed by Nikolai Ladovskii (1881-1941) that, in short, meant to discover the rationalizations behind the perceptions of the human mind so that these could be applied to architectural space.

3.3.1 Nikolai Ladovskii

Ladovskii was the founder of the group ASNOVA (Association of New Architects) and played an influential role in ZhIVSKULPTARKh (Commission for the Synthesis of Painting, Sculpture and Architecture), INKhUK (Moscow Institute of Artistic Culture), and ARU (The Union of Architects-Urbanists). These groups were important in Ladovskii's founding of Rationalist theory in the VKhUTEMAS.

After the disbandment of ZhIVSKULPTARKh, many of the members flocked to InKhUK, where within a year, a subgroup had formed and replaced the leader with one of their own: the architect Aleksandr Rodchenko. The group divided into two different practices: Russian Constructivism and Russian Rationalism. Russian Constructivism was about the rationality of construction, while Russian Rationalism emphasized the role of composition and human psychology. Ladovskii then formed ASNOVA, a group he formed to separate his ideas from those of the Constructivists.[25] Ladovskii was interested in the spatial qualities of architectural form as well as the cognitive psychology of perception.[26] These were the main themes for Ladovskii's ASNOVA group, and these values are associated with Rationalism. Ladovskii's ASNOVA Rationalist group was thus named Rationalism as the members hoped to discover rational principles behind the emotional, psychological reaction so that these principles could be applied to elicit the desired emotional reaction from the design of an architectural space.[27]

Ladovskii later formed ARU in the late 1920s after spending time on city planning projects. This group focused on researching urbanism through a scientific approach.[28] Urban planning in this group continued to stress the importance of the psychology of architecture within city planning. His theory was backed up by research conducted by the group as well as by practical applications.

25. Alan Colquhoun, *Modern Architecture*, Oxford History of Art (Oxford ; New York: Oxford University Press, 2002), 122.

26. Milka Bliznakov, "Nikolai Ladovskii: The Search for a Rational Science of Architecture," *The Soviet and Post-Soviet Review* 7, no. 1 (1980): 170–96, https://doi.org/10.1163/187633280X00101; Colquhoun, *Modern Architecture*, 122.

27. Bliznakov, "Nikolai Ladovskii."

28. Bliznakov, 185.

29. Bokov, "Teaching Architecture," 164.

30. Bliznakov, "Nikolai Ladovskii," 183.

31. Bliznakov, 174.

32. English, "Arkhitektura I Mnimosti," 144.

33. English, 144.

Ladovskii continued to develop his Rationalist theory while a professor at the VKhUTEMAS With the help of Georgii Krutikov (section 3.3.2), Ladovskii created and constructed measurement devices for his research on human perception. Ladovskii included in his psychoanalytical method a way to analyse properties of material forms: geometric (relationship of surfaces), physical (weight and mass), mechanical (stability and mobility), and logical (articulation of a surface).[29] Three examples of such devices are as follows (see also Figures 54-56):[30]

Prostrometr (Space-Eye-Meter)– Examines the spatial properties of forms.

O-Glazometr (Volume-Eye-Meter) – Checks a person's perception towards different properties relating to three-dimensional volumes.

Plo-Glazometr (Plane-Eye-Meter) – Checks a person's perception of surface qualities.

3.3.1.1 Ladovskii's Social Housing

Ladovskii created his design for a commune (Figure 57) for the theme "Architectural manifestation of a communal house" in the Nineteenth State Exhibition in Moscow.[31] There is a cosmic theme evident throughout these drawings. The 1920 Design for a Commune resembles a rocket lifting off the surface of a sphere – a planet.[32] His sketch from 1921 of a Collectivist House (Figure 58) is even more apparent as having cosmic connotations, as the top storey looks like a rocket ship.[33] While these projects were not feasible for construction, they are perfect examples of visionary architecture. Rationalist theory is the backbone of the entire design for these social housings. Along with the work Ladovskii put into the housing portion and the organization of the social order within these sketches, we can also see Fedorovian cosmic ideals popular in Russian intellectual circles during this time applied to his architectural formulations.

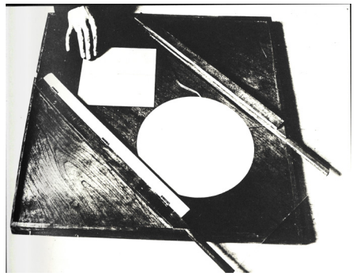


Figure 54

Prostrometr (Space-Eye-Meter)
Developed at the Psychotechnical Laboratory at the VKhutemas by Nikolai Ladovskii and Georgii Krutikov, 1927
Photograph Author uncomfirmed

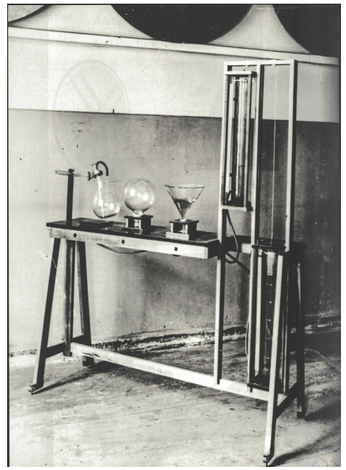


Figure 55

O-Glazometr (Volume-Eye-Meter)
Developed at the Psychotechnical Laboratory at the VKhutemas by Nikolai Ladovskii and Georgii Krutikov, 1927
Photograph author uncomfirmed

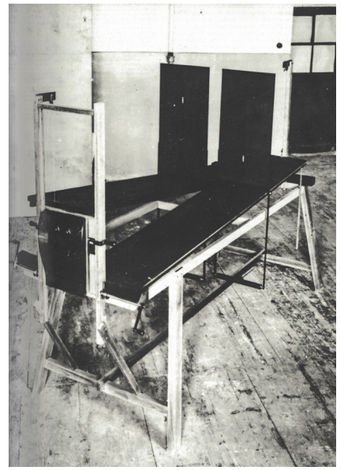


Figure 56

Plo-Glazometr (Plane-Eye-Meter)
Developed at the Psychotechnical Laboratory at the VKhutemas by Nikolai Ladovskii and Georgii Krutikov, 1927
Photograph author uncomfirmed

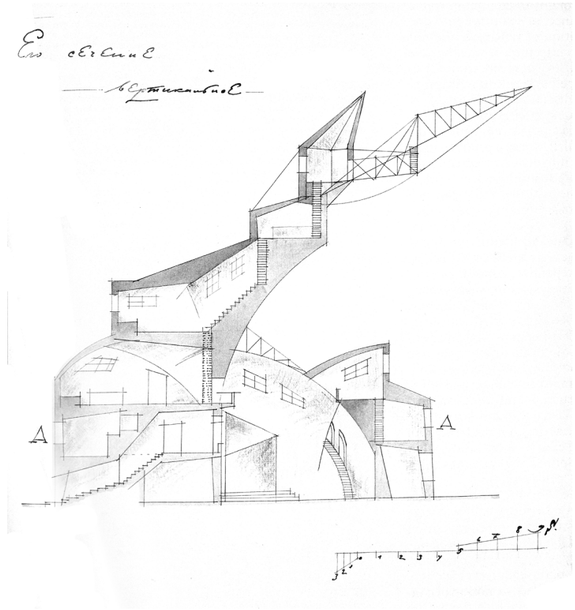


Figure 57

Design for a Commune
Sketch by Nikolai Ladovskii, 1920

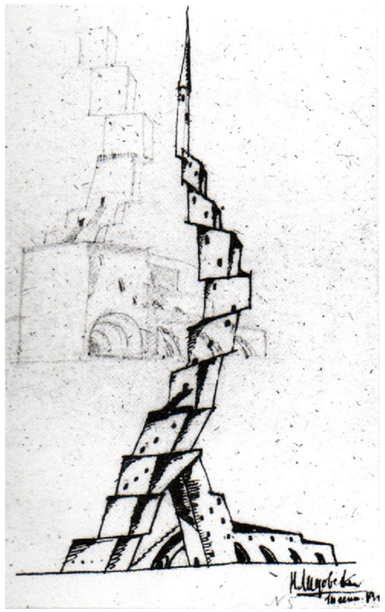


Figure 58

Collectivist House
Sketch by Nikolai Ladovskii, 1921

3.3.2 Georgii Krutikov

Georgii Krutikov (1899-1958) was one of Ladovskii's students at the VKhUTEMAS. His most famous project, the Flying City, was his final thesis project. He was always interested in mobile architecture and Krutikov's love of aeronautics is clear throughout his projects. He always had an interest in mobile architecture, even before officially working on his thesis. In his 20s, a particular interest of his was airships. He had worked with Lissitsky on design of airships, and had even written to Tsiolkovskii with an architectural airship inquiry.[34] His visionary way of city planning was rooted in his thoughts that land was precious, and should be cultivated.[35] With the world advancing technologically, Krutikov dreamed of raising cities not just above the ground but above the Earth itself, once again linking to the cosmic theme that pervaded the Russian avant-garde.[36]

3.3.2.1 The Flying City Project, 1929

In the Flying City Project, the Earth was to be used for tourism, leisure, and work, while the sky housed the people.[37] The city in the sky would stay fixed in the sky above the same spot on the ground, with the inhabitants moving around the city as they went about their lives. Figure 59 shows a plan and cross section of how the flying architectures would be arranged, in the form of an upside-down parabola shape whose center axis lines up with the center of the city on the ground. Figure 60 shows a perspective. Transportation within the sky and between the sky and the Earth was to be done using mobile cabins that could be used for a short-stay living arrangement as well as for quick transportation. Figure 61 is a drawing of the cabin module and Figure 62 is a diagram explaining the links to the residential dwellings and how it was designed to move between the residential areas throughout the different parts of the Earth. While the common name for the project "Flying City" does refer to the architecture in the sky, it is actually the inhabitants who are flying around.[38] Krutikov's name for his project was the "City of the Future" and it focused on aerial communications, again reflecting his love for aeronautics.

Krutikov was interested by the emerging and rapidly evolving rate of technology during the early 1900s. He predicted that technological progress would introduce massive changes to the field of transportation.[39] In his City of the Future, the Earth would no longer house the transportation structures for cities, and instead people would use individual transportation in the sky.

34. Selim O. Khan-Magomedov, *Georgii Krutikov: The Flying City and Beyond*, trans. Christina Lodder (Barcelona: Tenov Books, 2015).

35. Khan-Magomedov.

36. English had first made the connection between Krutikov and Cosmism in English, "Arkhitektura I Mnimosti," 143.

37. Selim O. Khan-Magomedov, *Pioneers of Soviet Architecture: The Search for New Solutions in the 1920s and 1930s*, ed. Catherine Cooke, trans. Alexander Lieven (New York: Rizzoli, 1987), 283.

38. Khan-Magomedov, 283.

39. Selim O. Khan-Magomedov, *Georgii Krutikov: The Flying City and Beyond*, trans. Christina Lodder (Barcelona: Tenov Books, 2015), 74.

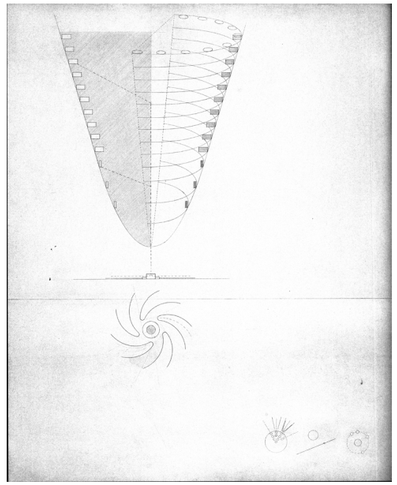


Figure 59
Plan and Section of the Flying City
Drawing by Georgii Krutikov, 1921

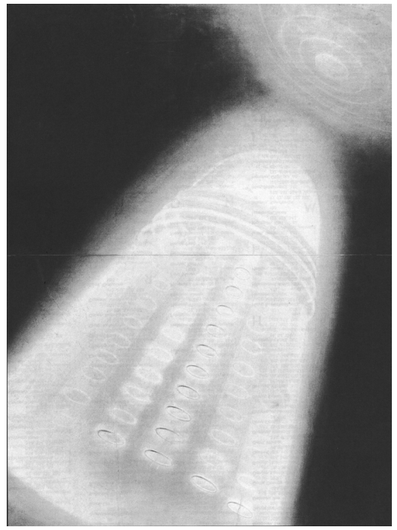


Figure 60
Perspective of the Flying City with planet Earth in the distance
Drawing by Georgii Krutikov, 1921

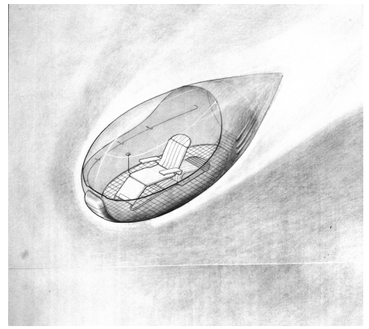


Figure 61
Drawing of the Flying Capsule
Drawing by Georgii Krutikov, 1921

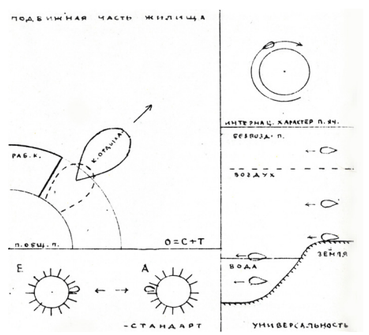


Figure 62
The Mobile Component of the Residential Structure
Diagram by Georgii Krutikov, 1921

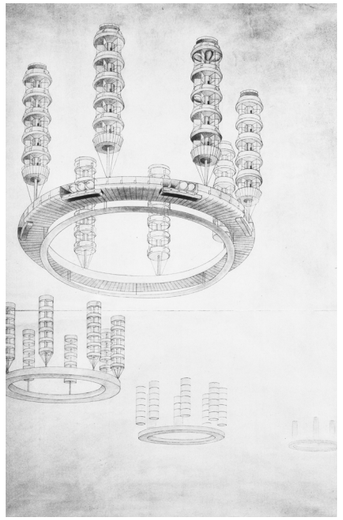


Figure 63
The first type of Living Quarters for the Flying City
Drawing by Georgii Krutikov, 1921

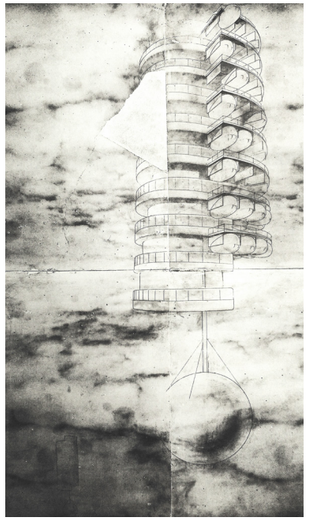


Figure 64
The second type of Living Quarters for the Flying City
Drawing by Georgii Krutikov, 1921

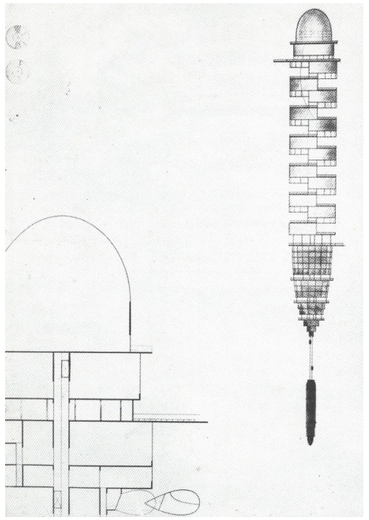


Figure 65
The third type of Living Quarters for the Flying City
Drawing by Georgii Krutikov, 1921

This reflects on his views of travel and communications.[40] However, he did not let available technology dictate the project's final form.[41] He used visionary architecture to express his thoughts on architecture and its relationship with social order and technological progress, reflecting the social and architectural dilemmas of the time.

Krutikov's living quarters were designed to be communal. As many of the architects in the Soviet era focused on the design of the living spaces due to the need for it, Krutikov also did, especially in his City of the Future. There were three types of living quarters. The first type of living quarters consisted of eight five-storey structures (see Figure 63), with the top of each storey providing a place for a mobile capsule. These vertical ring structures are attached to a horizontal ring structure which is meant to serve as the communal portion. In the second type of living quarters (see Figure 64), the homes were all stacked in one floating tower, carrying the social communal area in the sphere below it, with a lift for access. Lastly, the third type of housing (Figure 65) was a residential hotel. This was not meant for permanent stays, but rather for visitors and temporary living arrangements as needed, located outside the boundaries of the Flying City. The upper dome seen in Figure 65 was the communal space.

40. Khan-Magomedov, 85–89.

41. Khan-Magomedov, 85.

42. Khan-Magomedov, 88.

43. Khan-Magomedov, 105.

Overall, the cosmic connection is evident though how the design rationalises space in relation to the Earth and its resources. Visually, the city has forms related to the cosmos with Krutikov's rings, spheres, and the parabolic shape of the city that visually allude to the forms of celestial bodies such as the sun. By using three-dimensional space in a very vertical way, Krutikov references the scale of the cosmic frontier. Krutikov studied his fantastical proposition seriously because, to him, making a city in space, in the sky, was not just an avenue to drive his vision of architectural social reform forward, it was also a way to celebrate changing technology. He had referenced books and journals of architecture, town planning, social sciences, astronomy, natural sciences, mathematics, transportation technology, and aeronautics, with some notable authors including Tsiolkovskii, Lobachevskii, and Einstein.[42] He believed that his city would be feasible at some point in the future and did his research to design the city with an understanding of the scientific advances of the time. Krutikov approached his design carefully, and his interest in mathematics and the cosmos is a clear driving force in this visionary piece of work.

3.3.2.2 International Competition for a Memorial Lighthouse to Christopher Columbus, 1929

The Memorial Lighthouse to Christopher Columbus was submitted to a competition in Santo Domingo by Krutikov and his colleagues Andrei Bunin and Trifon Varentsov, to build a memorial monument to Christopher Columbus (Figures 66-69). Krutikov extended the prompt of the competition with a vision of exploring the cosmos. This building compositionally plays between two spheres, the bottom one representing the Earth and the top one representing a planet. The vertical line seen in the drawings is meant to be representative of a rocket trail, with mirrors to reflect light.[43]

This project pays homage to Columbus exploring the world over the oceans. This can be seen through the rotating sailboat, which also mimics the planetary rotations in our solar system. As written in the architects' explanatory note on the drawings, this monument extends Columbus's explorations one step further by dedicating itself to discovery *beyond* the Earth: outer space. It is important to recognize the cosmic connections in this monument, such as the significance of the planet, rocket trail, and moving boat, because section 4.4 will be using this monument as a starting point to explore the theories of Lissitsky and Florenskii that were prevalent during this time.

While this monument is dedicated to Columbus as per the competition theme, Krutikov's passions for flight and exploring the cosmos are clearly displayed within the project. This is a monument of possibilities, and it clearly showcases Krutikov's vision both in the architectural execution as well as the supporting text. The following are some extracts from this text (note that all bolded formatting is from the original writing):

> Beginning with the insignificant movement over **the surface** of the Earth, humanity is now about to cover the entire **volume** of the Earth's sphere and is on the threshold of discovering vast new **spaces**, beyond the confines of the Earth.
>
> … we are now standing on the verge of **great new discoveries,** beyond established limits. And recalling the **bold step** of the intrepid traveller of oceans, we must get ready for a **new, even bolder step** – the leap into universal space.
>
> The monument's pedestal … articulates various stages in the early development of human culture and provides a logical approach to the further elaboration of the fundamental meaning of the monument.[44]

44. Khan-Magomedov, 108.

Krutikov and his colleagues used the architecture to push their interest in the rising technological possibilities and cosmic connections, to arrive at new forms and develop new ideas in architecture. This is the power of visionary architecture: we can clearly see the unique influences that so many of the architects of the avant-garde integrated within their worldview to create a new architecture for a new world.

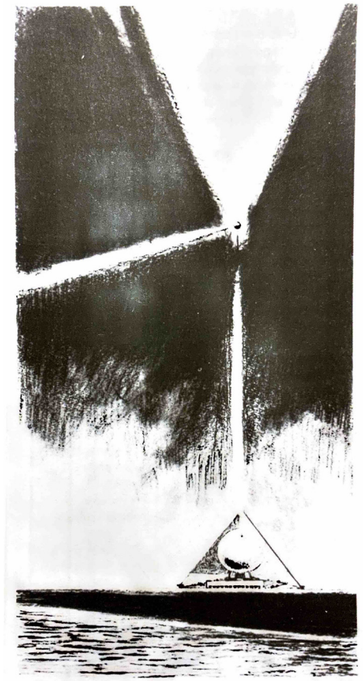


Figure 66
Design for the Memorial Lighthouse general view
Drawing by Georgii Krutikov, 1929

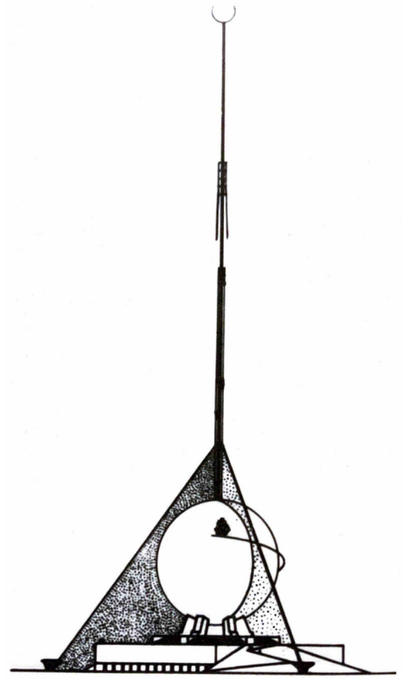


Figure 67
Design for the Memorial Lighthouse facade
Drawing by Georgii Krutikov, 1929

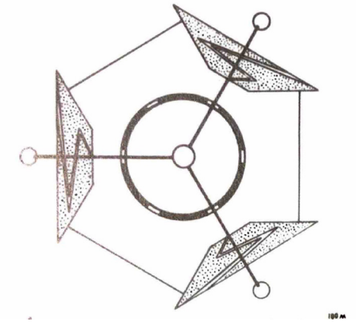


Figure 68
Design for the Memorial Lighthouse site plan
Drawing by Georgii Krutikov, 1929

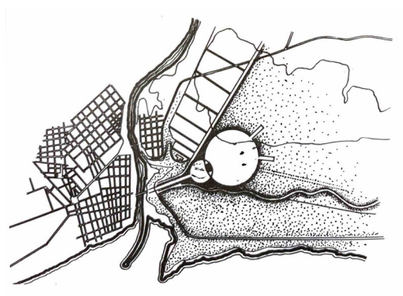


Figure 69
Design for the Memorial Lighthouse plan
Drawing by Georgii Krutikov, 1929

3.4 Constructivist Visionary Architects

Constructivism was developed by the Working Group of Constructivists within INKhUK. The original group was made up of several people: Aleksandr Rodchenko, Aleksei Gan, Varvara Stepanova, Karl Ioganson, Konstantin Medunetskii, and Georgii and Vladimir Stenberg.[45] As the group began to take shape from the discussions of the INKhUK, Rodchenko in January 1921 expressed a statement that would propel Constructivist goals from then on: "All new approaches to art arise from technology and engineering and move toward organization and construction."[46] In the early years of Constructivism as it was still developing into a more unified theory, it was not a phenomenon that belonged solely to the field of architecture. The term "constructivism" was only brought forwards in the year 1922 by Gan.[47] Furthermore, in a post revolution world, Constructivist practices were also tied quite closely with the sociopolitical regime of this time. The goals of the Constructivists arose from their belief that technology and engineering are the basis for new art, and that these new approaches must contribute to the construction industry.

Constructivism finally solidified as a movement in the mid 1920s with the foundation of OSA (Organization of Contemporary Architects) in 1925 by Moisei Ginzburg.[48] Ginzburg defined Constructivism as a "functional architecture," and that an architect should understand the era in which they reside, to create architecture that serves the needs of that time period.[49] For Ginzburg, his era was that of a "doubly constructive" era, as the architect deals with rapidly evolving technology and the opportunities this can provide for a "new life."[50]

3.4.1 Vladimir Tatlin

Vladimir Tatlin (1885-1953) was a Constructivist who was particularly interested in physical material properties, such as texture, and this led to many artistic engineering explorations.[51] Tatlin was one of the first to move Constructivism from the two dimensions of painting to the three dimensions of architecture and the exhibition of his Monument to the Third International (see Figure 70) that was a public exposure of three-dimensional Constructivism that inspired many others.[52]

Tatlin intended for a cosmic symbolism in the tower from the rotations of its three parts: the cube, the tetrahedron, and a cylinder: which represented the legislature, the executive, and

45. Christina Lodder, "The Transition to Constructivism," in *The Great Utopia: The Russian and Soviet Avant-Garde, 1915-1932*, ed. Solomon R. Guggenheim Museum, Schirn Kunsthalle Frankfurt, and Stedelijk Museum Amsterdam (New York: Guggenheim Museum : Distributed by Rizzoli International Publications, 1992), 267.

46. "Protokol Zasedaniia INKhUKa," January 1, 1921 and January 21, 1921, private archive, Moscow. Quoted in Lodder, 267.

47. Bokov, "Teaching Architecture," 79.

48. Bokov, 78.

49. Bokov, 165,166.

50. Bokov, 165,166.

51. Khan-Magomedov, *Pioneers of Soviet Architecture*, 64.

52. Khan-Magomedov, 64; Lodder, "The Transition to Constructivism," 272.

53. Christian Werner Thomsen, *Visionary Architecture from Babylon to Virtual Reality* (Munich ; New York: Prestel, 1994), 62; Lodder, "The Transition to Constructivism," 272.

54. Kirill Sokolov and Avril Pyman, "Father Pavel Florensky and Vladimir Favorsky: Mutual Insights into the Perception of Space," *Leonardo* 22, no. 2 (1989): 238, https://doi.org/10.2307/1575237.

55. Leon Trotsky, *Literature and Revolution.*, Ann Arbor Paperbacks for the Study of Communism and Marxism (Ann Arbor, Michigan] The University of Michigan Press [1966, 1960, n.d.), 210,211.

the propaganda ministry of the Comintern respectively.[53] The inclination of the tower also matches that of Earth's axis, so this along with the differing rotations and its projected height of almost 400m, there is the sense of reaching for outer space Additionally, the lower cubic portion was meant to rotate a full 360 degrees in one year, the middle portion once a month, and the top once a day. One could imagine the rotation of the tower as rotations of any number of types of celestial bodies. Furthermore, in the more mystical sense of the cosmos rather than the pure mechanical was Tatlin's interest in Florenskii's concept of technology and how technology serves as an extension of the human body.[54] Interestingly, Leon Trotsky, a Leninist, Marxist, and a central revolutionary in establishing the Soviet Union had spoken out against early soviet poetry for its tendencies of Cosmist and mystical thinking,[55] and thus, despite the tower being seemingly

Figure 70

Tatlin's Model for the Monument to the Third International on Exhibition in Petrograd

Photograph author unconfirmed

infused with Communistic ideals, something prevented Trotsky from seeing the tower positively, potentially due to the symbolism that was being attached to the tower.[56] This negative review shows that Tatlin had successfully embedded his interest in the cosmos into his tower, and that these references are visually apparent.

The visionary nature of this monument is seen within its portrayal of a giant technological machine as well as its representation of the society in which it was made. In the social sense, it was designed to house the Communist administration and in the artistic sense, it was a functional way of transforming Constructivist ideals into an architectural form. Many factors behind the monument and Tatlin's general influences and works sets it as a valuable visionary piece of architecture to examine due to its post-revolution influences. Overall, when looking into Tatlin's work and sources, Tatlin's visionary architecture of the Monument to the Third International is yet another example of the pervasiveness of the mystical cosmic philosophical culture of the Russian avant-garde, even within the industry-driven style of architecture.

56. Gail Harrison Roman and Virginia Carol Hagelstein Marquardt, eds., *The Avant-Garde Frontier: Russia Meets the West, 1910-1930* (Gainesville: University Press of Florida, 1992), 55.

3.5 Unaligned Visionary Architect

3.5.1 Konstantin Melnikov

Konstantin Melnikov (1890-1974) was an outlier in terms of the prevailing theories of the time. He was not interested in joining the Rationalist or the Constructivist way of thinking, ending up somewhere in the middle of the two.[57] Melnikov believed that, unlike in Constructivsim, there was more to architecture than engineering, as engineering and mathematics were not a complete discipline on their own. Engineering alone could not produce architecture. Melnikov was deeply Orthodox and talked about bringing the human spirit to life through architecture, while in conversation he often turned to topics such as metaphysics and philosophy.[58]

Along with his faith, Melnikov had a fascination with death, and turned to his architecture to contend with that.[59] Offering a new kind of immortality based on memory and permanence, Melnikov was even given an opportunity to wrestle with this idea when he was presented with the privilege to design Lenin's sarcophagus, embedding within it many orthodox Christian symbolisms.[60] The iconography behind Lenin's sarcophagus alludes to Fedorov's ideas of the "battle against death," and Melnikov confirmed decades later that he meant for the sarcophagus to be equated with the story of the sleeping Princess, wherein the princess appeared to be dead but was actually asleep, just waiting to be woken up.[61]

Melnikov applied the principles of economic rationalization by still using appropriate building techniques when required, such as using Shukhov's modern and well-engineered steel girder structures in projects. To him, architecture was a synthesis of both form *and* mind. His famous "Melnikov House", that he designed for himself and his wife, and was subsequently confined to for 45 years, was deliberately made of common construction materials, optimizing the structure to his artistic vision instead.[62] He believed that while new materials and techniques can be very cost-reductive in theory, in practice new techniques and materials add to the cost instead due to the unfamiliar nature.[63] As Melnikov was not allowed to build for the latter part of his life, the Melnikov house remains one of his most famous built works. Due to accumulated rumours and his individualistic personality—not aligned to any architectural groups—he was deemed a selfish architect for not upholding the Stalinist regime and was banned from practicing architecture.[64] Melnikov then turned to the visionary realm, where, despite being

57. Catherine Cooke, *Russian Avant-Garde: Theories of Art, Architecture, and the City* (London: Academy Editions, 1995), 91.

58. S. Frederick Starr, *Melnikov: Solo Architect in a Mass Society* (Princeton, N.J: Princeton Univ. Press, 1978), 244.

59. English, "Arkhitektura I Mnimosti," 206–23.

60. Starr, *Melnikov*, 247.

61. Starr, 249.

62. Juhani Pallasmaa and Andrei Gozak, *The Melnikov House, Moscow (1927 - 1929), Konstantin Melnikov*, trans. Catherine Cooke, 1. publ, Historical Building Monograph 7 (London: Academy Editions, 1996).

63. Cooke, *Russian Avant-Garde*, 137.

64. Khan-Magomedov, *Pioneers of Soviet Architecture*, 147.

under a regime where he could not express his true thoughts in words, he expressed his thoughts, theories, and desires through his paper architecture. Additionally, not being allowed to build led him to apply to many competitions for a second chance at built works.

Most of Melnikov's projects refer back to Fedorovian ideals with architecture as a guiding force.[65] It is documented in Melnikov's interviews with Frederick Starr that Melnikov was interested in Fedorov, even if during the height of his career any reference to him and other suppressed philosophical thinkers was not documented.[66] As any references to Fedorov were hidden due to the political milieu, Melnikov's and other creatives' references to him were concealed within their respective arts, as well as any references to Melnikov's devotion to his faith.[67]

65. English, "Arkhitektura I Mnimosti," 215.

66. English, 215,223,239; Starr, *Melnikov*, 245–46.

67. English, "Arkhitektura I Mnimosti," 215, 223,239.

3.5.1.1 Palace of Soviets, 1932

When Melnikov studied architecture, he was exposed to Renaissance architecture, and was introduced to the work of Etienne-Louis Boullée, Claude-Nicolas Ledoux, and Jean-Jacques Lequeu.[68] Boullée's influence on Melnikov's entry for the Palace of the Soviets Competition (Figures 71-73) is evident in its colossal scale. This was a two-phase competition that lasted three years from 1931-1933 and called architects to design a national capital. Melnikov took to this assignment with great enthusiasm, and the historian Frederick Starr wrote, "The architect went to great lengths to ensure that the form of his Palace of Soviets would be determined by its ideological purpose, which he believed was to apotheosize the Russian Revolution and its social consequences."[69]

68. Starr, *Melnikov*, 24–25.

69. Starr, 157.

We can see the influence of his fascination with death, through the basis of the piece, which is the pyramid. While Melnikov was not the only one to use a pyramid, the revolutionary nature of his design was clear, and the gigantic size and design of his pyramid stood out from others' more simple forms. While there are many reasons this entry may have been rejected – structure, Boullée's influence, classic symbols, Starr speculates that it was most likely due to Melnikov's political ideas embedded within the piece that caused its rejection.[70] Its imagery of the lower class rising above the higher class, dealing with such an inhuman scale, represents ideas that Melnikov had had in previous work.

70. Starr, *Melnikov*. 159.

This sort of ideologically driven mode of design is what defines this visionary piece of architecture and cements it within its historical context. This theory of architecture, brought forth through thought and driving the art of architecture forwards appears in many other of his visionary pieces as well.

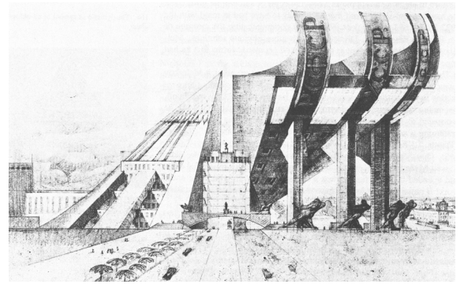


Figure 71
Project for a Palace of Soviets
Drawing by Konstantin Melnikov, 1932

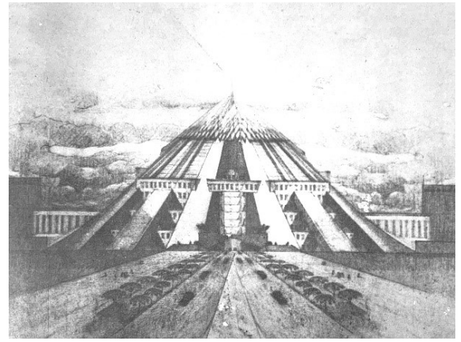


Figure 72
Project for a Palace of Soviets, Proscenium Entrance
Drawing by Konstantin Melnikov, 1932

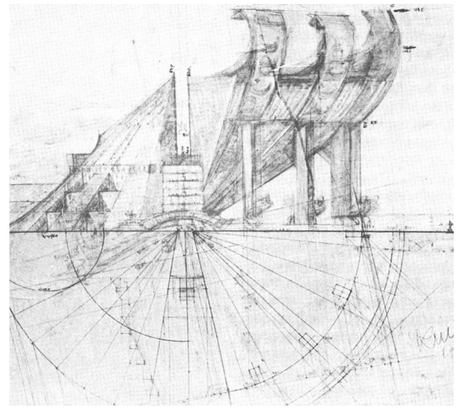


Figure 73
Sketch of the Palace of the Soviets
Drawing by Konstantin Melnikov, 1932

3.5.1.2 Monument to Christopher Columbus, 1929

This monument to Christopher Columbus for the same competition as Krutikov's Lighthouse Memorial was designed during the years of greatest upheaval of the cultural revolution in Russia. Melnikov's monument (Figure 74) was submitted as an entry for the competition run by the Pan American Union, with the prompt being to encourage and celebrate Christopher Columbus and to encourage an interest in America. While most architects focused more on the "America" rather than with the "Columbus" part, Melnikov's sculpture drew so much attention that the coordinator of the competition let Melnikov know privately that "it was considered too risky to honor [your project] with a prize."[71]

71. Starr, 166.

Similar to Boullée, Melnikov had not integrated people into his visionary pieces, and even Columbus who was meant to be the center of the entire piece is overshadowed by the rest of the structure. Melnikov's sculpture was very grandiose and monumental, with its water turbine-based rotating system, and the overall composition of the elements. Melnikov's lack of resolve of the individual human scale with the large technological world was common of many Russian avant-garde architects, as this period was in revolutionary cultural turmoil.[72] This is where the subfield of visionary architecture within architecture becomes indispensable, as it allows the expression of ideas in a pure paper form, which allowed architects like Melnikov to express architectural ideas that wouldn't translate well to "efficient" or "practical" buildings.

72. Starr, 167.

As for the design of this monument itself: the cone once again makes itself present, and there is a sense of infinity to it in the way they almost touch. As seen in Figures 75-77, the interplay of the cones brings more attention to the gap between them than to the rest of the tribute to Columbus. The dynamic nature of the two cones touching also looks like it alludes to Lobachevskii's non-Euclidean surfaces, which may have been an influence from his collaboration work with Shukhov. The dynamic nature is also seen within the design of the exterior wings. The wings are attached to a base that rotates them when there is wind, meaning that it is not a continuous rotation. The only time there is consistent rotation is during rainfall, when water is collected by the wings in a certain way that activates a turbine in the base to rotate the wings uniformly. It is important to note the feature of these wings, as in Chapter 4, I add an additional drawing to this set of competition drawings which brings attention to the movement and dynamic nature of this monument.

Overall, the architectural elements of his monument were done in a very large scale, speculating on scale and subsequently infinity, as there cannot be talk of scale without infinity, as it is a matter of spatial representation. With Melnikov's confirmed fascination with Fedorov, he was no doubt also reading the work of other Russian thinkers. Melnikov brought an introspective insight to architecture from his faith while he was addressing the rapid changing technology of the post revolution period, which can be found hidden in his architecture where it cannot be found in his writing.

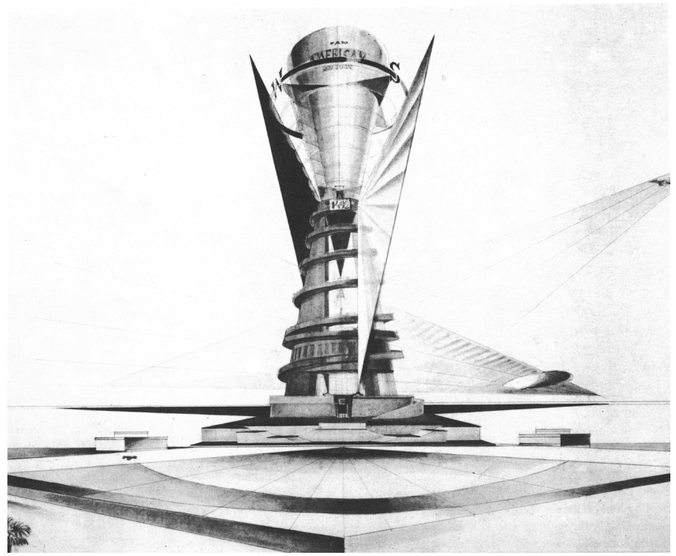


Figure 74
Project for a Monument to Christopher Columbus, Perspective
Drawing by Konstantin Melnikov, 1929

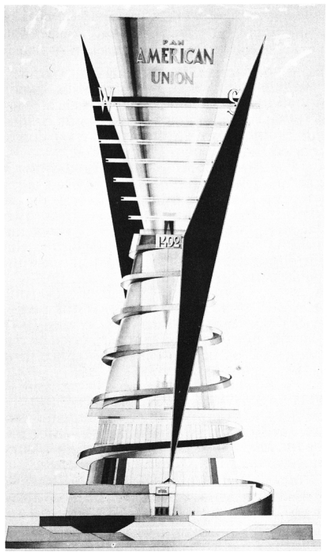


Figure 75
Project for a Monument to Christopher Columbus, Elevation
Drawing by Konstantin Melnikov, 1929

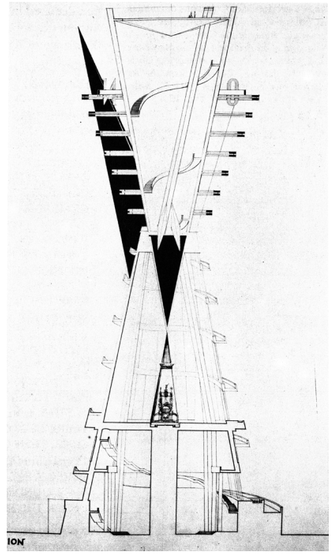


Figure 76
Project for a Monument to Christopher Columbus, Section
Drawing by Konstantin Melnikov, 1929

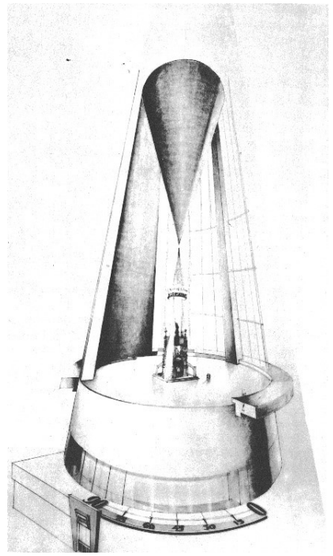


Figure 77
Project for a Monument to Christopher Columbus, Interior Perspective
Drawing by Konstantin Melnikov, 1929

3.6 Summary

Melnikov, Tatlin, Krutikov and many of the other architects of the Soviet era designed their architecture and monuments under the influences of the Russian avant-garde: technology, Cosmism, intuitive thinking, and other values previously discussed. While the visionary nature of some of the ideas (such as Krutikov's flying buildings) were still out of reach due to physical limitations, other projects were visionary due to their ambitions, such as Melnikov's and Tatlin's more structurally feasible projects. These architects found it was more important to prove their values on architecture rather than simplify it so that it could be built. And yet despite the infeasibility of their projects, it was not due to a lack of disregard for reality; for example, Krutikov followed many academic journals. The Soviet technology boom fostered development in engineering capabilities and other such disciplines, seen for example by Shukhov's engineering influence and his collaboration with many architects such as Melnikov. This also is seen in the intuitive technical explorations led at the VKhUTEMAS, and the interest in exploring beyond the third dimension. It is also seen in the interest in mathematics, brought upon by technology and the holistic approach taken by Russian Slavophilism and its philosophical extensions.

This technological boom and fascination with spaceflight helped many architects foster their connection with the cosmos. After all, Krutikov assumed that atomic energy would be available in the near future to realise projects like his. Moreover, contemporaries, such as the Cosmist writers Fedorov, Dostoevskii, Tsiolkovskii and Leo Tolstoy, also promoted an interest in spaceflight, which made its way into the social sphere of architects. Along with the Cosmist influence from Fedorov, there was an evident connection between technology and the passion for space. Many of the architect's projects responded to rapidly evolving technology, for example Tatlin and Melnikov whose gigantic scale dealt with an individuals place in a world of technology with their large structures, unable to come to a conclusion.[73]

In the Russian avant-garde architectural sphere, the interrelationship between religion, technology and space naturally developed through the visionary realm, making it an ideal medium to explore architectural ideals. The concept of the unbuilt and the unbuildable, that is, speculative architecture drawn in an unrealistic capacity is to evolve the theory of architecture. These Russian architects, with the religious and cosmic culture present during the avant-garde, made full use of visionary architecture as a tool to showcase their theories on architecture.

73. Starr, 168.

4 Four-Dimensional Geometry as a tool to explore Russian Avant-Garde Visionary Architecture

4.1 Introduction

This chapter uses drawing as a form of active research to further explore the visionary architecture of this time and how the cosmos and geometry is represented within the drawings and the architecture. Due to the nature of Russian visionary architecture mainly engaging with its early 20th century social and political climate through drawings, examining the visionary work by adding to it may yield some conclusions that are otherwise more difficult to see.

I produce drawings based on original works from the avant-garde and in doing so, the act of drawing becomes a tool for understanding. Analysing a drawing or building design with the intent to change it or add to it builds a deeper understanding of the thought processes behind the original work. After the initial breakdown of a drawing and the original architect's intent, I gain an awareness of the theoretical work of the material I intend to mix into my re-creation. Making an addition requires attention and awareness to detail which I had gained during the initial breakdown. I chose active research through drawing as my method to demonstrate to the reader how to gain an understanding of visionary architecture from deconstructing a specific piece. In the end, the reader will also gain a clearer understanding of theories from the different philosophers and architects whose work I analyse through the act of drawing.

Visionary architecture as a subset of the field of architecture is also extremely useful for an investigation, as a visionary project is typically the idea of one architect. Because of this, we are able to use an architect's visionary works as a means to more easily investigate how the surrounding culture influenced their thinking. In a built work, even if the design is primarily by one architect, a team is still required to get the project built, which means more input and ideas that get mixed together rather than the ideas of one person. In the case of visionary architecture, it is fully formed as drawings on paper because its goal is not to be built but to be imagined. That is why this chapter will be using visionary architecture as its base for explorations.

The goal of this chapter is to use drawing as a form of active research to understand the thinking behind several visionary architectural pieces from several architects so that the additions are in dialogue with the originals while adding a new proposition to each piece.

The methodology I used in this chapter is to apply theories and concepts from the 19th and 20th century to pieces from the avant-

garde in three distinct ways. First, to understand the geometry elements of the drawings, I will go through the different projections of four-dimensional geometry on a two-dimensional surface so that the projections and how they are made are understood. We as three-dimensional beings cannot conceive of the fourth dimension in its entirety, but much like we can project three-dimensional objects onto a two-dimensional plane, we can also project four-dimensional objects onto a plane, going down in two dimensions and giving us a sense of the "shadow" of the four-dimensional object. Because we need to filter these sorts of visual projections of four-dimensional space into something we can understand, there are different ways of representing them. To do this, I'd like to introduce my own characters "Ms. 2D Square" and "Ms. 3D Sphere" (see Figure 78) who will participate in many of the diagrams within this chapter to help explain concepts. These characters are a tribute to: Flatland: A Romance of Many Dimensions, by Edwin A. Abott (see section 2.4).

Once the basics of representing the projections of four-dimensional geometry are introduced, the second half of the chapter will apply several different theories introduced by Russian thinkers and build upon existing visionary architecture drawings from projects that I discussed previously. One of my experiments will build upon existing work to push the original theory further, such as in the case of trying to develop Lissitsky's proun work as a next generation of painting. The other experiments will be to add an extra drawing or two to a competition set, using hypergeometry projections as a theoretical basis, based on Florenskii's and Lissitsky's theories. Lastly, inspired by Lobachevskii's disproof of Euclidean space, I will re-imagine one of the visionary architectures in another geometrical world where light would behave differently.

After these explorations, I will discuss how the original intent of the "vision" behind the visionary architecture has been changed now that it has become a collaborative piece between the architects' original work and my additions. I have argued that visionary architecture is a form of expressing theory within a visual format, and this final chapter aims to put this part of the definition into practice. Correspondingly, my additions will engage with the concepts that were influential during the avant-garde period, thus adding another layer of information to the original work. Through drawing as a form of research, I hope to investigate and discuss in greater detail these works of visionary architecture to explore in depth how the values of the mystical philosophical intellectual culture appear within the work of Russian avant-garde architects.

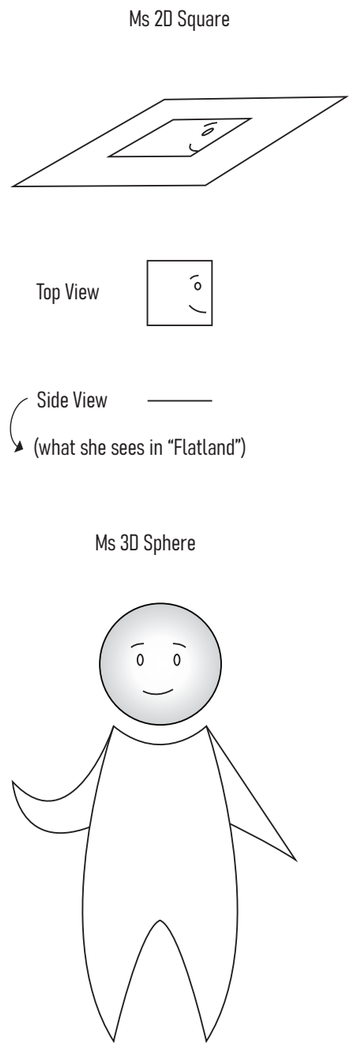


Figure 78
Introduction to Ms. 2D Square and Ms. 3D Sphere
Diagram by author

4.2 Reading Four-Dimensional Projections on a Two-Dimensional Surface

4.2.1 Moving Between Dimensions Using Increasing Units of the Form Below

There is an interesting relationship of numbers when you move from one dimension to the other. For example, in the diagram labelled, "Moving Between Dimensions Using Increasing Units of the Form Below" (Figure 79) one can see how motion can be used to move between the different iterations of the square/cube/hypercube from having it fold into itself. Firstly, by taking a line and splitting it into four, one can rotate them about their intersecting points to form a square. After that, to form a cube out of a square, two more units are required in the rotation sequence: six squares rotated about their intersecting lines will make a cube. Following this logical sequence, it is clear then that eight cubes folded in one another about their intersecting planes will form a hypercube. Figure 79 shows the non distorted view on a two-dimensional surface of the square, cube, and hypercube. This notion of the six squares to make a cube and eight cubes to make a hypercube is present within all the hypercube projections as it is the base geometry of a hypercube.

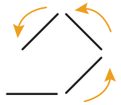
MOVING BETWEEN DIMENSIONS USING INCREASING UNITS OF THE FORM BELOW

HOW MOTION AND DUPLICATION WORK TO MOVE BETWEEN DIMENSIONS

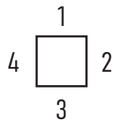
LINE
SQUARE — 4 — Four rotating lines make a square

LINE

ROTATION



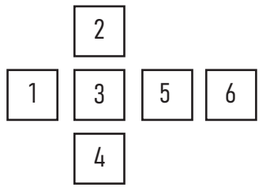
SQUARE



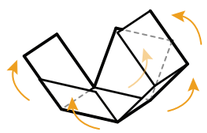
distorted view

SQUARE
CUBE — 6 — six rotating squares make a cube

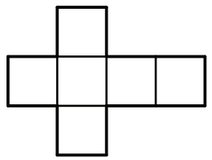
SQUARE

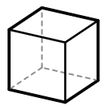


ROTATION



CUBE

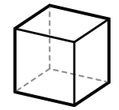




distorted view

CUBE
HYPERCUBE — 8 — eight rotating cubes make a hypercube

CUBE

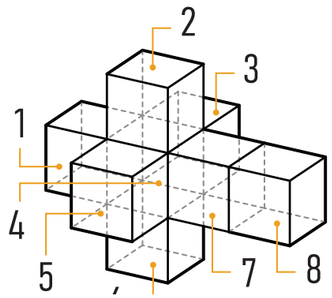


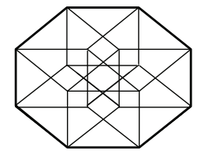
distorted view

ROTATION

cannot be perceived by three dimensional beings

HYPERCUBE





distorted view

Figure 79
Moving between dimensions using incresing units of the form below
Diagram by author

4.2.2 Understanding Projections of Spatial Dimensions Through Shadows

Shown in Figure 80, a diagram titled “Understanding Projections of Spatial Dimensions Through Shadows” explains one of the ways of understanding projections into the fourth dimension in an intuitive way. We go “down” in dimensions rather than working “up” to the fourth. As seen, the shadow or projection of a square is a line, and the projection of a line is a point. Rather than calling them by their names, in this diagram I refer to squares, cubes, and lines as what shadow they are made from. Hence, a dot is a zero-dimensional shadow of a line, a line is a one-dimensional shadow of a square, a square is a two-dimensional shadow of a cube, and a cube is a three-dimensional shadow of a hypercube. What does the four-dimensional hypercube actually look like? We don’t know, hence the examples of different projects of how we, as three-dimensional beings, can attempt to understand it. Looking at projections as shadows of a higher dimension can be a first step in understanding the world of n-dimensional geometry.

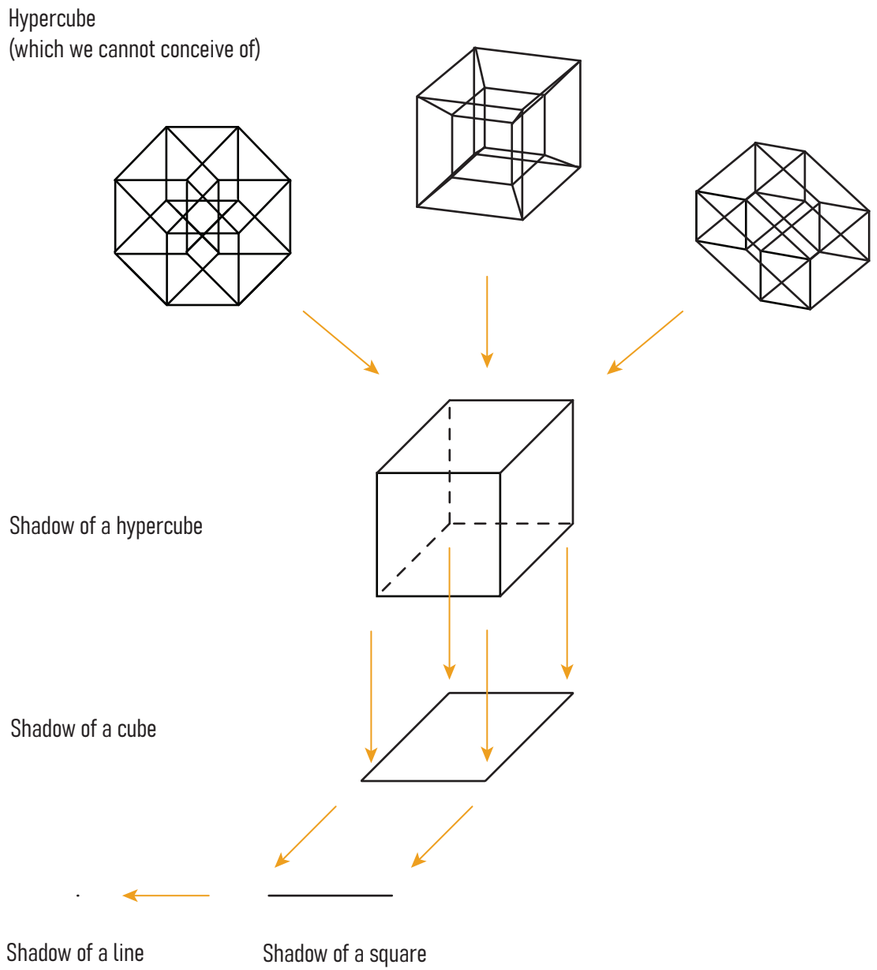


Figure 80
Understanding projections of spatial dimensions through “shadows”
Diagram by author

4.2.3 Understanding the Perspective Projection Method of Displaying a Hypercube

Understanding the perspective projection method of a hypercube as described by Claude Bragdon – is best done through a wireframe view. When looking at the projection of a cube, as seen in Figure 81, we understand that the 30° angle of the isometric projection is 90° in real life. Figure 82 explains how, when displaying a hypercube on a flat surface, we must choose yet another angle different than the one chosen for the projection of a cube to represent yet another dimension of space, in this case being the fourth dimension. Once again, just as we understand the isometric angle for a cube to be a 90° angle in three-dimensional space, we must understand that this arbitrary fourth angle chosen is representing another 90° projection into space, as explained in Figure 84. When the projection of the hypercube is seen in this projection, we can see the eight cubes that form the hypercube within the projection drawing (Figure 85). As explained by Bragdon in his explanation of projecting the square into a hypercube: "The resultant figure will be a perspective of a tesseract, or rather the perspective of a perspective, for it is a two-dimensional representation of a three-dimensional representation of a four-dimensional form."[1] Because the angles chosen for two-dimensional representation of a hypercube are arbitrary, we can end up with many different views of a hypercube that all represent the same thing. This can be seen in Figure 83.

1. Claude Fayette Bragdon, *Projective Ornament* (New York: Dover Publications, 1992), 19.

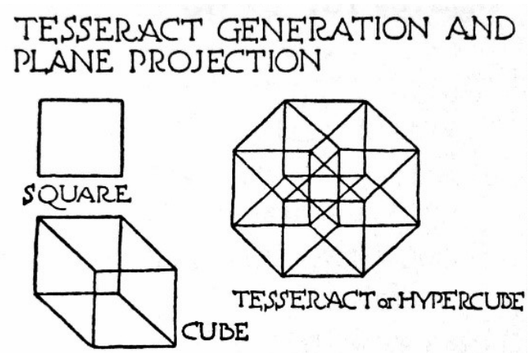


Figure 81
Tesseract Generation and Plane Projection
Digram by Claude Bragdon, 1915

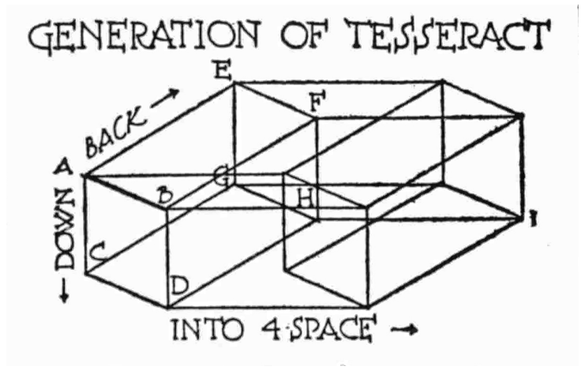


Figure 82
Generation of Tesseract
Diagram by Claude Bragdon, 1915

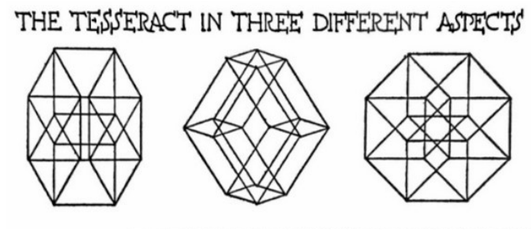
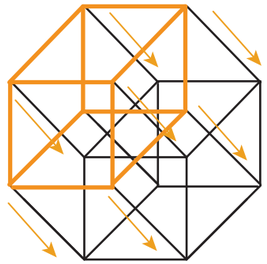


Figure 83
The Tesseract in Three Different Aspects
Diagram by Claude Bragdon, 1915

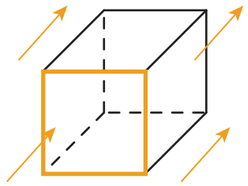
GUIDE TO UNDERSTANDING THE PERSPECTIVE PROJECTION METHOD OF A HYPERCUBE

FOURTH-DIMENSION
HYPERCUBE

We reached the point where we need to choose an arbitrary angle to represent projecting into the fourth dimension, as we cannot conceive of the fourth dimension.



THREE-DIMENSION
CUBE



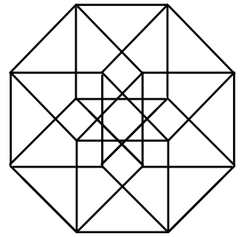
TWO-DIMENSION
SQUARE

ONE-DIMENSION
LINE

ZERO-DIMENSION
POINT

Figure 84
Guide to understanding the perspective projection method of a hypercube
Diagram by author

A PERSPECTIVE REPRESENTATION OF A HYPERCUBE



This is a two dimensional representation of a three dimensional representation of a four dimensional form

THE EIGHT CUBES OF A HYPERCUBE

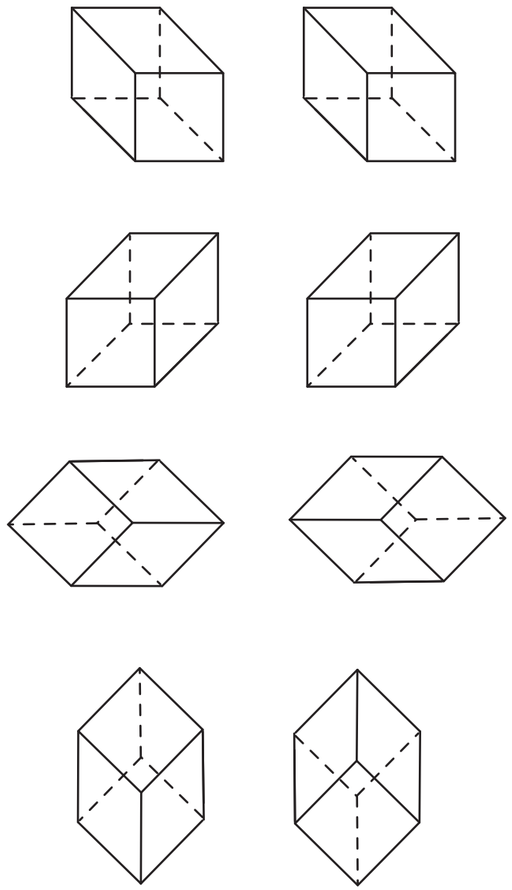


Figure 85
The eight cubes of a hypercube in a perspective representation of a hypercube
Diagram by author

4.2.4 Understanding the Parallel Projection of a Hypercube

The parallel projection, or more accurately a method *analogous* to making a parallel perspective, as told by Bragdon, contains the eight cubes that form a hypercube configured in a different way than the perspective projection method. Figure 86, drawn by Bragdon shows an example of a glass cube if one were to look directly down at it. This looks like a square within a square, with lines connecting the corners. We understand that these 6 panels visible in this projection are squares – shapes with four sides of the same length and width. The distorted squares are as follows: the exterior square, the inner square, and the four trapezoids that converge onto a vanishing point. The next dimension up showing a hypercube view, has eight cubes that are distorted: the exterior cube, the inner cube, and the six distorted cubes. Understanding the original glass cube analogy by Bragdon helps in understanding why this projection is drawn the way it is, particularly the reasons why the inner and outer cube are meant to represent the same size. As three-dimensional beings we can look at Figure 87 and understand why the two squares are different sizes in the drawing while knowing they are the same size in a three-dimensional world. Figure 88 is a diagram that visualizes how to understand a hypercube, and Figure 89 explains where to find the eight cubes that are present in this projection of a hypercube. The same logic can be applied to understanding this way of projecting a hypercube into three-dimensional space despite not being able to visualize a hypercube.

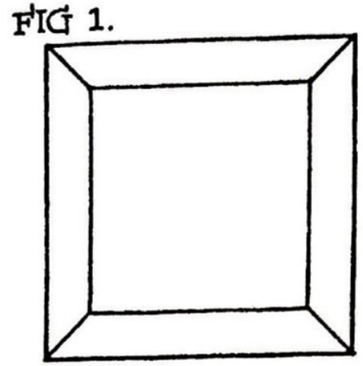


Figure 86

The top down view from Bragdon's explanation of the "parallel" projection method on plate 5

Diagram by Claude Bragdon, n.d.

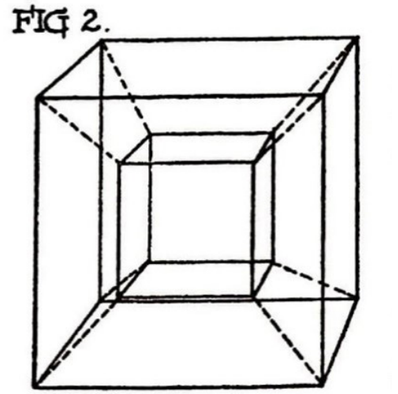


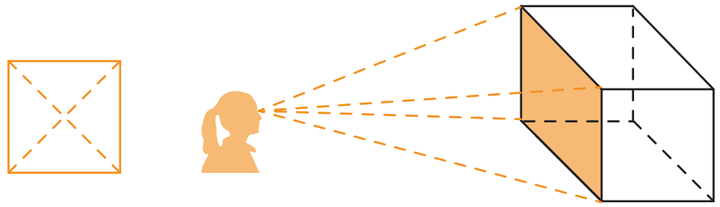
Figure 87

The view of a hypercube in the parallel projection view from Bragdon's explanation of the "parallel" projection method on plate 5

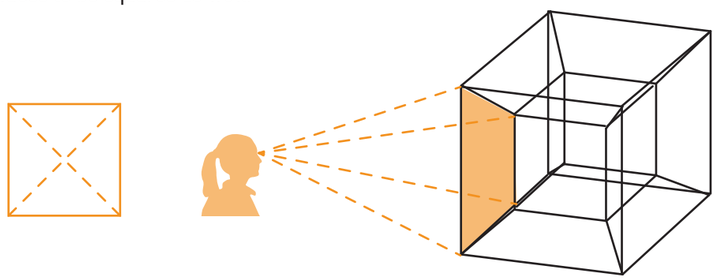
Diagram by Claude Bragdon, n.d.

GUIDE TO UNDERSTANDING THE PARALLEL PROJECTION OF A HYPERCUBE

The same way we understand this parallelogram side to be a square in this projection of a three dimensional cube —



when viewing this parallel projection of a hypercube, imagine these trapezoidal faces to be squares as well.



Additionally, the outer and inner square are meant to represent the same size, and therefore the two visible traditional cubes should be imagined of the same size.

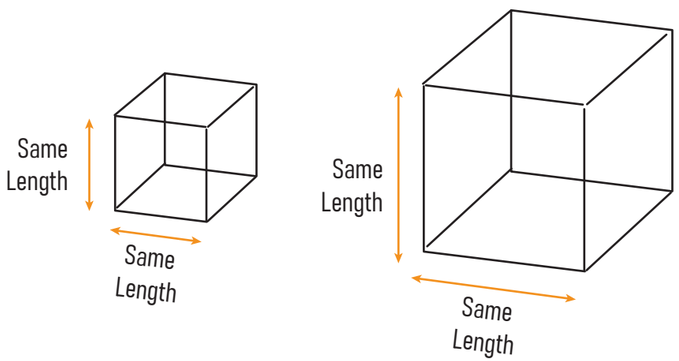
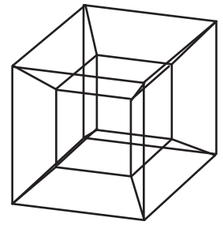


Figure 88
Guide to understanding the parallel projection of a hypercube
Diagram by author

PARALLEL PROJECTION METHOD OF GENERATING A HYPERCUBE



This is a two dimensional representation of a three dimensional representation of a four dimensional form

THE EIGHT CUBES OF A HYPERCUBE

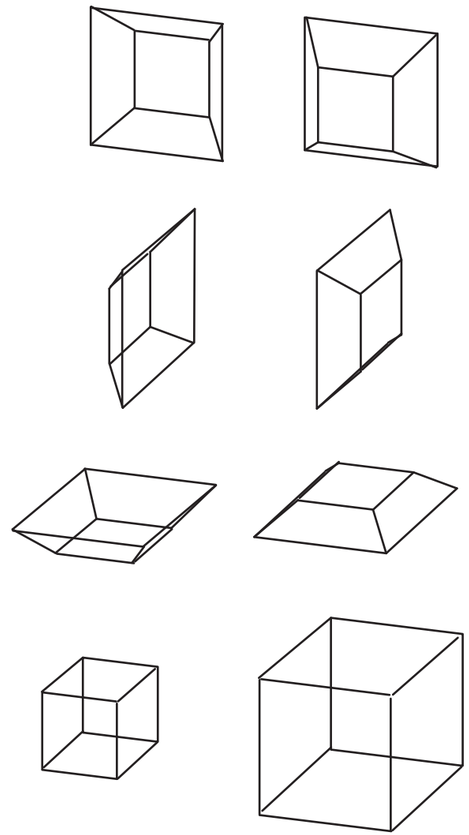


Figure 89
The eight cubes of a hypercube in a parallel representation of a hypercube
Diagram by author

4.3 Lissitsky's Prouns and Reprojecting Them into the Fourth Dimension

As written in section 3.2.2, I argue that when Lissitsky defined his prouns as "the 'waystation' between painting and architecture," this could be read as the "waystation" between *two dimensions* and *three dimensions*. Where he sought to understand the relationship between two and three dimensions through his geometrical compositions in order to better understand the eventual jump from the third to the fourth dimension, I will expand on two of his prouns as a continuation of his studies by making that final jump to the fourth dimension.

In Chapter 3, I mentioned that it is important to understand what Lissitsky was trying to investigate in his proun series, and here, it is where I continue his research. By analysing two proun case studies of different graphical styles by attempting to add one of many possible ways of representing the proun with an added fourth dimension, the resulting proun drawings will form a dialogue between the original and my study. The proun will be a combination of Lissitsky's examination of the second and third dimension, and that of my addition of the fourth.

It is important to make clear that my transformed drawings are the result of a process. I manipulate the original compositions' individual forms to imply an additional spatial dimension. This process of "moving up a dimension" can be done several ways, and the results shown in this section are two of infinite possible interpretations that could arise from this method. It is particularly due to the intentional ambiguity between Lissitsky's two- and three-dimensional forms that there are so many possible outcomes for my dimensional manipulations.

The first proun to analyse is that of proun 2 (Figure 90), from his Kestner Portfolio. This proun was chosen for its technical qualities of delineating the qualities and geometries that make up the forms. This includes the wireframe view of the sphere and the lines that extend to make up planes which are then used to imply three-dimensional forms. This extension of many little forms to make a longer plane seem to reference Lissitsky's theory of imaginary space in which a form is created out of motion, in this case an extending line that forms a square (like that seen in Figure 84). The "planes" then cleverly offer an optical illusion that either imply the

2. Esther Levinger, "Art and Mathematics in the Thought of El Lissitzky: His Relationship to Suprematism and Constructivism," *Leonardo* 22, no. 2 (1989): 229, https://doi.org/10.2307/1575236.

existence of a fully six-sided cube or an implication of a half a cube that displays its interior surface. In this lithograph, Lissitsky also incorporated time – the representation of time passing can be seen by the faded angled copy of the main construction.[2]

Now what if we were to reproject this proun painting? The essence of Lissitsky's prouns lies in that transition between two- and three-dimensional space. Working with this notion, we can use his prouns as a base to explore the next step: the jump from the third to the fourth dimension by continuing his work from his own drawings.

In my reprojection of proun 2 (Figure 91), I made a few very deliberate choices. With Lissitsky originally having the planes imply a cube, I took that further by turning those planes (which are made out of many lines) into a projection of a hypercube in the perspective style. Those same planes were made from lines displayed closer together, a technique that references the idea using the form from a dimension below to the build a form of the dimension above, with the technique taking influence from rotational construction of geometrical forms such as in Figure 79. The addition of many one-dimensional lines together forms two-dimensional planes out of which three-dimensional objects are implied, to which I added the implication of a four-dimensional form as well.

For this reprojection, I made the assumption that the planes were making up the cube and chose to represent the perspective projection of the hypercube, but it is important to note that I could have reprojected this proun painting in many different ways. This ambiguity was one of Lissitsky's key points.

Furthermore, I changed the form being displayed in keeping with the original style that clearly showed the construction of the geometrical forms. The hypercube and cube are easy to understand due to the graphic style, and the hypersphere also employs guidelines to help understand its shape. Figure 92 explains the logic behind this way of projecting a hypersphere. Where Lissitsky denoted the logic behind the form of a sphere using two interlocking circles and a line denoting the diameter of the sphere, I aimed to be similarly clear with the logic of a hypercube: I represented the hypersphere with seven wireframe circles and added a line denoting the diameter of the object. The way the forms are depicted in the original proun are very intentionally thought through and graphically clear and I felt that it was important that I keep the character of the original when I reinterpreted the original work of art to represent a higher dimension.

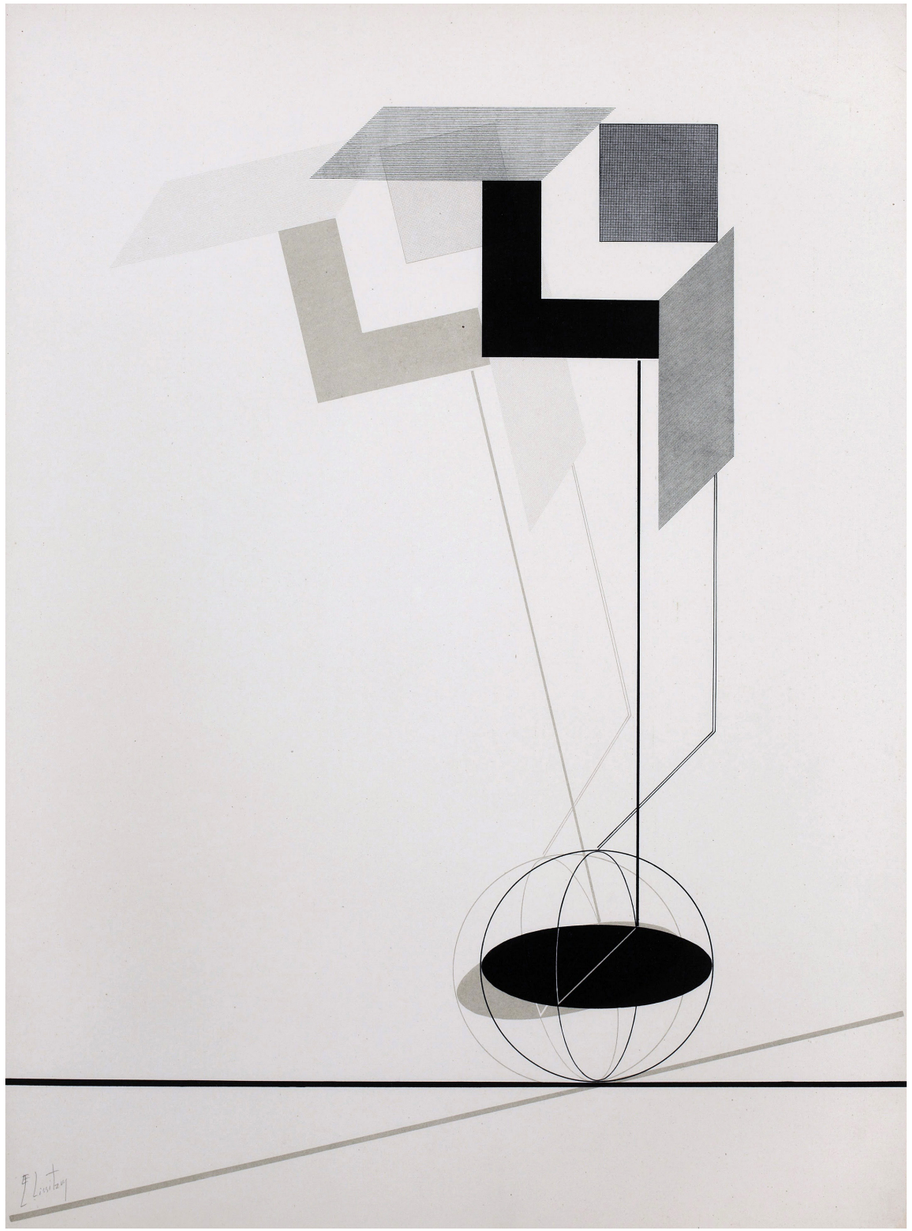


Figure 90
Proun 2 from the Kestner Portfolio
Lithographic print by El Lissitsky, 1923

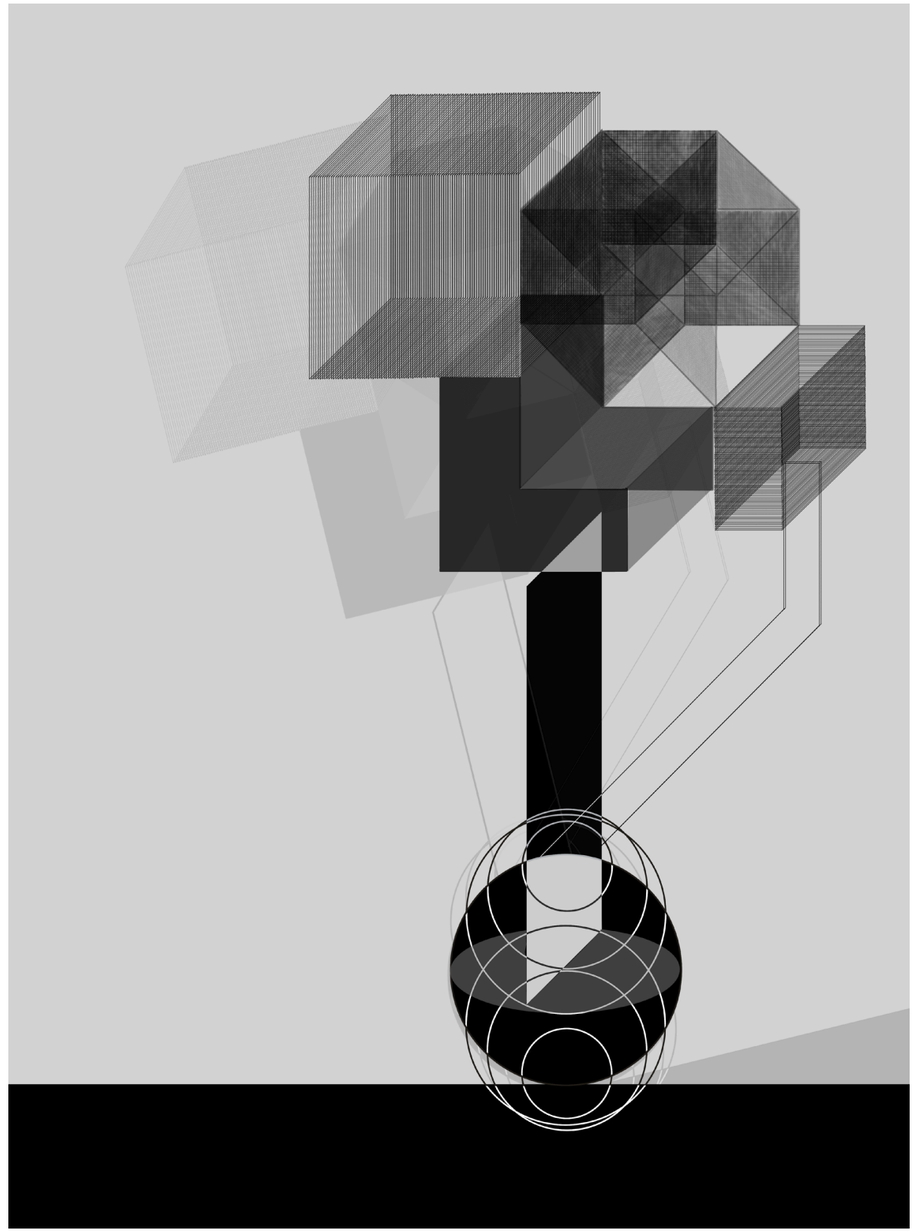


Figure 91
Reprojection of Proun 2 from the Kestner Portfolio
Digital drawing by author

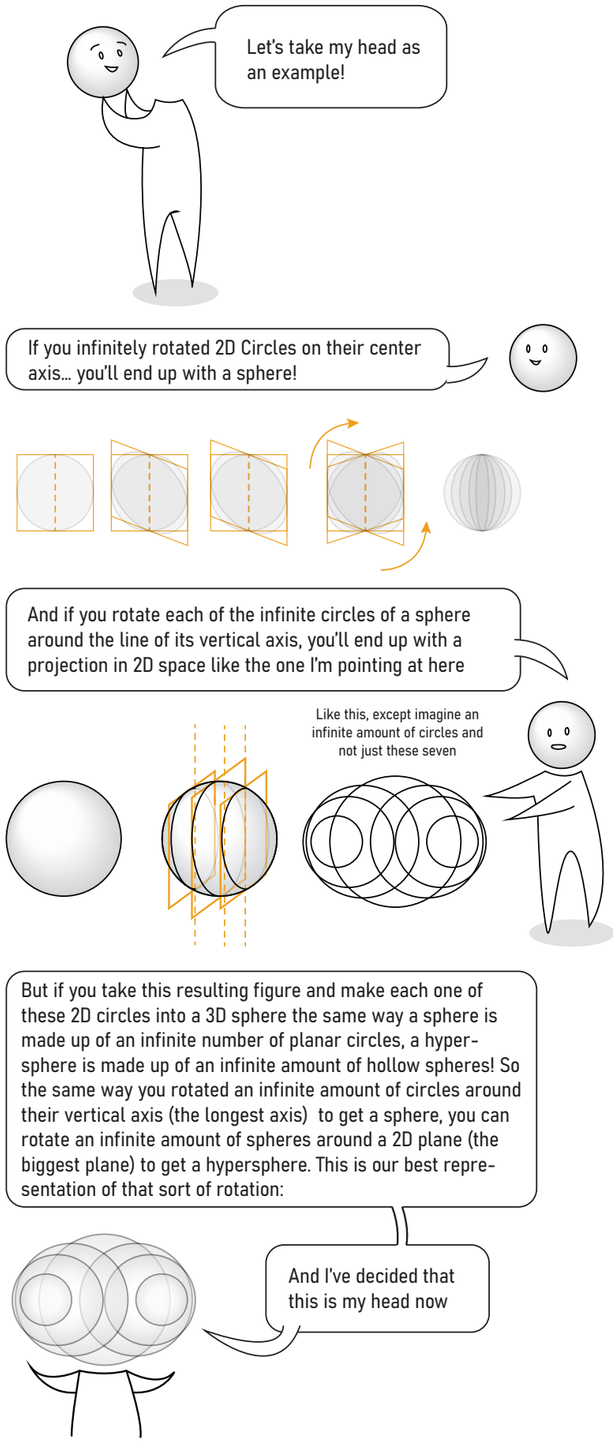


Figure 92
Explanation of the projection of a hypersphere
Diagram by author

The second proun I explored was Proun 5 A (Figure 93). This one very clearly depicts three-dimensional forms represented on a two-dimensional plane through the use of colour and clean boundaries between planes. Unlike proun 2 from the Kestner Portfolio, this composition is clearly a cosmic view. The background is white as the colour of outer space and unity in Suprematism (as explained in section 2.5.1), the red spheres are clearly planets, and the rectangular prism geometrical forms represent Suprematist spaceships. Referring to Lissitsky's mentor Malevich, these spaceship geometrical forms seem to be a reference to Malevich's Suprematist Satellites and his Planits.

My reprojection up a dimension (Figure 94) sought to do several things. While the previous proun reprojection aimed to keep a more diagrammatically geometrical representation of the forms, this one uses colour and opacity to get a sense of the form of the projections. For example, for the hypersphere projections, I chose to reproject the planar spheres as overlayed hollow spheres (again using the concept described in Figure 92) where unlike the previous proun reprojection, it is less a geometrical representation of a hypersphere but instead a visual implication of a hypersphere. It is drawn to imply an illusion of an infinite number of spheres laid over each other to form the slices that make up a sphere rather than a more "accurate" representation. On the cosmic side, this strange inverted view of a planet shows that there is more to outer space than meets the eye.

Using the same method as the previous proun study, I employed the perspective method to reproject the satellites. However, despite using the same method my intention was to produce a visually different result as the style of this proun is quite different than the previous one. Rather than using a rigid diagrammatical wireframe view, I kept with the original grey colouring and made the projection visible by using a lighter opacity overlay. This way, the planes and volumes that need to collide within a two-dimensional surface in the drawing are visible to represent the forms of the four-dimensional object, in keeping with the original character of Lissitsky's satellites. I used the same graphical style on the hyperspheres for the same reason. By using colour coupled with opacity, I could show the four-dimensional representations without losing Lissitsky's original message.

With Lissitsky's intention behind his prouns as "the waystation between the second and third dimension," these two studies I made are meant to embody the next step: that of the waystation between the second, third *and fourth* dimension. Where he wanted

Figure 93
Proun 5 A
Oil painting by El Lissitsky, 1923

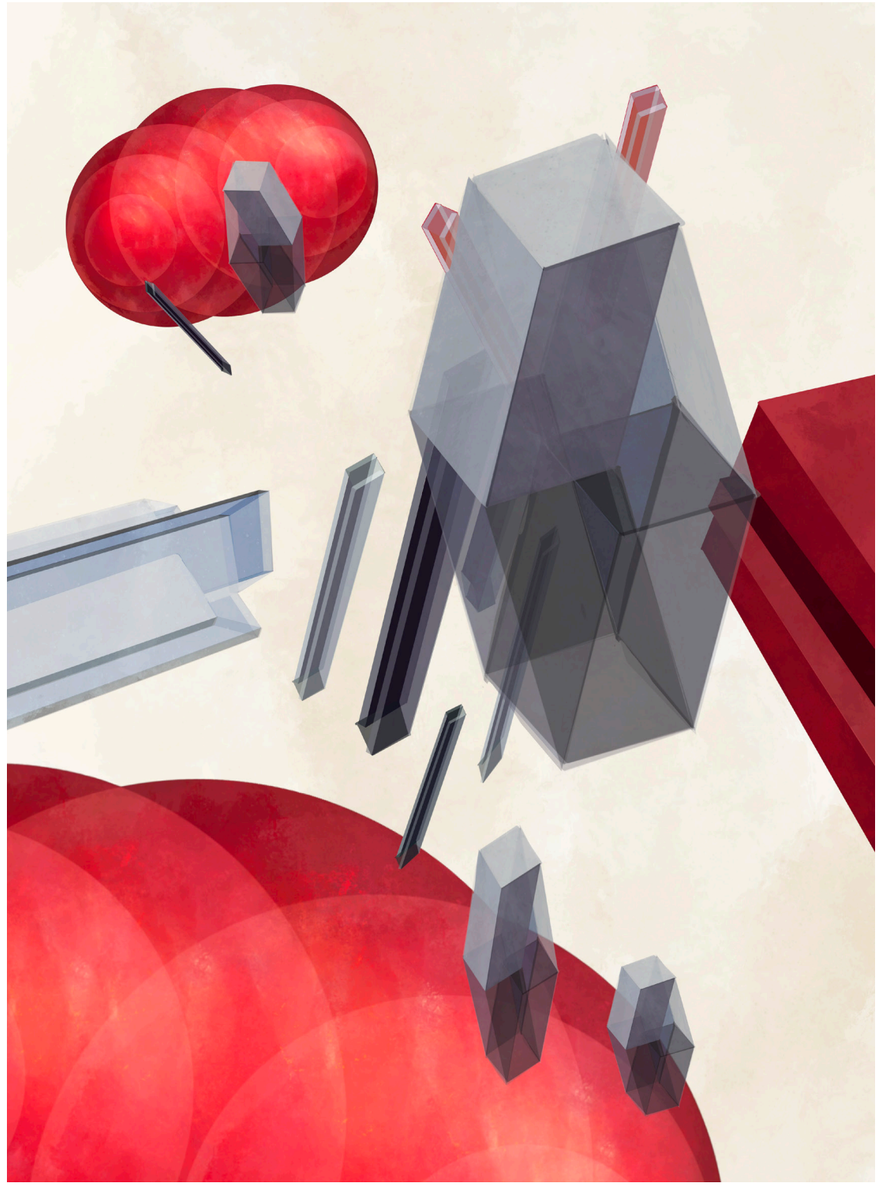


Figure 94
Proun 5 A reprojection
Digital drawing by author

to further understand the relationship between two and three dimensions so that we could eventually move to understanding the fourth dimension, my additions to his studies take that plunge in understanding geometrical forms of the fourth dimension.

A future exercise could involve exploring more of the potential results of processing the forms in Lissitsky's compositions to have one additional spatial dimension. This would emphasize that the way I chose to perform the transformations within the drawings results in Lissitsky's ambiguous forms being given a more definite form. For example, his ambiguous "cube" which could be a cube, three walls, or a blank space, being solidified as a three-dimensional object so that I can manipulate from a now solid definitive three-dimensional object to a new ambiguous four-dimensional one. Showing more of the possible interpretations would further demonstrate that there exists inherent ambiguity in the process to alter these drawings. Additional iterations of my transformative process would also further visually illustrate Lissitsky's theories about manipulating geometrical forms between dimensions, in which proun elements combine to make up a concentration of elements that are rigorous yet unmeasurable.[3] While extending my process of dimensional re-projection to more of Lissitsky's paintings could add more to the discussion, on the whole, the two prouns that I redrew still provide a demonstration of Lissitsky's theories of moving between multiple spatial dimensions to explore dimensions we cannot observe ourselves. Overall, I believe that the choices I made when reinterpreting these two works up another dimension were successful in keeping the original character of Lissitsky's work, while adding upon his original research.

3. Sophie Lissitzky-Küppers and El Lissitzky, *El Lissitzky : Life, Letters, Texts* (New York: Thames and Hudson, 1980), 358.

4.4 Florenskii's and Lissitsky's Time Theories and How We Might apply Them to the Theories of Visionary Architecture

El Lissitsky (section 3.2.2) and Pavel Florenskii (section 2.5.3) were two Russian thinkers who had approached time and space as topics of interest. Florenskii had asserted the importance of mathematics when exploring subjects such as art and religion, and linked spirituality with the world of irrational math. In terms of understanding space as the way matter is arranged in the universe, there are many models and theories from which to approach this subject including but not limited to the now disproved Euclidean space, Lobachevskii's space of negative curvature, and Lissitsky's imaginary space. The importance of time and the fourth dimension can be seen in Lissitsky's theory of imaginary space and Florenskii's theories about time and the existence of a super-body.

Due to the prevalence of these concepts in intellectual circles during this time period, I decided to take two visionary architecture competition projects and add two drawings to the original sets. The two projects that I have taken on as case studies are the following: Krutikov's and Melnikov's entry to The Memorial Lighthouse to Christopher Columbus Competition in 1929 (sections 3.4.2.1 and 3.5.1.2 respectively). I used the theories from Lissitsky and Florenskii as a base from which to work off of, to create an additional drawing to each set that would help inform a viewer of movement or a more hidden concept not seen in regular plans and sections. Specifically, I wanted to add additional content to the original visionary works by applying the concepts of four-dimensional geometry: time, projection, and non-Euclidean curved space, all with the cosmic undertone prevalent during the Russian avant-garde period.

These drawings are a mix of the original architect's intent and my insertion of the theory of geometrical projection. With this in mind, I will later discuss how the clear intentions of the original visionary drawings are now altered due to the additions of my work, with the understanding that the additions I made were in keeping with the theories and concepts that were subjects of interest during the time period.

4.4.1 The Theory of Time in Four-Dimensional Geometry added to Melnikov's Monument to Christopher Columbus

In the original set of competition drawings that Melnikov submitted for The Memorial Lighthouse to Christopher Columbus Competition, it is unclear that this monument has moving parts. I propose a new drawing (see Figure 95) that combines the shadow theory of projection (section 4.2.2), imaginary space made from moving parts (section 3.2.2), and the theory of Suprematist colour intensity (also section 3.2.2) to create a drawing that shows viewers that this building moves as time passes.

Firstly, the elevation shown in the drawing represents the parts that move in colour so that it is clear which parts move. Following that is a projection of the movement of the wings with the elevations of the wings moving 360° around in a circle. The movement of the wings is erratic because it is based on the wind, and the only time it is steady is when rain is funneled down the top cone and runs past a motor which makes it run smoothly. The time it takes for the projection of the wings to move is purposefully arbitrary with no scale to show that the wings may move in minutes with a strong wind, or in hours with a slow steady wind. This drawing is an amalgamation of the rotating wings being shown at different moments in time to embody Florenskii's theory of a fourth dimensional super-body.

Moreover, I employed the concept of a positional system using only colour and intensity to show irrational distances, which Lissitsky had continued to develop taking inspiration from Malevich (see section 3.2.2 and Figure 44 that was used in that section as an example). As explained in Chapter 3, in Suprematism, the intensity of the colour represents how far away it is from the two-dimensional plane of the painting, but not in a quantifiable way.[4]

I took inspiration from this system to give each "slice" of time – shown as different degrees of an arc – a different intensity of colour to depict how long ago the wings had moved, but not in any way that would show how much time has passed, keeping it irrational. The different intensity of the colours also allows the viewer to assess whether the wings have gone clockwise or anti-clockwise. The rotation of the wings in this view gives the wings their own property, their own axis, on which to form an imaginary space of a circle created by the whims of the wind. Or perhaps if one extended

4. Lissitzky-Küppers and Lissitzky, 354.

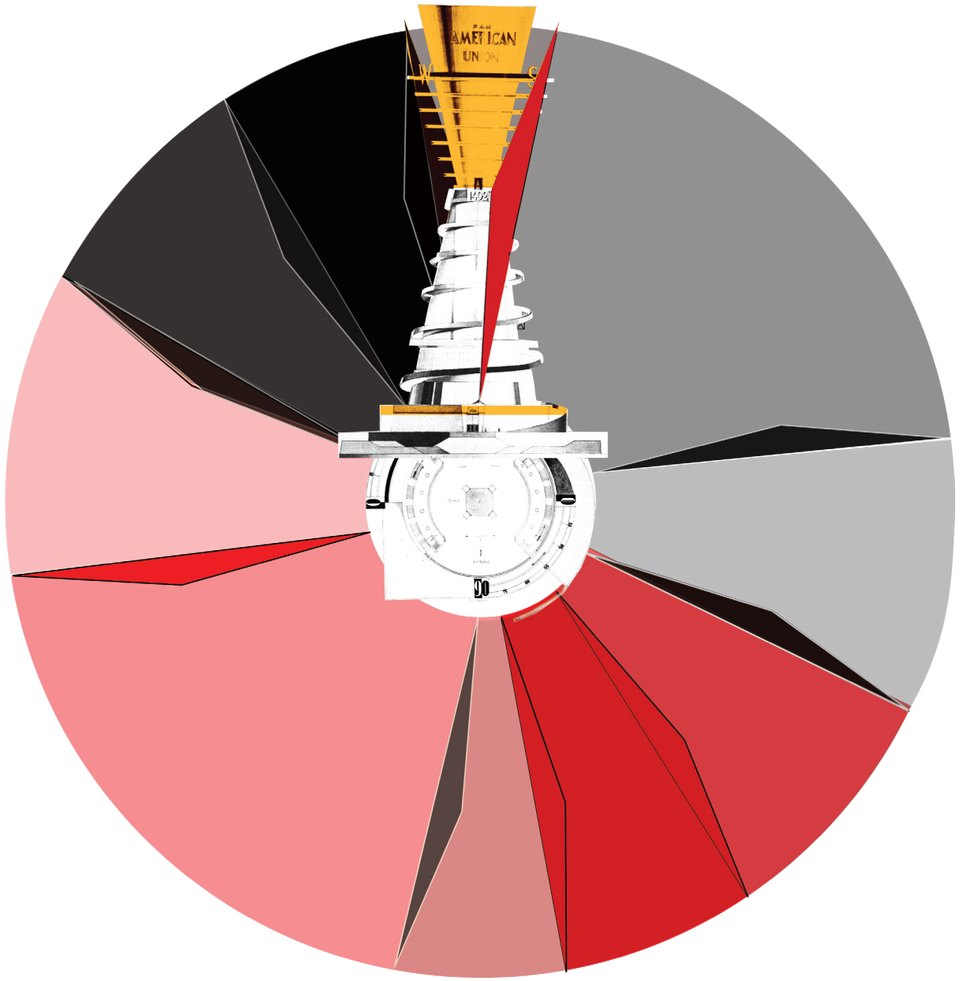


Figure 95
Drawing explaining the movement of the wings of Melnikov's monument to Christopher Columbus
Digital illustration and collage by author
Original architectural plan and elevation by Konstantin Melnikov, 1929

them into a helix with the vertical axis being time, the imaginary space changes in form. This drawing opens up many possibilities and could have been drawn in many different ways.

Overall, by combining the ideas from Suprematism, Lissitsky's technique of imaginary space, and Florenskii's theory of the four-dimensional super body with Melnikov's visionary monument, this additional drawing is a culmination of many geometrical theories developed by Russian intellectual thinkers and add to the original competition drawings an understanding of the intended movement of this monument.

4.4.2 The Theory of Time in Four-Dimensional Geometry added to Krutikov's Monument to Christopher Columbus

4.4.2.1 Movement Through Time

Similar to Melnikov's monument, the drawings of the cosmic monument that Krutikov and his two classmates designed for the very same 1929 Christopher Columbus competition similarly does not represent movement. To bridge this gap, I propose a simple hybrid section drawing (Figure 96) that implies the movement of the spaceship around the globe of the monument.

In Chapter 3 (section 3.2.2), I mentioned that Lissitsky wrote that time factors are sequential, and this diagram emulates this saying by showing a sequence of an object moving through time. To better understand this, diagram Figure 97 shows Ms. 3D sphere interacting through Ms. 2D square's Flatland plane and it is this exact analogy of a three-dimensional object passing through a two-dimensional plane that I wished to represent in the drawing. I decided to use the concept of this commonly used analogy in an additional drawing for the Krutikov monument, so that the viewer can understand the moving portion of this monument implicitly through keyframes. By having little slices of time of the building side by side, a viewer can see the section of the ship as it changes while passing through a plane. Because the viewer understands the third dimension, it becomes clear that it is an object passing through, rather than a shape inexplicably changing sizes. The addition of this drawing serves to suggest to viewers that the ship rotates around the planet.

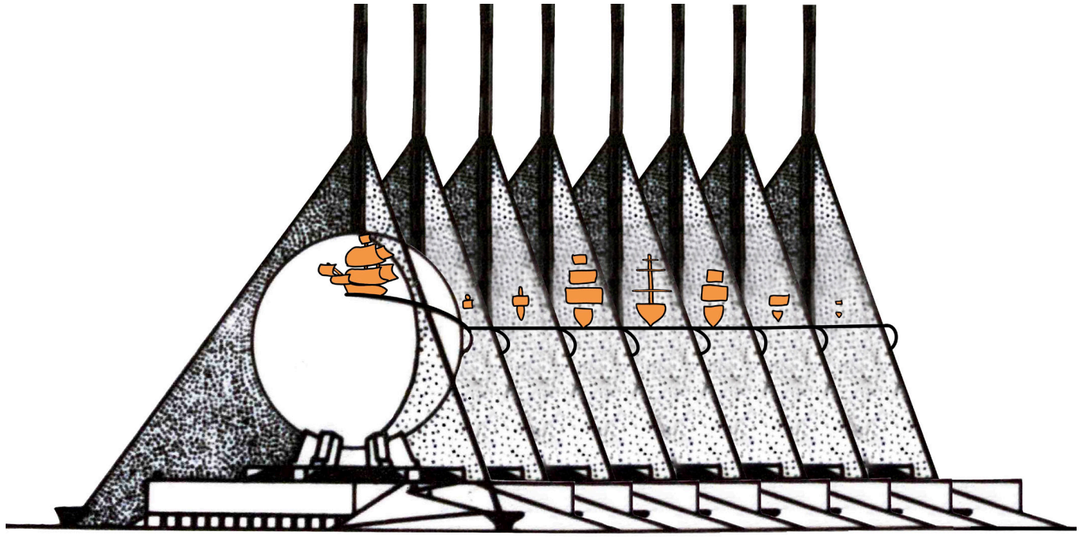


Figure 96 (above)

Drawing showing the movement of the Ship on Krutikov's monument using the analogy of a third dimensional object moving through a two-dimensional plane

Edit and digital illustration addition by author

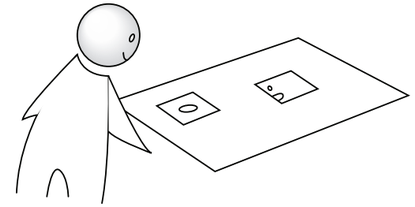
Oiriginal architectural elevation by Georgii Krutikov, 1929

Figure 97 (right)

Explanation of moving a three-dimensional object through a two-dimensional plane

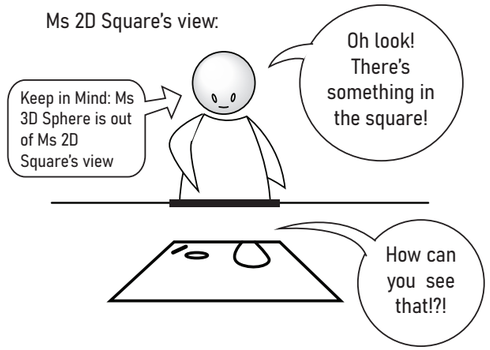
Diagram by author

Ms 3D Sphere's view:

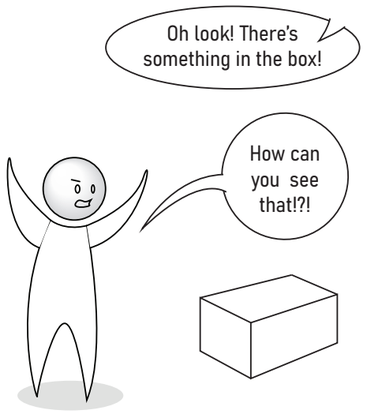


Take the following situation:
Ms 3D Sphere sees a square in Flatland, and she can see everything inside of it! While Ms 2D Square, who lives on flatland can't see the inside at all because she lacks the ability to understand the third dimension!

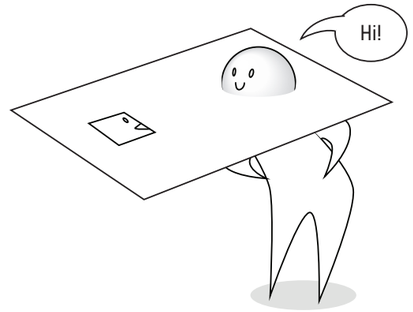
Ms 2D Square's view:



So let's put Ms 3D Sphere in Ms 2D Square's situtation by having Ms 4D Hypercube visit the three dimensional world.

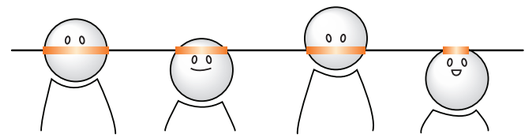


So a 4D being, because they can access another "axis" that we can't, they can pop in and out of our 3D dimension the same way Ms 3D Sphere can pop in and out of Ms 2D Square's dimension - because Ms 3D Sphere has access to the vertical axis while Ms 2D Square does not.

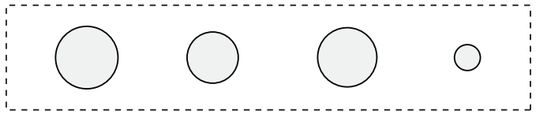


While Ms 3D Sphere pops her head up and down vertically, the orange line is what Ms 2D Square sees! And it's up to her to piece together how this could possibly be a sphere by only seeing a little bit at a time, knowing that these are slices of circles!

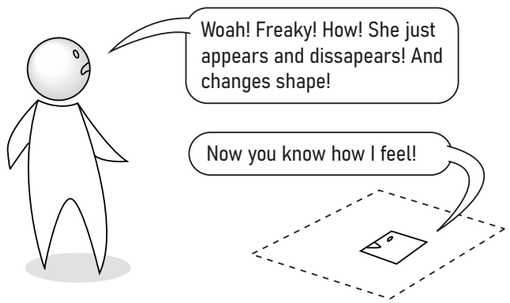
The orange bar is what Ms 2D Square sees



This is a section cut of Flatland, so we can see that Ms 3D Circle turns into circles when passing through Flatland.



So Ms 4D hypercube can pop in and out of Ms 3D Sphere's world as well, confusing her just like Ms 3D Sphere confused Ms 2D Square!



4.4.2.2 Non-Euclidean Space Theory applied to Krutikov's Monument to Christopher Columbus

The culmination of my visual research into visionary architecture through geometry ends with one final foray into non-Euclidean geometry on the grand cosmic scale. Krutikov provided an explanation for his competition entry his idea behind the ship around his rotating monument; the same way Christopher Columbus "found" America and explored the Earth by sailing the sea, we might explore the universe by sailing through outer space on a rocket ship to explore new cosmic frontiers. But how might this exploration work on a cosmic scale? Non-Euclidean geometry starts to become visibly apparent in the physical world only on a cosmic scale. Due to this, we can speculate that we may live on a surface of a hypersphere or some other geometrical phenomenon that is so monumentally grand we cannot even imagine it from our point of view, in the same way that we cannot imagine large numbers in our head. Before we delve into the final drawing, let us go back to Ms. 2D Square and Ms. 3D Sphere to understand what a sphere may look like from our perspective if we did indeed live on the surface of a hypersphere. Figure 98 describes the Flatland analogy to explain what things might look like to us three dimensional beings and why.

With that in mind, let us return to our non-Euclidean space. What might Krutikov's monument look like to one of us if we were to look at it from the farthest possible view on a finite hypersphere? For the sake of scale, I have imagined this universe as extremely small so that the distortion of light is visible. If we were to travel across the universe and look at this monument that signifies that very act of exploring cosmic frontiers and the lofty endeavours we can achieve as humans, what might this monument look like?

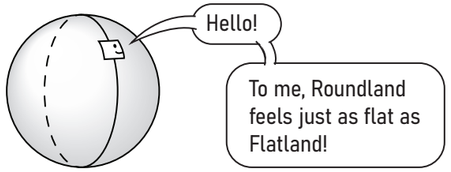
In Suprematist ideology, white is the colour of unity and is used to depict the cosmos. Therefore, the white circle in the middle is meant to represent the small pocket of outer space that the ship resides in, while the black is the colour of the monument that is reaching the observer from the ship at all angles.

At this distance on the far side of a hypersphere, light behaves such that whatever object one is looking at surrounds them making it seem like one is inside the sphere of the planet part of the monument. This because the light is reaching us from all angles, just like how Ms. 2D Square is surrounded by her circle in Figure 98 as the light rays reach her from every possible direction. Additionally, the trail of the rocket of the monument

would also appear to be all around us for the same reason: as the distorted light rays bend around the positive curvature of this reality, there would appear to be very many trails (Figure 99). The same would occur with the planet sphere from the top of the monument, hence the "duplicates" of the sphere as seen in the final drawing (Figure 100).

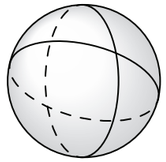
Another important part of this drawing was to solidify the connection between travelling around Earth and travelling through the cosmos. A play on words of the origin of the word spaceship means that the ocean vessel can just as easily represent a spaceship that is travelling the cosmos. Therefore, my additional drawing includes this ship as an important artistic element, to place the viewer into this non-Euclidean positively-curved space, as well as to connect it with the Krutikov's original sentiment for this competition. This drawing is not meant to be a mathematically-driven model, but is instead meant to embody the beauty of geometry and the cosmos. I believe the essence of the ideas behind it are preserved, giving an understanding of non-Euclidean geometry and an insightful view of the power behind these ideas of higher dimensions. Krutikov's monument is an ideal vessel for understanding this link between geometry and the cosmos due to Krutikov's impetus behind his visionary architecture: to be one of exploring new frontiers.

So far, Ms 2D Square has been on a Euclidian Flatland for educational purposes, so let's transfer her, and now she lives on a surface of a sphere, we can call it Roundland.



A Great Circle is a the biggest line of the biggest diameter you can make on a surface of the sphere, much like the equator of the earth.

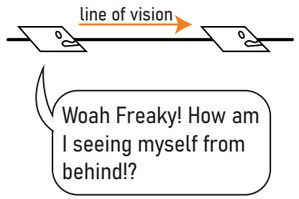
A great circle is a straight line on a curved world, the flattest possible line you can get.



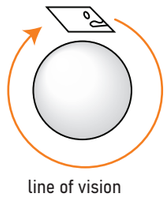
As you can see, if you walk in a straight line on Roundland, you will end up back where you started.

And if the world was small enough, Ms 2D Square would always be able to see herself from all times!

How Ms 2D Square sees it:



How Ms 3D Sphere sees it:



So let's put Ms 3D Sphere in Ms 2D Square's perspective by putting her on the surface of a hypersphere!

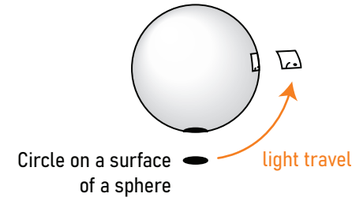
Ms 2D Square will play out a diagrammatical view that we can understand as three dimensional beings, and Ms 3D Sphere will show us the view from her eyes as she experiencences traveling along the surface of a hypersphere.

Figure 98

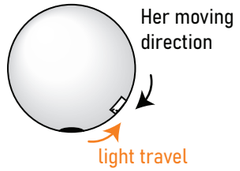
Explanation of viewing a sphere on a hy-persurface (a space of positive curvature)

Diagram by author

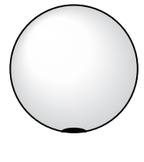
Outsider view of a circle of Ms 2D Squares's view of living on a surface of a sphere



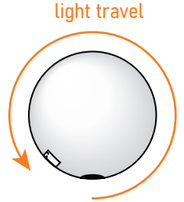
Ms 2D Square starts to move clockwise



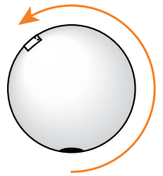
Ms 2D Square is inside the circle now



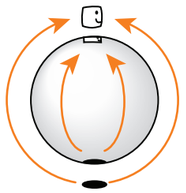
Ms 2D Square continues to move clockwise and even though the circle is behind her, light travels across the spherical universe and reaches her anyway



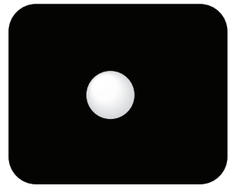
The circle is getting bigger because Ms 2D Square is getting closer to the point where all the light rays will reach her equally

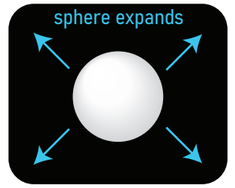


Once Ms 2D Square is on the complete opposite side of the sphere, the light reaches her from all directions so she will see it no matter what direction she turns, giving her he impression she is inside the outer skin of the sphere

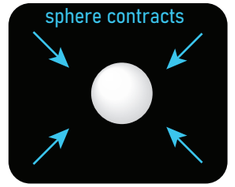


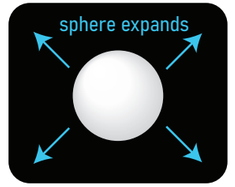
Insider view of a sphere (instead of a flat circle) of Ms 3D Sphere's view of living on a surface of a hypersphere

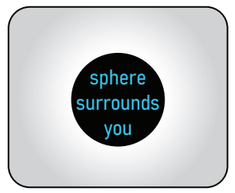




Sphere is everywhere







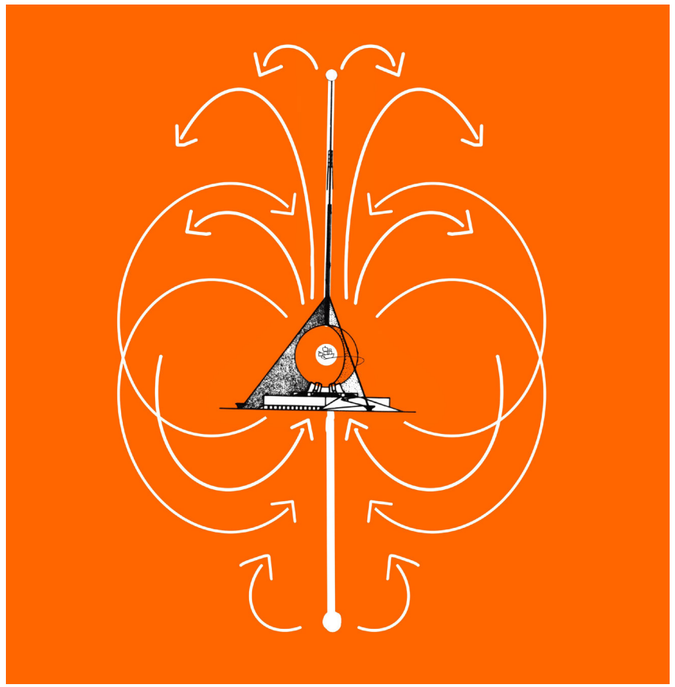


Figure 99

Explanation of the appearance of the rocket trails and planets for figure 100

Illustration by author

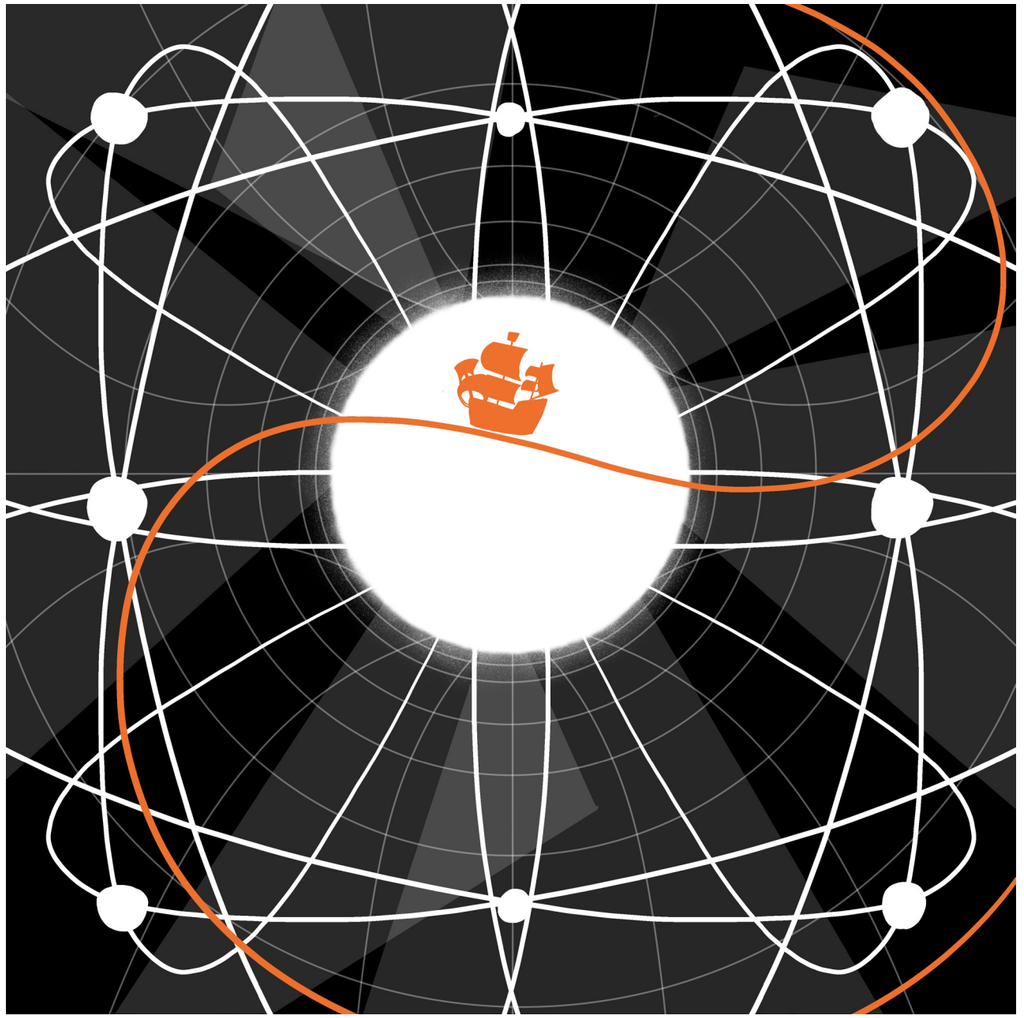


Figure 100

The view of Krutikov monument at the farthest view on a hyperspherical surface

Illustration by author

4.5 Drawing as Research Discussion

When I first introduced the drawing section of this chapter, I sought to explore how to use drawing to ascertain visual information in the form of drawing by assessing and then adding to other architects' drawings. By drawing and spending ample time with each individual drawing or set of drawings for a project, I could examine the theories behind the original work while adding my own perspective. This led to the next inquiry: how much might my additional drawings employing the theories about the fourth dimension add to and/or change the intent from the original vision of the visionary architect?

The first and most obvious change of course is that the vision behind their visionary work is no longer solely their own. Through these explorations, I examined the common threads between architects from the intellectual circles of mathematics, architecture, art, and philosophy. I have added my own theories to it, even if they stem from other architects and important thinkers of the same era and culture. It is no surprise that cosmos and geometry are easily connected in visionary architecture of this era, proven by using cosmic scales or geometry to expand on these original works.

In particular, the final drawing featuring Krutikov's monument is drawn from the perspective of a viewer on a hyper-spherical surface, an addition that serves as a conclusion for all the theories and concepts that pervaded the Russian avant-garde. My final drawing allows for expanding Krutikov's vision to two definitions of the same concept – one mine, and one his. Krutikov's original concept was that of exploring new boundaries with the cosmos as the playing field, and my added concept was that of expanding our minds whether through geometrical lens or a theological one, like Florenskii's. The time slices work as a purely geometrical concept to explain movement that was not there, while the final drawing (Figure 100) has both hypergeometry and the idea of exploring that which we don't understand or cannot conceptualize.

For the additional drawing to Melnikov's monument (Figure 95), it is complex in the additional theoretical layers that were added to it such as the projection of the wings to a flat plane to the implementation of Lissitsky's theory of irrational space and Florenskii's theory of the super-body. While some of the theoretical nuance might be lost without its accompanying explanation, the drawing still serves its intended purpose of incorporating theories by Russian thinkers. As Melnikov and Florenskii were both

deeply religious, it made sense to combine Florenskii's theories with Melnikov's visionary architecture. In this case however, I believe that a drawing like Figure 95 would have changed the original intent of Melnikov's original contribution, based on his description of the original monument. However, within the context of visionary architectural theory and the theory of fourth dimensional geometry, I insist that such a drawing such as Figure 95 is still valuable on its own when seen within the subset of the original architect's work.

Finishing up with a final remark upon Lissitsky's prouns and my reprojections of his work, I conclude that my ventures into expanding his second- to third-dimensional explorations to the third and the fourth dimensions are successful as long as it is seen, like the previous works, within the original context of the work. On their own they no longer have that pure underlying theory of only trying to understand the relationship between two and three dimensions.

While some of my images may serve to improve the clarity of the presentation of the drawings, and some may include a more metaphysical addition to the drawings, they are no longer the vision of only those visionary architects. It is now a visionary architecture or a speculative drawing of those architects and myself, and therefore the drawings, when they do enhance the original vision or add another layer of cultural context, must be seen within the original context of the work. Deconstructing the original works to add further context allowed me to further develop my understanding of the visionary architecture of this time. I identified details about the original drawings that I would not have otherwise, which has increased my knowledge of the original architects' work as a supplement to information I learned from written work from the architects and painters.

∞. Conclusion

The visionary architecture from a century ago expressed the cosmic mysticism that pervaded Russia's intellectual circles, very different from the Western rationalism of Russia's neighbours, and subsequently misunderstood.[1] With this in mind, along with the highly interdisciplinary connections between various subjects in 19th and early 20th century Russia, there is merit in re-examining some of the ideas offered from that time in today's modern world.[2]

There has been a disconnect in understanding the architectural work of the Russian avant-garde period for many reasons, including disjointed disciplines, censoring, and for Western scholars, a language barrier and, most importantly, a rationalistic[3] approach due to a lack of understanding of Russia's unique heritage.[4] This thesis, through the examination of visionary architecture, has explored how the intellectual philosophical tradition of the 19th century transformed under the 20th century Russian avant-garde movement. The connection that these architects made between mystical thinking, geometry, hypergeometry, time, irrational mathematics, the cosmos, and Orthodoxy[5] becomes apparent when we look at visionary architecture specifically.

This thesis first presented a discussion on the importance of visionary architecture along with an explanation of how Russian architects had collaborated with the Western world. However, the works by these architects, even at the time that they were made, were not understood with a Russian cultural background in mind.[6] The two decades around the turn of the 20th century led to a century in which unique and noteworthy philosophical viewpoints were created, from the spiritual to the mathematical. This period of time also saw the rise of the Slavophile cultural movement which offered a new solution from Russia's unique heritage to solve Russia's social issues.[7] From the late 1800s and into the avant-garde years of the 1920s and 1930s, mystical non-materialism theories became more prevalent in Russia. Understanding the intellectual history behind Russian avant-garde theories from Slavophile philosophy to Fedorov to other philosophers, as well as the mathematical influences, means that avant-garde work is filled with a deep and rich history.[8] These philosophies, due to their increase in popularity, were used both intentionally and unintentionally by avant-garde architects and artists. This phenomenon is especially visible within visionary architecture as visionary architecture is a reflection of the society in which it is made.[9]

1. Elizabeth C. English, "Arkhitektura I Mnimosti: The Origins of Soviet Avant-Garde Rationalist Architecture in the Russian Mystical-Philosophical and Mathematical Intellectual Tradition" (University of Pennsylvania, 2000), 3-5,236.
2. English, 241.
3. The word "rationalistic" in this sentence is taken in the Western sense of the word
4. English, "Arkhitektura I Mnimosti," 2–5.
5. These connections were first made apparent to me in English, "Arkhitektura I Mnimosti."
6. English, "Arkhitektura I Mnimosti," 2–4.
7. Peter K. Christoff, *An Introduction to Nineteenth-Century Russian Slavophilism : A Study in Ideas*, Slavistic Printings and Reprintings 23 ('s-Gravenhage: Mouton & Co, 1961).
8. English, "Arkhitektura I Mnimosti," 5,6.
9. Christian Werner Thomsen, *Visionary Architecture from Babylon to Virtual Reality* (Munich ; New York: Prestel, 1994), 7.

Lastly, I used drawing as a form of visual research to further explore the theory of visionary architecture as well as to further develop an understanding of the theories and ideas that circulated during this era while demonstrating the merits of looking towards visionary architecture within the architectural field. The content within this thesis provides a foundation for appreciating the Russian avant-garde movement within the context of its history, therefore this could also be done, and surely is already so, for other non-Western cultures. There is much to learn from choosing a driving force such as visionary architecture to be the lens through which to explore something new. Additionally, by building upon this work, future studies could continue the analytical drawing work started in Chapter Four. I believe that drawing can be a useful tool for the integration of non-architectural disciplines with architecture. As the architectural field is a visual discipline, we can use visual tools, such as drawing, for analysis.

By working to understand more cultural nuances of non-Western architecture and schools of thought, an architect can broaden their horizons when examining historical architectural projects. Both in academia and in architectural practice, this can lead to more multidimensional discussions and designs. Furthermore, this thesis provides another voice to the value of theoretical work done by visionary architects. There is a lot that visionary architecture can show us, as visionary architecture is a product of its time and can act as a time capsule. As the goal of visionary architecture ends at the drawing stage rather than the building stage, it can be used as a tool meant to tackle new architectural innovations, which reflect the culture and question of its environment, as seen in the selected work discussed in this thesis.

For architects today, this thesis can be used as a starting point to understand the complexities found in architectural theory in different places across the globe. While this thesis specifically discussed the accomplishments of Russian architects by giving the appropriate historical background to understand the nuances of this critical time, there are many more ways of understanding the world.

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