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ARTICLE Network of Architecture Roads

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ABSTRACT

In the literature that follows the history and theory of architecture, architecture is mainly studied from the aspect of disposition, construction and materialization "in itself", sporadically establishing the "originality" (first appearance) of certain dimensions of architectural solutions and their connection with solutions from previous historical epochs. The title of this work (Network of Architectural Paths) suggests the simultaneous uniqueness (authenticity) of people and their culture throughout the planet Earth and comprehensiveness (universality) of human ideas and all forms of human creativity. The aim of this work is to show the authenticity of ideas (expressed by architecture) in accordance with the concrete natural and social environment and, at the same time, their mutual connection (networking) on the global world level (Earth). Examples of vernacular architecture in various parts of the world and examples of author's (contemporary) architecture in other parts of the world that are articulated in the language of the modern era while preserving the concepts of their vernecular "models" are thus compared. The methodological approach in this paper is based on the author's theory of architecture, which he described and published in his book: Hadrovic, A. (2007). Defining Architectural Space on the Model of the Oriental Style CityHouse in Bosnia and Herzegovina, Serbia, Montenegro, Kosovo and Macedonia, Booksurge, LLC, North Charleston, SC, USA.

1. Introduction

This paper is based on the author's theory of Architecturally Defined Space (ADS), which was defined in his doctoral dissertation (1988), later published as a book under the title: Hadrovic, A. (2007). Defining Architectural Space on the Model of the Oriental Style CityHouse in Bosnia and Herzegovina, Serbia, Montenegro, Kosovo and Macedonia,

Booksurge, LLC, North Charleston, SC, USA

The author emphasizes his understanding of SPACE and architecture (where the term ARCHITECTURALLY DEFINED SPACE is used):

"According to us, space is the most general concept that is characterized by: all-dimensionality, boundlessness, permanence. Space is everything that is, has been and will be" [1] (Figure 1).

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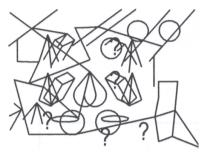
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PROSTOR SE KAO TAKAV NE MOŽE ZAMISLITI. PA. PREMA TOME, I NE POSTOJI

SPACE AS SUCH CANNOT BE IMAGINED, SO, THEREFORE, IT DOES NOT EXIST

1. Parmenides (5th century BC)



PROSTOR JE A PRIORI KATEGORIJA KOJA U SEBI SADRŽI BESKONAČNU MNOŽINU PREDSTAVA

SPACE IS A PRIORITY CATEGORY THAT CONTAINS AN INFINITE PLAN OF PERFORMANCES

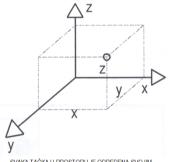
4. Immanuel Kant (1724-1804)



PROSTOR JE ZBIR SVIH MJESTA, DAKLE, JEDNO DINAMIČNO POLJE SA SVOJIM PRAVCIMA I KVALITATIVNIM OSOBINAMA

SPACE IS THE SUM OF ALL PLACES, THEREFORE, ONE DYNAMIC FIELD WITH ITS DIRECTIONS AND QUALITATIVE CHARACTERISTICS

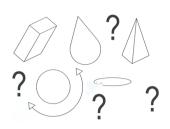
2. Aristotle (384-322 BC)



SVAKA TAČKA U PROSTORU JE ODREĐENA SVOJIM KOORDINATAMA (X, Y, Z)

EACH POINT IN SPACE IS DETERMINED BY ITS

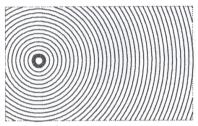
5. René Descartes (1596-1650)



CIJELA PRIRODA SE ZASNIVA NA DVIJE STVARI POSTOJE PREDMETI I POSTOJI PRAZNINA U KOJOJ SE ONI NALAZE I U KOJOJ SE KREĆU

THE WHOLE NATURE IS BASED ON TWO THINGS: THERE ARE OBJECTS AND THERE IS A GAP IN WHICH THEY ARE LOCATED AND IN WHICH THEY MOVE

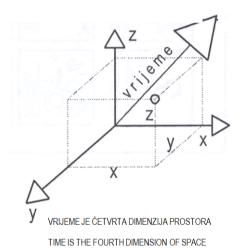
3. Euclid (4th century BC)



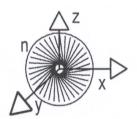
POSTAJE OČIGLEDNO DA U PROSTORU BEZ TIJELA IMA STANJA KOJA SE VALNO ŠIRE

IT IS BECOMING OBVIOUS THAT IN A SPACE WITHOUT A BODY, THERE IS A STATE WHICH IS EXPANDING A WAVE

6. Electromagnetic field theory (1831): Michael Faraday FRS (1791-1867) and James Clerk Maxwell (1831-1879)



7. Theory of Relativity: Albert Einstein (1879-1955)



PROSTOR JE NAJOPĆIJI POJAM KOJI SE ODLIKUJE:

- SVEDIMENZIONALNOŠĆU, BEZGRANIČOŠĆU.
- SVETRAJNOŠĆU.

PROSTOR JE SVE ŠTO JEST, ŠTO JE BILO I ŠTO ĆE BITI

SPACE IS THE MOST GENERAL CONCEPT THAT FEATURES:

- BORDERLESSNESS,
- SUSTAINABILITY

SPACE IS EVERYTHING THAT IS, WHAT HAS BEEN AND

8. Ahmet Hadrovic (1987)

Figure 1. Understanding Space through time

Source: Author (1987)

Architecturally Defined Space (ADS, architecture) treats Space in the most complex way of all human activities, and as such it implies three basic components:

- 1) ENVIRONMENT,
- 2) MAN,
- 3.) BOUNDARIES.

These elements should be added 4. PERSPECTIVES, as that dynamic relationship that connects now - future, existing - possible, realized - desired, as that dynamic relationship which unites now - future, existing - possible, realized - desired" [1] (Figure 2).

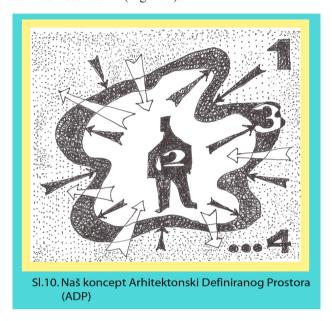


Figure 2. Architecturally Defined Space (ADS) concept: 1. ENVIRONMENT, 2. MAN, 3. BOUNDARIES, 4. PERSPECTIVES.

Source: Author (1987)

The second book by the author of this paper, on which this work is based, is "Architecture in the context" where the author defined the "absolute typology of architecture":

1. Earth Architecture (EA), 2. Space Architecture (SA), 3. Architecture on Other Celestial Bodies (SBA). Each of these basic types has a number of subtypes. For example, Earth Architecture (EA) has the following subtypes: Earth Air Ground Architecture (EAG), Earth Ground Architecture (EGA), Earth Ground Architecture (EGA), Earth Water Architecture (EW), Earth Air Water Architecture (EAW), Earth Air Architecture (EAW), Earth Air Architecture (EAW),

In this paper, the author follows the paths of bioclimatic architecture and architecture of abstract forms horizontally and vertically (through the Earth and through historical

epochs), while following the conception of ideas about bioclimatic architecture and architecture of abstract forms, their articulation in time, and space, their duration and perspectives. Namely, the author believes that these two ideas are crucial in the entire history of architecture, in its present and in the future. The author connects bioclimatic architecture to physics, as a science: nature = physics (physics, ancient Greek: φυσική (ἐπιστήμη) = "knowledge of nature", φύσις = "nature"), while "architecture of abstract forms" connects to mathematics: mathematics, Greek: μάθημα = "knowledge, study, learning"). Mathematics includes the study of topics such as number theory, structure (algebra), space (geometry), and change (analysis).

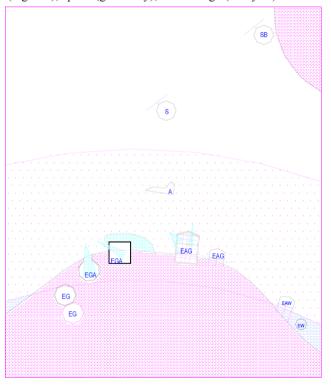


Figure 3. Absolute typology of architecture

Source: Author (2011.)

Through the presented content in this paper, it will be clear that the primary age (first appearance) of one of these two ideas cannot be determined, as well as their temporal permanence (actuality). These two primary ideas are intertwined (sometimes parallel) and sometimes contradictory to such an extent that, for example, the architecture of abstract forms contains more features of bioclimatic architecture than the architecture we nominally refer to as "bioclimatic architecture".

The term "bioclimatic architecture" means architecture whose design is based on local climate, aimed at ensuring human comfort (from the aspect of thermodynamics,

① Hadrovic, A. (2011), Architectura in Context, Sarajevo, Acta Architectonica et Urbanistica, Faculty of Architecture, University of Sarajevo

lighting and acoustics) through special design of horizontal and vertical construction plan, using in situ resources (local materials, solar energy, geothermal energy, rainwater, wind...) [3]. The principles of bioclimatic architecture, when applied with an understanding of the natural environment, can simultaneously increase the energy efficiency of a building and create a more comfortable living space. Passive measures such as solar panels, rainwater and gray water collection, natural light openings, natural space ventilation - there are some strategies used in the realization of bioclimatic architecture ²².

Abstraction in its main sense is a conceptual process in which general rules and concepts are derived from the use and classification of certain examples, literal ("real" or "concrete") signifiers, first principles or other methods. "Abstraction" is the outcome of this process - a concept that acts as a common denominator for all subordinate concepts and connects all concepts as a group, field or category. The sculptural form is a strong abstraction from real objects and the three-dimensional space we construct ... by touch and sight "^[4].

Abstract art uses the visual language of shapes, colors and lines to create a composition that can exist with a certain level of independence from visual references in the real world. Western art was, from the Renaissance to the mid-19th century, supported by the logic of perspective and the attempt to reproduce the illusion of visible reality. In the late 19th century, many artists felt the need to create a new kind of art that would embrace the fundamental changes taking place in technology, science, and philosophy. The sources from which individual artists drew their theoretical arguments were varied and reflected social and intellectual preoccupations in all areas of Western culture at the time.

Since architecture is a creation of man (not nature), it is basically an act of abstraction. Therefore, bioclimatic architecture, although based on respect for the immediate natural environment, can be considered the architecture of abstract forms. The purpose of abstraction is to simplify nature, to separate the primary logic for the expression of design. Through abstraction, the complex power of a natural phenomenon can be removed, simplified, studied and transferred into dynamic design possibilities. The artist first distinguishes between phenomena, or the appearance of things, and then recognizes design ideas through intuition. By the method of seeing, visualizing, sketching, and abstracting, the process continues, in a series of stages, until

the basic element of the design is defined. Continuation of the abstraction phase leads to two basic design directions:

- the first design direction leads to an abstract design element for two-dimensional design,
- the second direction of design extends the process of abstraction to a higher level, for architecture and threedimensional design.

These two possibilities of design start from nature, but each phase in the process leaves nature more or less farther away (as the body can die, while the spirit lives on). In the design process, more "grinding solutions" leave nature farther and farther away. In the end, with the final solution, not much of nature remains, but what is left is the spirit, the source itself. The power of abstraction comes from the spirit of nature, and the creativity of the human mind results in "new art".

Abstraction gains its power through suggestive ideas triggering our imagination, which leads to inspiration, which occurs during the process of abstraction. Sometimes this is the idea of the brain, and it includes imagination, intuition and inspiration. Everyone has their place in the process of abstraction. Inspiration to organic design gives psychological and artistic strength. The suggestive power of imagination can be positive or negative. It is one of the most powerful forces in the world, a producer of myths, religion, art, architecture, peace, cold and hot wars, oil wars ... The value of abstraction lies in its ability to stimulate creative ideas, inspire open thinking and stimulate imagination, generate creative energy. Imagination allows the designer to come up with endless design concepts, which are unpredictable, individual and creative, leading to an original artistic structure.

From the earliest days of modernism, questions have been asked about the nature and difference between twodimensional and three-dimensional abstract art. In the first decade of the 20th century, Constantin Brancusi (1876-1957) posed the basic question of what abstract sculpture was supposed to convey: the image of the subject or its essence? In the next decade, Pablo Picasso (1881-1973) showed that sculpture should not be engraved, shaped or cast: it could be assembled. In the decade after that, Alexander Calder (1898-1976) showed that sculpture can move. And decades later, Donald Judd (1928-1994), referring to his interdisciplinary works, offered "Specific Objects" as an alternative to the words of paintings and sculptures [5]. Because every society - stationary or nomadic - has a spatial relationship to the natural world and other societies, the structures they produce reveal much about their environment (including climate and weather), history, ceremonies and artistic sensitivities, as well as many aspects of everyday life [6].

 $[\]textcircled{2}$ The carbon footprint of a building is defined as the amount of CO_2 that a building produces during its "lifetime", from taking material from nature, processing it and making building elements, its construction to use

The phrase "abstract architecture" is mostly associated with modern architecture. Modern architecture is generally characterized by simplification of form. It is a term applied to the all-encompassing movement, and its exact definition and scope vary greatly. Modern architecture has continued in the 21st century as a contemporary style, especially for business office buildings. In a broader sense, modern architecture began at the turn of the 20th century in an effort to reconcile the principles underlying architectural design with the rapid technological advances and modernization of society ^[7].

2. Network of Architectural Paths

The work "Network of Architectural Roads" aims to present architecture, as a phenomenon, horizontally and vertically, that is, throughout the Earth and in the function of time (history). In this way, a "spatial network of architecture" was formed in which the phenomena of "bioclimatic architecture" and "architecture of abstract forms" are just some of the countless trajectories by which the reader creates his own image of architecture (Figure 4). Therefore, each reader will be able to interpret the content of this paper in their own way through countless questions, ie topics: architecture by individual countries (continents, regions), architecture of individual authors-architects, architecture of certain historical epochs, introverted and extroverted architecture, architecture and building materials, architecture and power of the state (ruler), architecture and ideology, architecture and philosophy, architecture and religion, architecture and science, architecture purpose and architecture-art, architecture in a friendly relationship with nature, architecture that "defies" its natural environment, architecture as "natural creation" and architecture that "emerges in the minds of architects", architecture and the human ego, "eternal architecture" and "architecture of the moment" ...

The intersection of the paths of bioclimatic architecture and architecture of abstract forms is illustrated by many examples presented in this paper. Thus, for example, the Yanomami colony in the Amazon (Figure 10) is a clear example of vernacular and bioclimatic architecture, as it was created from natural materials taken "in situ" (wood, vines, leaves), but according to its concept of organization and the way it satisfies a wide range of man-individual, his immediate (family) and wider (tribe) needs extremely sophisticated. The shape of a circular ring is a complex geometric shape that in itself generates strong social energy within the structure, while at the same time generating a defensive attitude towards "unpleasant surprises" from the immediate natural environment. Houses in Fuyang and Chengqilo (China) were built on

the same concept (Figure 11). On the other hand, Apple Campus 2 in Cupertino, USA (2013-2017) is a business complex of the rich and sophisticated company Apple, designed by architects from one of the most famous architectural and design firms Foster & Partners, has the same architectural concept and form (Figure 12), as a colony of the Yanomami tribe in the Amazon.

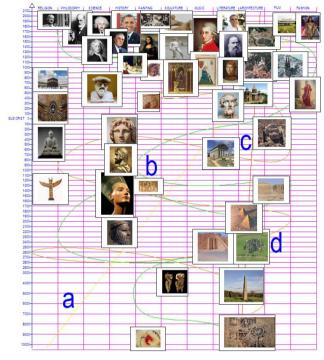


Figure 4. Network of architectural paths

Source: Author (2011, Revised 2021)

Some of the examples illustrating the intertwining of the trajectories of bioclimatic architecture and architecture of abstract forms are shown in Figures 5-9.

Iglo, a house made of blocks of packed snow (in the conditions of the polar climate in the Arctic) is one of the "purest" examples of bioclimatic architecture (Figure 5). In addition to the habitat being made of materials from the site, and the material being a renewable resource, ensuring the inner comfort of people is achieved through the strategy of the concept of architecture and means also taken from nature: seals and whale fat is used to illuminate space. The pure geometric shape of the ball segment is the most efficient way of building (rows of blocks of packed snow are arranged continuously, in a spiral from the bottom to the top of the dome). During the day the mantle of the dome lets in diffuse natural light (at night the interior lighting is outside). Finally, the shape of the dome gives the best possible ratio of the volume of the interior space and the surface (sphere) that defines it, as a boundary.

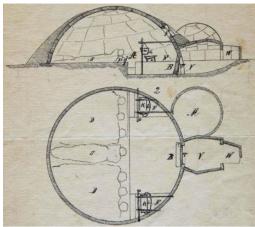






Figure 5. Iglo

https://canadianmysteries.ca/sites/franklin/context/contextHomeland_en.htm

Accessed: 6.22.2022.

Yurt, the traditional dwelling of nomadic people in Central Asia, is formally and physically a combination of geometrically pure forms of cylinders and cones (or shallow domes), (Figure 6). Its borders are made of "prefabricated" elements-rods (structural elements of the structure) "mattresses", especially decorated fillings made of canvas and "felt" of wool. All the elements of the yurt are arranged in "loads" carried by horses and camels, from place to place "camping" in the constant movements of nomads. Similar to the igloo, in the case of the yurt, the most favorable relationship was found between the volume of space and the area (boundary) that defines it. Here is a form of construction of a "pointed dome" in which the lateral forces are reduced, and additionally accepted by rods whose ends are anchored to the body of

the dome in the direction of its diameters.

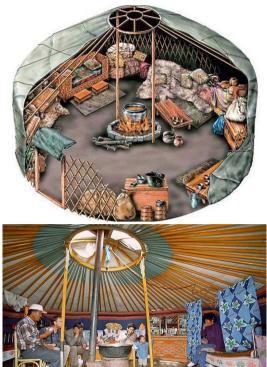


Figure 6. Yurt

https://livingnomads.com/2017/06/mongoliatravel-blog/mongolia-yurt-334/ Accessed: 6.22.2022.

A traditional Syrian house made of packed earth (Figure 7) has a form that corresponds to the available building material from which it is built (earth), local climatic conditions and people's way of life.

Dymaxion house, a house designed by Bacminster Fuller, looks like a yurt at first glance (Figure 8). In principle, the spatial concept and construction of the Dymaxion house is identical to the concept and construction of the yurt. However, there is a huge difference between these two houses. While the yurt is designed for a specific natural environment, a specific person and his family whose life is integrated into the natural environment, Dymaxion house is a "house in general", built of sophisticated materials, on the principle of science, which as such can be built by specialized highly trained builders. Dymaxion house can be built anywhere, in different climatic conditions, since human comfort is ensured in a sophisticated way - by using electricity. It has enormous embodied energy and is far from the concepts of bioclimatic architecture. Dymaxion house is, therefore, a typical example of the architecture of abstract forms.





Figure 7. Traditional Syrian house made of packed earth https://www.greenprophet.com/2011/07/syrias-beehive-architecture/

https://www.independent.co.uk/news/syriarefugee-school-zaatari-win-archdaily-eahrarchitecture-prize-photos-ammana8212496.html Accessed: 6.22.2022.

Buckminster Fuller designed his house and built it (1960) in Carbondale (Figure 9). He lived there with his wife Anne until 1971, when he was a professor at the University of Southern Illinois for 12 years. During his stay in Carbondale, Fuller made the cover of Time magazine and was nominated for the Nobel Peace Prize. He has also produced some of his most influential works and received more than a quarter of his 23 patents and nearly half of his 48 honorary doctorates. In February 2006, Fuller's Dome was added to the National Register of Historic Places. Given its unique role in his life, the Fuller House in Carbondale is probably the most important Fuller artifact left in the world today. The Fuller House is undeniably a valuable historical treasure and its preservation will have far-reaching positive effects, both locally and globally. The renovation will provide the city of Carbondale with another necessary educational and tourist resource. The structure of Fuller's house consists of a geodesic dome (single-layer spatial grid with two curvature curves), while the boundary (evelop) is made of weather-resistant canvas with thermal insulation in a sandwich. Fuller's house is an example of abstract, highly sophisticated architecture, which, despite its simplicity, carries a huge burden of embodied energy, which can only become "bioclimatic" in a long period of exploitation (using a huge amount of energy), especially if new systems are added support (photovoltaic panels, for example).

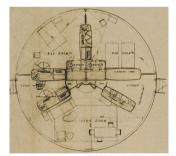
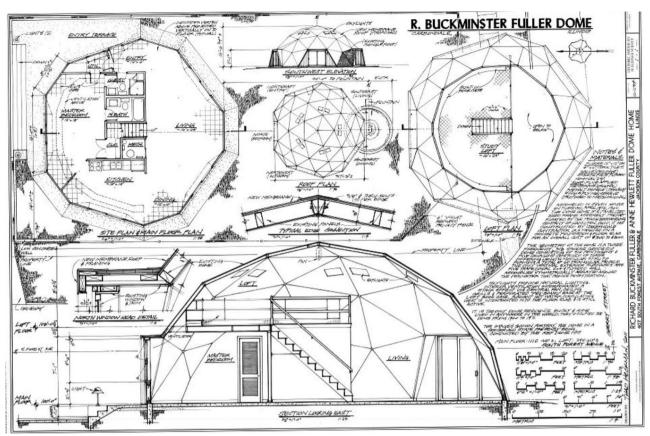






Figure 8. A Dymaxion house, 1920.

https://uxdesign.cc/special-hell-6-dymaxionman-13a3cb1023aa Accessed: 6.22.2022.



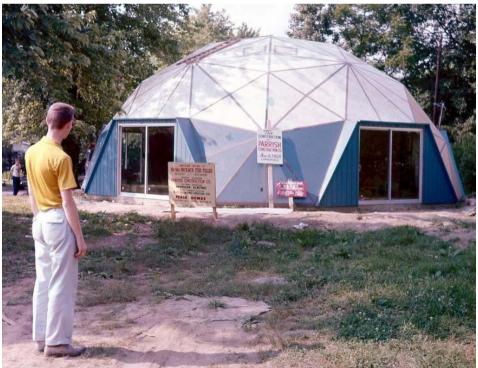


Figure 9. Fuller's home in Carbondale, Carbondale, Illinois, USA, 1960-1971.

https://www.loc.gov/item/il0995/

https://fuller domehome.com/fuller-domehome-carbon dale-illinois.html

Accessed: 6.22.2022.

The following is a comparative analysis of examples of bioclimatic architecture and architecture of abstract forms. As selected examples of bioclimatic architecture (ie vernacular or traditional architecture) we chose the Yanomami tribe colony in the Amazon and the Chinese Round House in Chengqilo, and as an example of abstract form architecture Apple Campus 2 in Cupertino, USA (2013-2017).

The Yanomami tribe colony in the Amazon is located in the largest rainforest (tropical) forest, the Amazon, and its structure is built entirely of materials from the site, wood, leaves, and earth (Figure 10). This structure is the habitat of several families of the Yanomami tribe, and the basic idea of its spatial planning (concept) is to place the tribal family in an equal position, in a "community". Hence, the shape of the circular ring proved to be the most expedient, where spatial family units are in the ring, while the open space that makes up the ring is a common space where all important ceremonies that define the social life of the tribe as a whole are held.





Figure 10. Colony of the Yanomami tribe in the Amazon https://www.independent.co.uk/news/world/americas/photos-uncontacted-tribe-community-village-amazon-yanomami-illegal-gold-miners-a7426651.html Accessed: 6.18.2022.

Chinese round houses "tulou" (literally translated as "earth objects") are rural houses, located in several locations in the southeastern Chinese province of Fujian (Figure 11). Most of them were built in the 19th and 20th centuries, as a "community of equal people". Changgilou tulou has long been considered the largest traditional Chinese round house in Yongdin Province, with a diameter of 62.5 m, while Huang Hanming did not discover that Shunyu lou in Nanjing Province is larger, with a diameter of 74.1 m. This tulou was built in 1933, and consists of four concentric rings. Its outer wall is 15 m high and 1.6 m thick. This house has 64 residential units. However, currently the largest tulou is Fushangu lou, built in the village of Chandong in Yongding province, from 1968 to 1981, which has a base diameter of 77.42 m open. They are made with a round or rectangular base, with three to five floors. They can be solved with a single circular ring, when they have a spacious inner courtyard inside, or with several concentric rings separated by a narrow street. In this case, the outer ring has a higher number of storeys than the inner rings. The Chinese Round House is a Chinese solution for the collective housing of hundreds of people (formerly more than 800). In addition to apartments, they have other facilities: larger and smaller production facilities, shops, ceremonial hall, shared bathrooms, laundry room, various warehouses ... Massive walls of these megastructures (sometimes up to 1.80 m thick) are made of earth to which stones have been added. Reinforcements of these walls, in case of uneven subsidence, are made of bamboo and wooden beams. Narrow openings (10 cm ~ 13 cm wide) were left in the walls to defend against possible attackers. The verandas oriented to the inner courtyard are made of wood and bamboo. The roof covering is mostly shingles. This construction is a typical expression of Chinese culture and worldview. In contrast to the worldwide manifestation of social hierarchy in all areas of life (including housing), China's Fujian tulou-house architecture expresses its attitude towards people as completely equal and equal, with the same housing conditions. All the rooms in this building were the same size, they were built of the same material, they had the same exterior decorations, the same windows and doors. The small family had one vertical set, from the ground floor to the top floor, while larger families, depending on the number of their members, had three or four vertical sets. There are cases when one whole tulou is inhabited by one large family (or "tribe") made up of several generations. Such a tulou symbolized "one roof" or family unity.

The land around Tulou belonged to a commune made up of its tenants. The Chinese round house, Fujian tulou, can be understood even better if it is compared with similar solutions from different parts of the Earth, as well as from different historical epochs. In addition to Fujian tulou, this book deals with two other examples, one from the domain of vernacular architecture (a colony of houses of the Yanomami tribe in the Amazon), and one from the domain of authorial architecture (Apple Campus 2 in Cupertino, USA).

All three solutions are permeated by the same idea: respect for the natural environment and strengthening life in community and the synergy of individual possibilities.





Figure 11. Chinese Round House in Fuyang (left) and Chengqilo (right)

https://www.thechinaguide.com/blog/exploring-the-mysterious-tulou-of-fujian-province

https://whc.unesco.org/en/list/1113/

Accessed: 2.18.2022.

Apple Campus 2 in Cupertino is the headquarters of Apple Inc., California, USA (Figure 12). The building was designed by the famous design house Foster & Partners according to the idea of the owner of the company, Steve Jobs (1955-2011), during his lifetime. The facility was built in less than four years (2013-2017). This megastructure is characterized, at the same time, by a huge built-up area (with all the necessary spatial-technical and infrastructural performances) and also huge efforts to keep the facility in a "friendly" relationship with nature,

providing optimal comfort for its 12000 employees. The owner and creator of this facility, Steve Jobs, wanted to build a facility where employees will be able to achieve joint creativity, collaboration, innovation, development and progress [®]. The building is in the form of a circular ring, with an outer diameter of 461 m, built with 4 aboveground and 3 underground floors, with a total net usable area of 260000 m². For employees and guests, 14200 parking spaces for cars (2000 in underground garages) and 2000 spaces for bicycles are provided.

The following examples of bioclimatic (vernacular) architecture and sophisticated architecture (architecture of abstract forms) also express the same idea (concept), with the difference that examples of vernacular architecture are representative examples of bioclimatic architecture, and examples of sophisticated architecture-examples of architecture of abstract forms.

Kandovan is a village located in the province of East Azerbaijan, near the city of Tabriz, in Iran. The village was built in the 13th century (Figure 13). The climate in Kandovan is cold to temperate (Ds, according to Köppen's classification of climate). The winter months are much rainier than the summer months. The average temperature in Kandovan is 6.7 °C. The annual rainfall averages 368 mm/m². The highest temperature is in July (around 19.0 °C), and the lowest in January (around -5.9 °C). The amplitude of annual temperature fluctuations is 24.9 °C. Houses and other buildings that accompany housing in the village are carved into the soft volcanic rock (tuff). Spaces are developed vertically, which uses the physical-spatial possibilities of geomorphological forms. The conical shape of natural geological structures enables efficient drainage of precipitation, and the development of space vertically - their efficient natural ventilation. The mass of natural rock ensures "thermal stability of the space in summer", while the summer heat accumulated in the rocks maintains the relative stability of indoor temperatures during the winter, which significantly reduces the need to heat the space in winter.

③ "Steve's vision for Apple stretched far beyond his time with us. He intended Apple Park to be the home of innovation for generations to come. The workspaces and parklands are designed to inspire our team as well as benefit the environment. We've achieved the most energy-efficient building of its kind in the world and the campus will run entirely on renewable energy".

Tim Cook, CEO of Apple, January 2017.

http://www.slate.com/blogs/business_insider/2017/02/22/you_will_be_able_to_visit_apple_s_new_spaceship_ca mpus.html, Accessed: 8.22.2017.





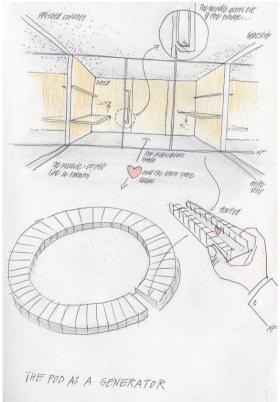


Figure 12. Apple Campus 2 in Cupertino, USA, 2013-2017 (Architects: Foster & Partners)

https://arquitecturaviva.com/works/apple-campus-2-en-proyecto-2, Accessed: 2.18.2022. https://www.wired.com/2017/05/apple-park-new-silicon-valley-campus/, Accessed: 2.18.2022.



Figure 13. Kondovan, Iran

https://www.unwto.org/es/node/11255, Accessed: 2.18.2022.

An almost identical example of the creation of architecture carved into the rocks can be seen in the Cappadocy belt, in present-day Turkey (Figure 14).





Figure 14. Cappadocya, Türkiye (left) and Derinkoyu, an underground city in Capadocya, Türkiye (right).

https://www.odysseytraveller.com/articles/cappadocia-turkey/, Accessed: 2.18.2022.

https://cappadocia4u.com/cappadocia-underground-cities/, Accessed: 2.18.2022.

Architect Steven Holl (1947-) is known for his aesthetic approach to defining an architectural space similar to a sponge structure. He developed this concept on several of his architectural projects, the most famous of which are Simmons Hall-MIT in Cambridge (realized in 2002), and Tianjin EcoCity Ecology and Planning Museums (project, 2013). The vast physical structure of the Simmons Hall dormitory was made as a kind of symbiosis of matter and

energy. Matter is an artificial parallelepiped composed of spatial modules that sometimes multiply in all three dimensions. Through this structure, completely freely, passes the "flame of life" which revives static matter (Figure 15).





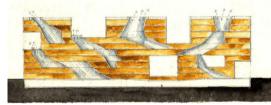


Figure 15. Simmons Hall-MIT, Cambridge, MA, USA, 2002 (Architect: Steven Holl)

https://www.flickr.com/photos/sanyambahga/38940685604, Accessed: 2.18.2022.

https://www.archdaily.com/65172/simmons-hall-at-mit-steven-holl, Accessed: 2.18.2022.

Of particular interest is the concept of Tianjin EcoCity Ecology and Planning Museums, which was developed on the principle of unity of two opposites, positive and negative, ie yin and yang. In a massive parallelepiped, a part of its mass is completely freely limited and thus "taken out" outside the parallelepiped. In this way, a "twice as large space" is obtained, where the mass of two parts (which are complementary to the whole) possesses within their imagined parallelepiped the "energy of life", ie a certain function. Placed next to each other at a certain distance, these two hollowed out parallelepipeds in their interspace generate an open space that, like an energy field, binds

two material volumes (Figure 16).

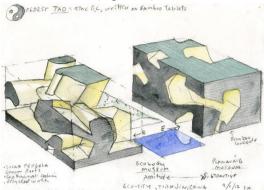




Figure 16. Tianjin EcoCity Ecology and Planning Museums, 2013 (Architects: Steven Holl Architects)

https://www.metalocus.es/en/news/tianjin-ecocity-ecology-and-planning-museums, Accessed: 2.18.2022.

Tracements of the geographical expansion of individual civilizations can be observed in the monitoring and understanding of the "network of architectural paths" (Figure 17).

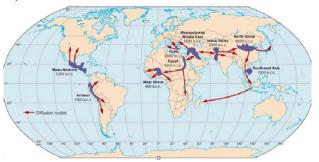


Figure 17. Map of the world: ancient civilizations https://www.pinterest.com/pin/476818679275857716/
Accessed: 6.20.2022.

On the other hand, one cannot avoid the impression that similar ideas and architectural realizations arose in different parts of the planet Earth as a result of the existence of the "universal world mind" (Figure 18).

The power of some architectural achievements (and the achievements of other aspects of the human spirit) is so great that they are repeated in the times after their original realization, until today.





Left: Pyramid of Cheops, Giza, Egypt (4th dynasty, 25th century BC) Right: Figure 19. Ziggurat (with temple), Ur-Nammu (c. 2113-2096 BC)





Left: Remains of the Maya Pyramids, Tikal, Guatemala (4th century BC)
Right: Pyramid of the Moon, Teotihuacan, Mexico (The oldest building in Teotihuacan, 200 BC)



Left: Borobudur Temple, Java, Indonesia (780-850)



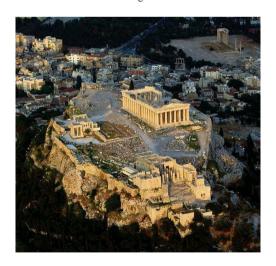
Right: Luxor Hotel, Las Vegas, Nevada, 1991-1993 (Architect: Veldon Simpson)



Left: Washington Obelisk



Right: Obelisk in Buenos Aires, Argentina



Left: Parthenon, Athens (447-434), (Architects: Ihtinos and Kalikrates)



Right: Replica of the Parthenon in Nashville, Tennessee, USA







- (a) Arch of Constantine, Rome (312-315)
- (b) Arc de Triomphe, Paris, 1806-1836 (Architect: Jean Chalgrin)
- (c) The Washington Square Arch, Washington, 1871 (Architect: McKim, Mead & White)

Figure 18. Similar architectural realizations in different parts of the world and at different times

https://www.worldhistory.org/image/5685/the-pyramids-of-giza-aerial-view/

https://www.ancient-origins.net/ancient-places-asia/great-ziggurat-ur-001767

https://www.pinterest.cl/pin/416231190554955414/

http://www.mexicoarcheology.com/teotihuacan-pyramid-of-the-moon-and-plaza/

https://writingfornewmedia.fandom.com/wiki/Borobudur_Temple

 $https://www.tripadvisor.co.uk/LocationPhotoDirectLink-g45963-d111709-i38544145-Luxor_Hotel_Casino-Las_Vegas_Nevada.html \\ https://edition.cnn.com/videos/travel/2019/09/18/washington-monument-reopens-dc-orig-cz.cnn$

https://www.alamy.com/obelisco-de-buenos-aires-or-obelisk-of-buenos-aires-buenos-aires-argentina-image177838582.html

https://br.pinterest.com/pin/336573772148010279/?amp_client_id=CLIENT_ID(_)&mweb_unauth_id={{default.session}}}&simplified=true

https://www.wallpaperflare.com/parthenon-centennial-park-nashville-tennessee-historic-wallpaper-ahjeh

https://www.britannica.com/topic/Arch-of-Constantine

https://www.istockphoto.com/search/2/image?phrase=arc+de+triomphe+aerial

https://www.planetware.com/new-york/best-parks-in-new-york-city-us-ny-91.htm

Accessed: 2.18.2022.

There are many examples where architects traveled the world, different from where they were born, grew up and educated (Erich Mendelsohn, Le Corbusier ⁽⁴⁾, Jørn Oberg Utzon ^⑤ ...), and then translated many values of indigenous architecture into their architectural realizations in their "Indigenous" natural and social environment (Figures 19, 20, 21).

④ In 1911, Le Corbusier traveled with his friend August Klipstein for five months; this time he traveled to the Balkans and visited Bulgaria, Turkey, Greece, Serbia, as well as Pompeii and Rome, filling almost 80 sketches depicting what he saw - including many sketches of the Parthenon, whose forms he would later praise in his work Vers une architecture (According to Architecture, 1923). He spoke about what he saw during this trip in many of his books, and this was the subject of his last book

Le Voyage d'Orient (Journey to the Orient, 1966).

⑤ Both before and after his study trip to China in 1958 (with renowned Norwegian architect Geir Grung (1926–1989), Danish architect Jørn Utzon (1918–2008) consistently cited dynastic Chinese architecture as one of his essential design ideals).

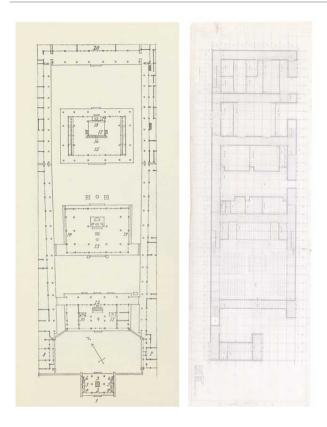


Figure 19. Left: Plan of Wen Shu Monastery, as drawn by Prip-Møller in Chinese Buddhist Monasteries (1937: 31). Right: Basic layout of Utzon's Bagsværd Church. From the Utzon Archives, Aalborg University Library

https://journal.eahn.org/article/id/7521/

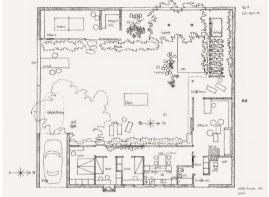
Accessed: 2.17.2022.



Figure 20. Left: Prip-Møller's photograph of the interior of Tung Yen Ssu in Chinese Buddhist Monasteries (1937: 134). Right: side hallway of Utzon's Bagsværd Church

https://journal.eahn.org/article/id/7521/, Accessed: 2.17.2022.





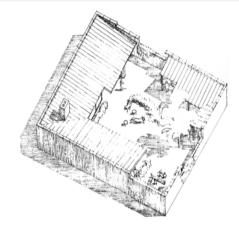


Figure 21. Houses in Fredensborg by Jørn Utzon

 $https://atrium-courtyard-patio-houses.tumblr.com/image/1647\\42522180, Accessed: 2.17.2022.$

https://www.scandinaviastandard.com/six-important-buildings-to-know-by-danish-architect-jorn-utzon/, Accessed: 2.17.2022.

The influence of the social environment ("power of capital", for example) is sometimes so strong that architectural-urban realizations (and life within them) form "their world" regardless of the natural and (traditional) social environment in which they are realized. The best examples are the business centers (city center, downtown) of some famous cities in the world (Figure 22).



Manhattan - New York City



Canary Wharf, London



La Defense, Paris



Frankfurt am Main



Dubai City



Abu Dhabi City

Figure 22. Business centers (city center, downtown) of some cities in the world

https://www.istockphoto.com/photos/manhattan-new-york-city

https://www.inyourarea.co.uk/news/canary-wharf-tops-out-the-uks-tallest-residential-skyscraper-newfoundland-available-to-rent-in-2020/https://www.istockphoto.com/photo/paris-city-view-towards-la-defense-financial-district-gm171578638-21090544 https://www.worldtravelguide.net/guides/europe/germany/frankfurt/history/

https://gulfnews.com/business/tabreed-pays-dh248b-for-stake-in-downtown-district-cooling-1.1586147701644

 $https://www.independent.co.uk/travel/48-hours-in/abu-dhabi-city-guide-things-to-do-best-bars-hotels-restaurants-a8803276. html \\ Accessed: 2.17.2022.$

3. Conclusions

According to the title of this paper, the author wanted to show how the knowledge of people in one part of the world spread to other parts and how, in the end, the "web of knowledge" was woven as a unique contribution of all mankind.

This paper seeks to point out the possibility that both "small nations" and "small states" can be seen on a map of a wide range of world ideas and concrete creations, provided they are an authentic expression of concrete natural and social threats and, at the same time, affirm universal values of man and his communities. In this way, these creations testify to the existence of universal energy inherent in all people of the planet Earth as well as the material world in general.

It is interesting how some well-known architects at the beginning of their professional career follow the trajectory of bioclimatic architecture, only to then switch to the concept of architecture of abstract forms. A representative example of such "upheavals" is the architect Frank Lloyd Wright. On the contrary, there are many architects who move from the trajectory of architecture of abstract forms to the trajectory of bioclimatic architecture: Skidmore, Owings & Merrill LLP (SOM), César Pelli, Helmut Jahn, Frank Gehry, Richard Rogers, Renzo Piano, Jean Nouvel... Approaching and the intersection of the trajectories of bioclimatic architecture and the architecture of abstract forms in contemporary architecture is mainly a consequence of the acceptance of the basic architectural agenda of the 21st century: the creation of energy-efficient architecture with the use of energy-renewable sources, concepts of natural ventilation and lighting, materials that can be easily and cheaply recycled...

Viewing the "network of architectural paths" cannot be complete without viewing the "network of overall achievements of the human spirit" [8] (Figure 4).

Conflict of Interest

There is no conflict of interest.

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