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RADOSŁAW ACHRAMOWICZ
ORCID: 0000-0002-3923-4504
Warsaw University of Technology, Poland

EWA KUHNERT
ORCID: 0000-0001-7446-181X
Warsaw University of Technology, Poland

ORIGIN OF CONTEXT: FROM MICRO- TO MACROCOSMOS

POCHODZENIE KONTEKSTU: OD MIKRO- DO MAKROKOSMOSU

A b s t r a c t

Since antiquity, cosmology and philosophy have shaped the concept of space; scientists have been more fascinated by inventing and proving various relationships between geometric figures than by the study of space. Cosmos are and were, as a universal concept, appear as a bond between different ages and a constant inspiration for designers, accompanied by a mathematical reflection of the relationship: human – nature. Throughout the ages, architects have moved between the micro- and macroscale as freely as their knowledge, imagination and tools have allowed.

Keywords: context, geometry, microcosmos, natural form, universe

S t r e s z c z e n i e

Od starożytności to kosmologia i filozofia kształtowały pojęcie przestrzeni, a uczonych bardziej fascynowało wynajdywanie i dowodzenie różnych związków między geometrycznymi figurami niż badania nad przestrzenią. Niemniej kosmos, jako pojęcie uniwersalne, był i jest spoiwem łączącym różne epoki i stałą inspiracją dla projektantów, czemu towarzyszy matematyczna refleksja nad relacją: człowiek – natura. Na przestrzeni epok architekci poruszają się między mikro- i makroskalą na tyle swobodnie, na ile pozwalają: wiedza, wyobraźnia i narzędzia, którymi dysponują.

Słowa kluczowe: geometria, formy natury, kontekst, kosmos, mikrokosmos

1. INTRODUCTION

In its broadest sense, context relates to architectural *representation* as a means of understanding, refining, creating or expressing the world. Alberto Pérez-Gómez and Louise Pelletier, in their book *Architectural Representation and the Perspective Hinge,* highlight the so-called *power of representation* that distinguishes the work of art and architecture from other technological products[1]. This principle is synthesised in the philosophical thought of Giordano

[1] A. Pérez-Gómez, L. Pelletier, *Architectural Representation and the Perspective Hinge*, MIT Press Cambridge, London 2000.

Bruno, which emerged during the Italian Renaissance: "The power of all visible objects lies in the invisible" (G. Bruno: *Against Mathematicians,* Prague 1588)[2] – a concept that goes back as far as Democritus and the Epicureans. The question of context has accompanied architecture since antiquity, when Platonism established a whole field of representation in philosophy, filled with copies – similarities. Since then, culture has been based on the category of *mimesis*, a concept derived from ancient Greek (*Μίμησις*) denoting representation, imitation, and similarity. The term itself originates in the Dionysian mysteries, during which it referred to the dance, singing and musical performance by a Dionysian priest. Originally, therefore, it was not an imitation of external reality, but an expression of internal reality – so it had a spiritual dimension. Overtime, an interpretation took hold and has survived to the present day, which in antiquity was subtly divided into three semantic areas,[3] the origin of attributable to three Greek philosophers who lived at the turn of the fifth and fourth centuries BC: Democritus (imitation of natural processes), Aristotle (creation based on the elements of nature) and Plato (copying nature). Among these, Plato's model has become the most prevalent, and in a way, simplifying the concept of *mimesis* in the realm of art.

2. WHEN EVERYTHING SEEMED OBVIOUS

In antiquity and the Middle Ages, cosmology and philosophy shaped the concept of space, and scholars were more fascinated with discovering and proving different relationships between geometric patterns than with the study of space. This is shown by numerous medieval illuminations, such as the 10th-century *diagram of the movements of the planets in the zodiac* (Ill. 1)[4]. Another example is the 6th/7th-century *Micro-Macro-Cosmic Harmony diagram* (Ill. 2), which represents the thesis that man is the microcosm of the universe and the universe is the macrocosm of man. The modern era brought a breakthrough in the perception and architectural representation of context. Whereas in the ancient and, to some extent, medieval hierarchy, manual skills and knowledge, or mechanics, were considered inferior, and hardly worthy of a free man, the Renaissance, and with it the Baroque, broke away from this approach. The artists of the period become both philosophers and craftsmen, equally

[2] A. Nowicki, *Giordano Bruno,* Wiedza Powszechna, Warszawa 1979, p. 221.

[3] W. Tatarkiewicz, *Mimesis* [in:] Philip P. Wiener (ed.), *Dictionary of the History of Ideas*, vol. 3, New York: Charles Scribner's Sons, 1973, pp. 225–230.

[4] Study based on: Bede the Venerable, Isidore of Seville, Abbo of Fleury, *Compendium of computistical texts* [in:] https://art.thewalters.org/files/pdf/W73.pdf (access: 20.06.2023). A digital facsimile of Walters Ms. W.73, Cosmography. The complete publication can be seen as a collection of natural history: climate zones, seasons, weather patterns, geographical relationships between continents; cosmology: planetary motions and zodiacal phenomena; and: music, geometry and humanity in general in one harmonious representation. According to the source description, the diagram of planetary motions is interpreted as follows: the vertical column label indicates the five known planets plus the Sun and Moon, the top horizontal label – the signs of the zodiac, the horizontal label at the bottom – the distances between the planets in musical values: in tones, semitones or three semitones, and an abbreviated description of the distances between the planets, expressed in relation to the distance from the Earth to the Moon. The second diagram – the harmonies – is interpreted as follows: each element illustrates the relationship between the four elements, the four moods – the humus, and the four seasons. It conveys the significance of Christ in restoring nature's original harmony, order, and meaning, believed to have been disrupted by the Fall of Man.

skilled at working with ideas and material. Leonardo da Vinci, for instance, considered himself more of a scientist-craftsman towards the end of his life than an artist[5]. In his *Treatise*, he encouraged young art students to study geometric principles and the laws of nature. Whether practicing painting, sculpture, music, or architecture, they should possess comprehensive knowledge of mathematics, nature, philosophy, or astronomy. Other philosophers and artists of the period were also convinced of the overwhelming importance of numbers and their grammar, i.e. mathematics, in constructing theories to explain reality. For them, geometry and mathematics in general were the best possible tools for constructing abstract models of the world. This perception and interpretation of the world through mathematical rules took shape in the *Mathesis Universalis*, a general principle described by Gottfried Wilhelm Leibniz in the Baroque period and called *universal science* by René Descartes[6]. These ideas were inspired by Giordano Bruno's Renaissance thinking, which in turn drew extensively from Lucretius' Roman hexametric poetry, according to which nothing comes from nothing and nothing is transformed into nothingness[7]. This approach finds resonance in the contemporary words of Michael Heller in the book: *Filozofia i Wszechświat*, where he writes: "There can be no rational world that is not a mathematical world" and: "If the ontic mathematicality of the world is a necessary condition for existence, then there is nothing around us that is not mathematical"[8]. This concept is well illustrated by Durer's mathematical model of the world (Ill. 3),[9] identical to the perspective mapping proposal, or the diagram showing the differences and similarities between Ptolemy's geocentric model and Copernicus' heliocentric model, which served as the starting point of Bruno's Renaissance philosophy (Ill. 4)[10]. Since ancient times, it was generally known that geometry, as the source of objective knowledge and the basis of cognitive processes, should be considered as an "introduction" to philosophy. As Plutarch questions, "What does Plato mean when he says that God always acts like a geometer?"[11], obscures the importance of geometry in Plato's academy, which operated for almost a millennium. Apart from philosophy, for which it was best known, the Academy practised practically all the sciences of its time. However, geometry was given special emphasis because it guided the mind towards eternal things and the world of ideas. While all sciences mirror certain truths about the objects of the mind, geometry does so most perfectly, as in Plato's doctrine of regular polyhedra – the so-called *Platonic solids* (Ill. 5)[12]. Such distant contexts were the closest to man at the time, and it

[5] Curatorial description of the exhibition, *Leonardo da Vinci: Anatomist* [in:] The Royal Collection, www.royalcollection.org.uk/exhibitions/leonardo-da-vinci-anatomist/exhibition-curator-martin-clayton-explores-some-of-leonardos, [after:] P. Celiński, *Renesansowe korzenie cyfrowego zwrotu* [in:] A. Radomski, R. Bomba (eds.), *Zwrot cyfrowy w humanistyce*, E-naukowiec, Lublin 2013, p. 15.

[6] *Ibidem*, p. 16.

[7] Titus Lucretius Karus, *De rerum natura*, [Polish edition:] *O rzeczywistości. Ksiąg sześć*, Zakład Narodowy im. Ossolińskich, Wydawnictwo PAN, Wrocław 1958, (e.g. vol. I, 150).

[8] M. Heller, *Filozofia i wszechświat*, TAiWPN Universitas, Kraków 2006, p. 54.

[9] Source: A. Dürer, *De symmetria partium in rectis formis humanorum corporum*, 1538.

[10] G. Bruno, *Pisma filozoficzne*, Książka i Wiedza, Warszawa 1956.

[11] *The Complete Work of Plutarch: Essays and Miscellanies*, vol. VIII, Crowell, New York 1909 [after:] M. Heller, *Bóg i geometria. Gdy przestrzeń była Bogiem,* Copernicus Center Press, Kraków 2015, p. 34.

[12] Source: *Mysterium Cosmographicum*, 1596, https://pl.wikipedia.org/wiki/Mysterium_Cosmographicum (access: 11.03.2023).

was only the Renaissance and Baroque thought, also ongoing scientific discoveries gave a new direction to the study of space, shifting the burden of observation from the macro to the micro level.

3. TOWARDS THE BAROQUE

The modern search for repeatability, symmetry, curvilinearity – concepts derived from geometry – caused man to measure nature by the means available, in order to imitate it in constructions over time. The Renaissance drew on Euclidean geometry and applied it to the emerging classical forms, and the independence in the shaping forms that developed at the time increased with the better understanding of the principles and possibilities of creating by following a rule: from points to straight lines, from surfaces to the third dimension[13]. Deepening this concept allowed the later transformation and deformation of basic figures, such as the circle (Ill. 6)[14]. The study of its curves enabled the creation of elaborate spatial forms that were based on the mutation and transformation of a single set of curves (Ill. 7)[15]. The next epoch, Baroque, made much freer use of the well-known code of its predecessors. In both art and architecture, Baroque artists, knowing the craftsmanship of their ancestors well, decided to introduce a dynamism of spatial arrangements that displaced the monumentality of the buildings. In architecture, chiaroscuro played a significant role, with ornamentation "growing" out of the massive walls, and sculpture becoming part of the architecture by being assigned to the whole interior[16]. These procedures created a style so different in character that it often intensified the impression of chaos in the viewer, but in time a rule began to be recognised, namely an attempt to show the viewer the continuity of the context, not through straightforwardness, but through elaborate and soft spatial forms that depicted a "curvilinear labyrinth of continuity". Deleuze's philosophy of the fold, which reinterprets Leibniz, refers to this concept in contemporary terms: "the labyrinth of continuity of matter reflects the labyrinth of continuity of the human soul"[17], and therefore in the apparent finiteness of the solid one could see infinity, and consequently perfection, as well illustrated by the modern experiment "Mobius House" by UNStudio (Ill. 8)[18]. The dynamics

[13] K. Januszkiewicz, *O projektowaniu architektury w dobie narzędzi cyfrowych. Stan aktualny i perspektywy rozwoju,* Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2010, pp. 15–23.

[14] L. DeLong, *Constructed Curves* [in:] L. DeLong, *Curves. Flowers. Foliates & Flourishies in the Formal Decorative Arts*, Wooden Books 2013.

[15] Study based on: P. Bohdziewicz, *Zagadnienie formy w architekturze baroku*, Towarzystwo Naukowe Katolickiego Uniwersytetu Lubelskiego, Lublin 1961, pp. 153–171.

[16] A. Maśliński, *Architektura antyku w interpretacji baroku*, Towarzystwo Naukowe Katolickiego Uniwersytetu Lubelskiego, Lublin 1962, p. 62.

[17] K. Januszkiewicz, K. Kowalski, *Architektura krzywoliniowa w przestrzeni zabytkowej miast* [in:] B. Komar, J. Biedrońska, A. Szewczenko (eds.), *Badania interdyscyplinarne w architekturze. Monografia konferencyjna*, vol. 2, *Przestrzenie publiczne w mieście*, Wydział Architektury Politechniki Śląskiej, Gliwice 2015, p. 78, source: http://delibra.bg.polsl.pl/Content/28971/BCPS_32809_-_Architektura-krzywol_0000.pdf (access: 02.06.2023).

[18] Source: Ill. 8a., b.: Möbius House, Het Gooi, Netherlands, 1993–1998 [in:] https://www.unstudio.com/en/page/12105/möbius-house (access: 09.06.2023); 8c. Möbius House Axonometric [in:] https://www.behance.net/gallery/6341885/Moebius-House-Axonometric/modules/49223315 (access: 09.06.2023).

presented in the project can also be observed in nature: light breaking through the leaves creates clearly illuminated patches, leaving some areas shaded; the shapes of trees, bushes and other inanimate elements create scenes thanks to contrasts; cavities, highlights, cracks and scratches, which look different in the daytime and at semidarkness. It was the desire to observe and understand the laws of nature that led to the development of modern optical devices, including the camera obscura (Ill**.** 9)[19]. The main purpose was to project an image continuously, making it possible to observe natural phenomena: to ancient astronomers, the movement of the planets in the sky; to Renaissance painters, perspective; and to modern scientists, countless examples, such as the anatomy and workings of the eye. The dynamics and continuity in space, already noticed in the Baroque, directed attention towards topological geometries, and contemporary research into them was undertaken by Andrew Saunders,[20] who generated computer models of Baroque Italian sacred vaults (Ill. 10),[21] which are independent compositions. The aim of the architect's research was to create the first digital archive of 3D scans and parametric models, which made it possible to experiment with the multiplication of vaults and to form more like organism-machine. In the resulting structures, both familiar forms from the natural world and references to geometric figures can be seen. The number of configurations is almost infinite, limited only by the human imagination. The architecture of recesses, cracks and faults was used to create a kind of scenography. The Baroque changed previous thinking about the stability of a building, forcing the building to be seen more as an infinite space than a compositionally closed self-contained monument. It is a turn towards nature, which has always accompanied man-made works, so marking clear boundaries seems unnecessary, shattering the order and harmony of the universe, which corresponds to Bruno's thought expressed in the Renaissance and cited in the introduction about the power of the invisible. Baroque artists sought to give buildings more freedom and fluidity in order to integrate art, and therefore architecture, into a wider scientific discourse, where the context was set by the philosophy of nature. Consequently, that view began to prevail: it is only by using mathematical language that we are able to understand the world[22].

4. DIGITAL UPHEAVAL

Today, digital tools have given new life to the question of natural philosophy and its architectural interpretations after almost three centuries. Already in the Baroque period, the viewer was transported into an imaginative realm of the time, an augmented reality described by Gottfried Wilhelm Leibniz, as discussed here. In his view, the Cosmos is transformed into a single infinite melody of bodies and their flows – *a harmony of nature* manifested in a so-called *Collective Unity.* This concept can be likened to a principle analogous to how "a flower affects a bee, like a set of counterpoints [which] affected the bee's morphogenesis and vice versa […] all of nature participates as a motive in the formation of my physical and

[19] Source: A. Kircher, Ars Magna Lucis et Umbrae. Rome 1646, pp. 806–807, http://www.cineressources.net/consultationPdf/web/o000/159.pdf (access: 20.05.2023).
[20] A. Saunders, *Baroque Topologies*, Palombi Editori, 2018, pp. 55–71.
[21] Source: A. Saunders, *Baroque Topologies,* https://www.andrewallensaunders.com (access: 15.05.2023).
[22] M. Heller, *Czy istnieje autentyczna filozofia przyrody?*, „Studia Philosophiae Christianae" 1987, vol. 23(1).

spiritual personality”[23], as articulated by the German biologist Jakob Johann von Uexküll and later recalled by Deleuze. In the 20th century, this harmony, rooted in monadology, was reframed through the lens of organisms as information processes engaged in feedback with the surrounding universe. In the digital age, these *monads* – immaterial, simple substances – have become emblematic in architectural experiments centred around the modelling of so-called *blobs* (Ill. 11). It is worth noting that these blobs were preceded by film works which were the first to ‘test’ new design tools based on animation (Ill. 12). Like the Baroque monads, the digital blobs have specific characteristics: firstly, they are eternal, incapable of natural creation or destruction, but only by their creator; secondly, each one is unique, following the principle that no two substances in nature are identical; thirdly, they are in a state of permutation due to their internal conditions impervious to external factors. As Leibniz phrased it: “the monads have no windows through which anything can enter or leave them”[24]. Given their infinite number, there are as many perspectives on the universe itself – a principle that upholds maximum order while maintaining infinite diversity – leading ultimately to the world’s perfection.

Reflections on perfection and infinity in the Universe have been taken up again since the end of the 20th century, when digital space began to familiarise people with different kinds of curvature: the fluidity of lines, the softness of shapes, the blurred boundaries between inside and outside, and the free treatment of the principles of geometry. The philosophical foundation for today’s architecture was provided by Deleuze, fascinated by Leibniz, who treats architecture as a living organism and links its development to specific cycles, which are elements of the entire creative process. Since the 1990s, there has been a tendency in architecture to design forms that, through the use of technology, come to life by equipping them with functions along the lines of those observed in nature. This direction of development is also changing the meaning of geometry itself, for which until recently, the inviolable system of proportions has been opened up to infinite transformation and recomposition of layout, allowing designers to break with previous rigid representations of the model and create more organic forms. In this process, it was helpful to see a kind of prefabrication in nature and to compare the development of living organisms to modern methods of building construction (Ill. 13),[25] including other fields of science in collaboration with architects. One of the pioneers of the implementation of digital methods into architectural design is Greg Lynn, who while exploring curvilinearity, concluded that: “form can be shaped by the collaboration between the shell and the active context in which it is located”[26]. Such a field for building complex, dynamic relationships in the model is provided by multidimensional digital space, and the most flexible tool for presenting these for more than thirty years

[23] Jakob Johann von Uexküll, *Mondes animaux et monde humain,* Paris, 1966, pp. 145–146 [after:] G. Deleuze, *Fałda. Leibniz a barok*, Wydawnictwo Naukowe PWN, Warszawa 2014, p. 314, note no 33.

[24] G.W. Leibniz, *Monadologia*, § 7 [in:] http://sady.up.krakow.pl/fil.leibniz.monadologia.htm (access: 17.07.2022).

[25] Source: Ill. 13.a. J.S. Lebiediew, *Architektura i bionika*, Arkady, Warszawa 1983, p. 49; Ill. 13b. B. Heisner, *Harriet Morrison Irwin’s Hexagonal House: An Invention to Improve Domestic Dwellings*, “The North Carolina Historical Review” 1981, 58(2), pp. 105–124; G. Benoit-Levy, *L’habitation hexagonal*, „La Technique du Traveaux”, 1929, no. 8, pp. 417–421, [after:] K. Kimic, *Architektura oparta na wzorze plastra miodu*, „Acta Scientiarum Polonorum Architectura” 2019, Issue 18(3), pp. 35–44.

[26] G. Lynn, *Animate form*, Princeton Architectural Press, New York 1999, p. 10.

has been the NURBS surface (Non-Uniform Rational B-Spline), which consists of control points that form curves, allowing the creation of organic shapes (Ill. 14)[27]. The 21st century continues to be inspired by the processes that control the development of biological forms, adding technological advances. In contemporary designs, one can see the tendency to give buildings a skin-like covering over internal organs (Ill. 15),[28] and the shell applied should be changeable, flexible and experienced in a multisensory way. The function of the objects is not only to insulate from external conditions, but to become an integral part of the whole system, complementing it not only visually but also in process.

Today, after more than thirty years of developing research into digital space and the possibility of creating in a virtual environment, technology is forging closer ties with architecture. It is another development that has made it so such *digital Architekton*[29] can not only have an organic shape, but also an action. The designed object comes to life, not through its shape, but through its functions: it breathes by using natural air currents or filling the structure with microorganisms (Ill. 16),[30] changes colour (interactive façades) or moves, as shown in the illustration below, where the movable shell, "innervated" by a system of pneumatic muscles, reacts to stimuli like a living organism (Ill. 17)[31]. The projects mentioned in the text are not just the result of research over the last two or three decades, but the result of a continuous process in which a human, or in our case an architect, explores nature, discovers its hitherto unknown properties and uses them in the design process.

5. CONCLUSIONS

To conclude the reflections undertaken in this work and to bring the sources of the context closer, let us summarise: the relationship between man and nature has been constantly evolving over the centuries, the research accompanying it has also been evolving, and new aesthetic, functional and technological links have been formed between the creative process and nature as a source of inspiration. The formation of these relationships is continuous, and the issue of the Cosmos continues to redefine the concept of space to this day. The expression of this search is the number, which has the character of a universal language; while in classical terms these were integers, led by the perfect "one", they have now taken on the form of parameters that allow for greater fluidity in form, while at the same time representing a contemporary attempt to interpret the world. From the examples cited in the text, it can be concluded that from ancient times to the present day, we have moved between the micro and macro scales as freely as tools, knowledge, and imagination allow. Thanks to technology, we extend the range of scales, thereby broadening our understanding of the Cosmos, and architects' exploration of the regularities that govern it sometimes leads us towards new directions and trends.

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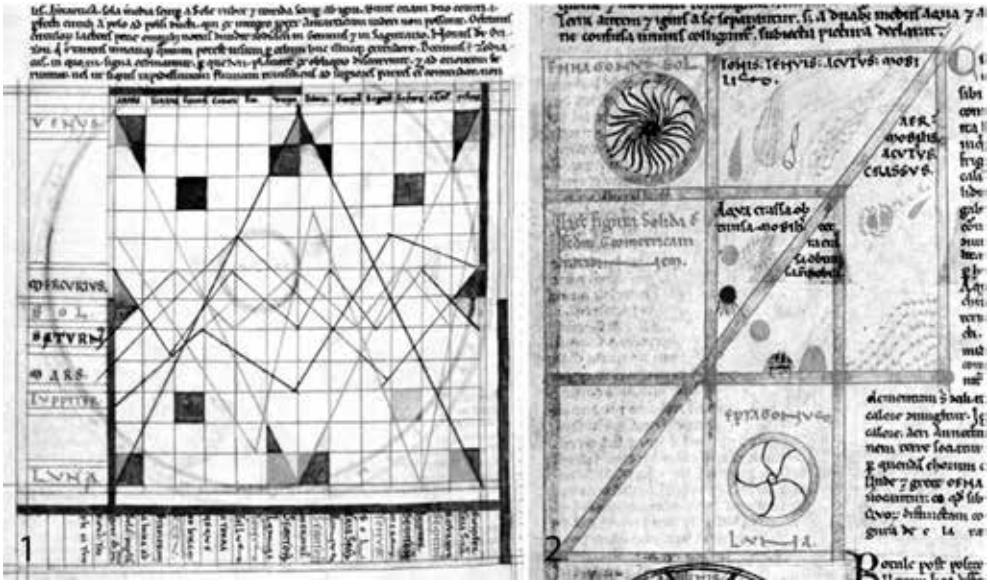
[27] L. Piegl, W. Tiller, *The NURBS book*, Springer, 1996, pp. 89, 93, 104, 105.

[28] Source: Ill. 15a. New York City, 2001 [in:] Greg Lynn FORM, http://glform.com/buildings/eye-beam-museum-of-art-and-technology/ (access: 28.05.2023); Ill.15b. E. Lupton, *Skin: Surface, Substance, and Design*, Princeton Architectural Press, New York, Enfield 2007, p. 39.

[29] *Digital Architekton* – is a term proposed by the authors, derived from the original term proposed by Kazimir Malevich.

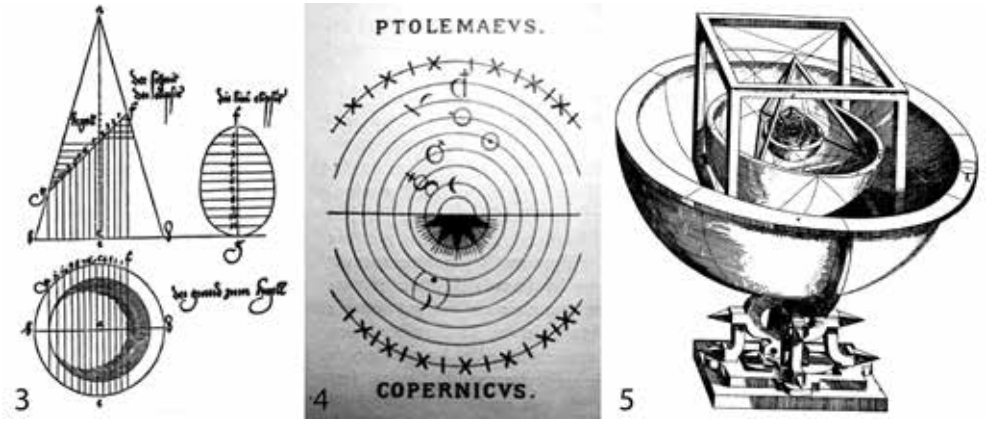
[30] Study based on: ecoLogicStudio, https://www.ecologicstudio.com (access: 28.05.2023).

[31] Study based on: K. Oosterhuis, G. Lynn, *Kas Oosterhuis and Greg Lynn discuss NSA Muscle*, Canadian Centre for Architecture, Montréal, Québec 2014.



Ill. 1. Medieval diagrams dealing with harmony. Abbo of Fleury (945–1004), *Diagram of the movement of planets in the zodiacal signs.*

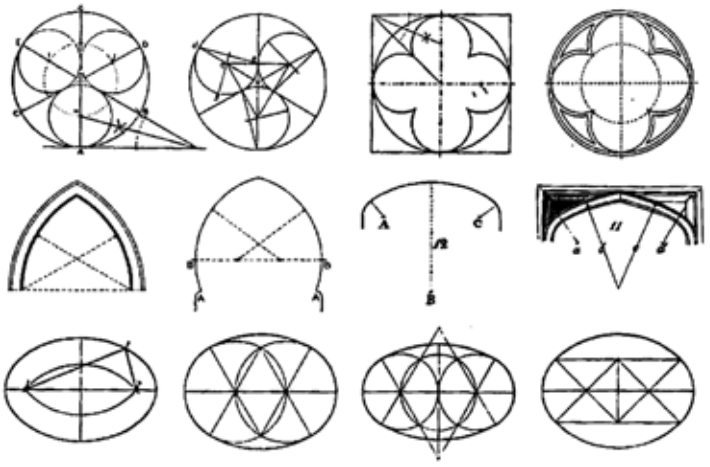
Ill. 2. Isidore from Seville (560–636) *Diagram of micro-macro-cosmic harmony.*



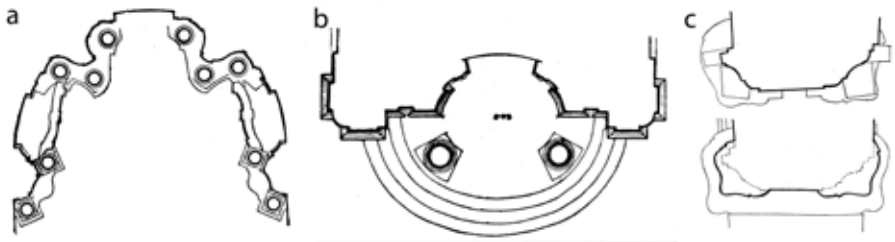
Ill. 3. Albrecht Dürer, A mathematical model of the world and at the same time a proposal for perspective mapping.

Ill. 4. Giordano Bruno, sketch showing differences and similarities between the Ptolemaic model and the Copernican model, late 16th century.

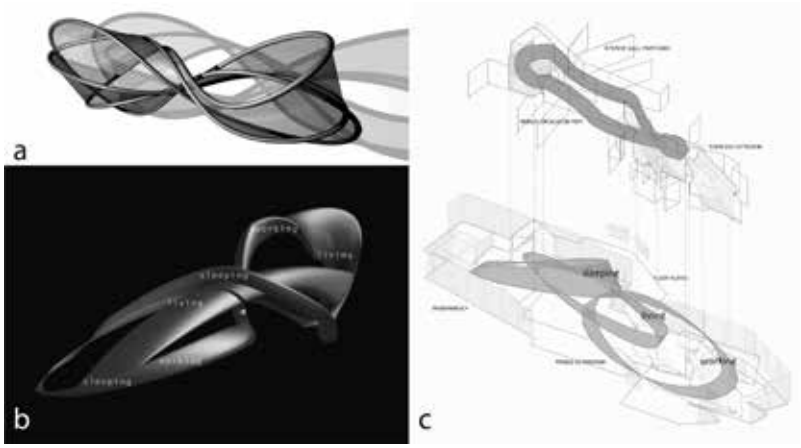
Ill. 5. Kepler model of the solar system based on platonic solids.



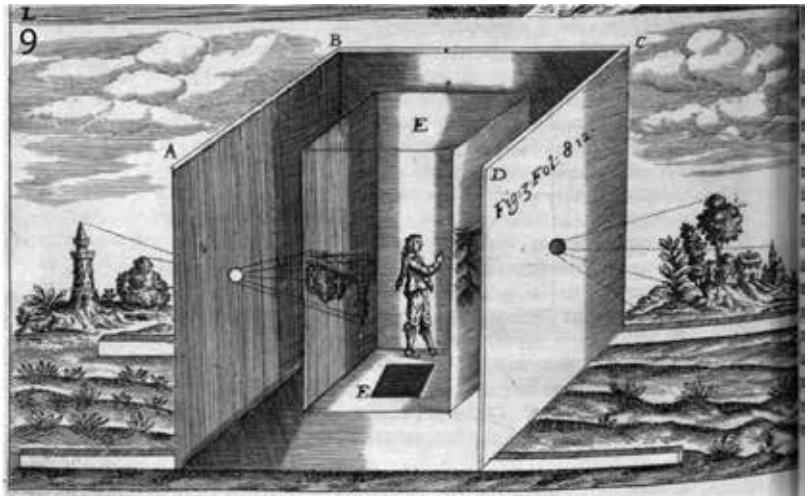
Ill. 6. The circle as a starting point for further considerations on curvatures. Radius, chord, and diameter are operators that allow you to model smooth lines.



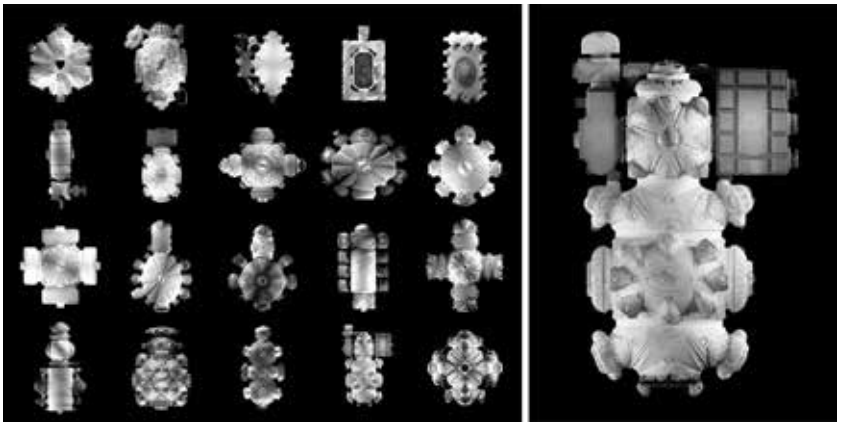
Ill. 7. Analysis fragments of horizontal projections of Baroque churches. The projections show the wavy decoration achieved by various transformations of the curvature of the arch: a) The Great Altar in St Casimir's Church in Vilnius, b) front facade – entrance to the Church of the Irish in Paris, c) altar by the pillar in the Church of St. Theresa in Vilnius.



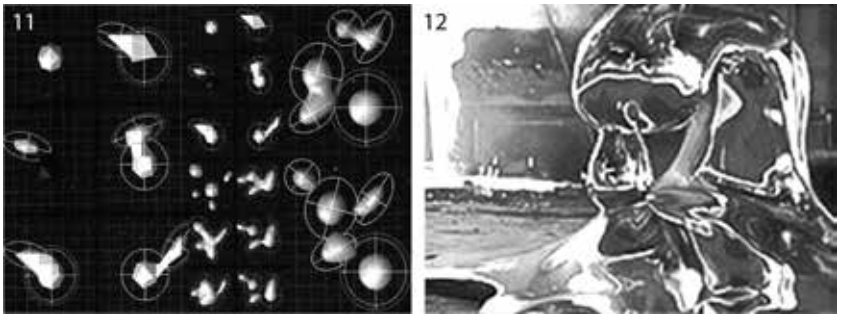
Ill. 8. Project Mobius House UNStudio: a), b) conceptual models showing the fluidity of form and the intertwining of surfaces, c) axonometric display of the functional system.



Ill. 9. Camera obscura in the form of a cubicle placed in a picturesque landscape.



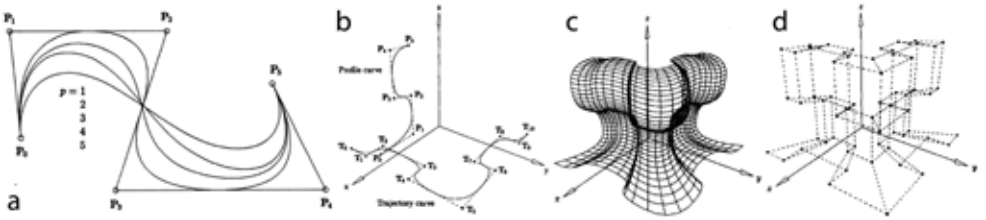
Ill. 10. Documentation of major Baroque works resulting in a digital archive of high-resolution 3D scans and parametric models.



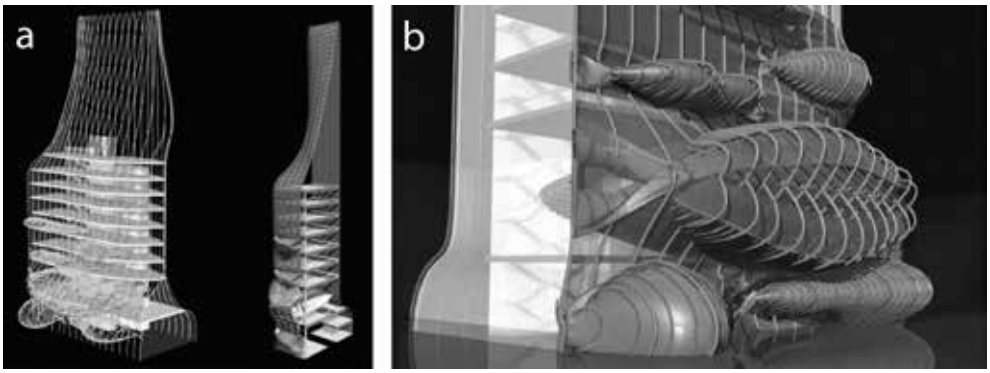
Ill. 11. Blob modelling diagram as part of the design process *Korean Presbyterian Church,* Greg Lynn 1995–1999.

Ill. 12. Still from the film *Terminator 2* directed by James Cameron, 1991.

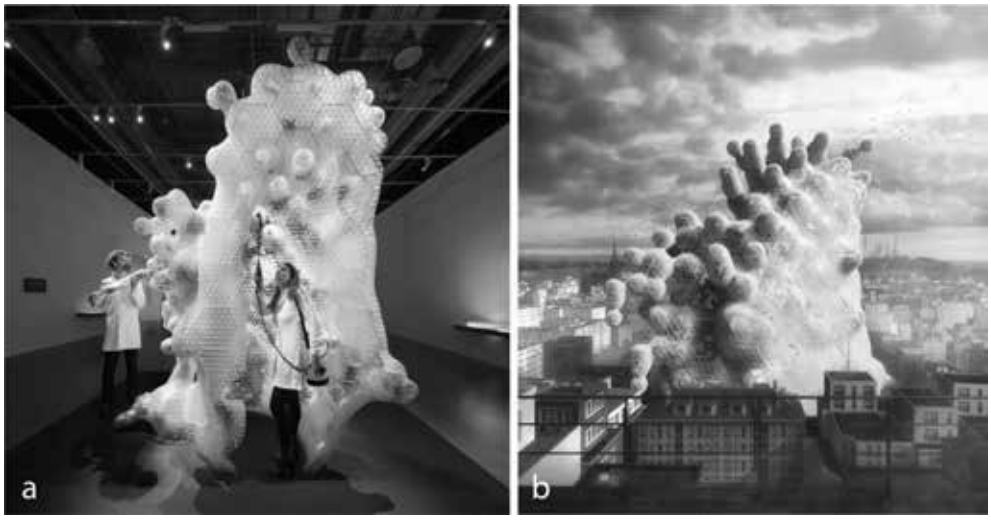
Ill. 13. Prefabrication in nature and construction: a) a hornet's nest, b) an example of using the insect's nest shape in construction is the hexagonal dwelling house from 1869 designed by Harriet Morrison Irvin and another around the year 1927 by Wilhelm Ulrich.



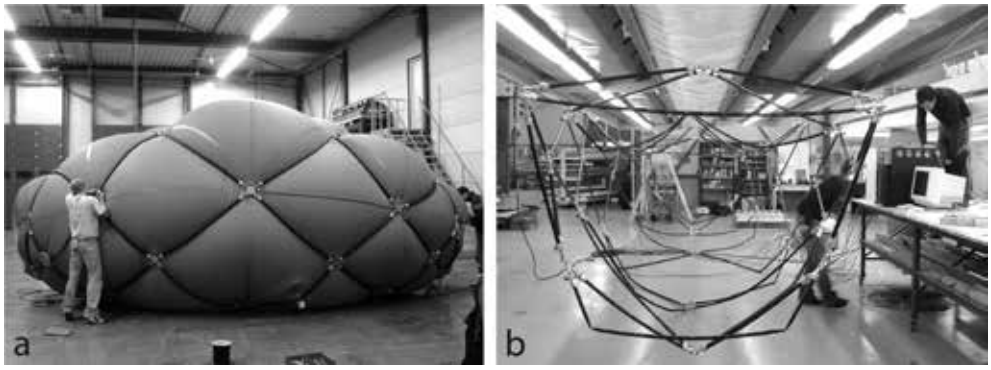
Ill. 14. Example of using NURBS curves to model any shape: a) parametric curves (B-spline, parametric curves composed of slices of polynomial curves) with different degrees of curvature and the same control points, b) parametric curve transferred to a coordinate system, c) superposition of planes, d) simplified grid of B-spline point connections.



Ill. 15. Project Museum Eyebeam.



Ill. 16. Living facades – a project by ecoLogicStudio. Inside the structure, colonies of photosynthetic microalgae and a group of bird spiders were placed: a) H.O.R.T.U.S. XL is a bio-digital sculpture showing the combination of the living (in this case microorganisms) as a complement to the structure created by advanced technologies, b) The PhotoSynthetica Tower project uses microorganisms to build a megastructure that looks like a complex synthetic organism.



Ill. 17. Installation showing the action of pneumatic muscles: a) skeleton composed of pneumatic muscles, b) the whole structure is composed of pneumatic muscles and a shell.

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A u t h o r ' s N o t e

Assoc. Prof. Radosław Achramowicz, DSc, PhD, Arch.

Graduated from the Gdansk University of Technology, Faculty of Architecture in 1998. Since 1999, he has been teaching at the Warsaw University of Technology, Faculty of Architecture, where in 2004 he received his doctoral degree. In 2013, he obtained a habilitation in Arts, Industrial Design at the University of Arts in Poznan, Faculty of Architecture and Design. Since 2015, he has held the position of Associate Professor at the Faculty of Architecture at the Warsaw University of Technology. Since 2019, he has assumed the role of Head of the Department of Architectural Design and Theory. His research focuses mostly on the interdisciplinary nature of architecture, especially on the intersection of architecture and industrial design. An important position in his scientific development is also shaped by the principles of an avant-garde and architectural utopia, embedded in a broader cultural and social context.

radoslaw.achramowicz@pw.edu.pl

Ewa Kuhnert, MSc, Arch.

PhD candidate at the Doctoral School of the Warsaw University of Technology. The main topics of disciplinary interest focus on the relationship between human and nature, and biomorphic forms. She works as an architect – urban planner at the Warsaw studio JAZ+Architects, whose main mission is to create user-friendly spaces that respect the environment and take into consideration the whole context of the place.

ewa.kuhnert.dokt@pw.edu.pl